EUROPEAN COMMISSION
Innovation and Networks Executive Agency

Director

GRANT AGREEMENT

NUMBER — 636329 — EfficienSea 2

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

*the **Innovation and Networks Executive Agency (INEA)** ('the Agency'), under the power delegated by the European Commission ('the Commission')*[1],

represented for the purposes of signature of this Agreement by executive director, Innovation and Networks Executive Agency, Dirk BECKERS,

and

on the other part,

1. 'the coordinator':

SØFARTSSTYRELSEN (SØFARTSSTYRELSEN), CVR29831610 , established in Vermundsgade 38C, KOEBENHAVN 2100 , Denmark, DK29831610 , represented for the purposes of signing the Agreement by Karoline LUNDHOLT

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. **GEODATASTYRELSEN (KMS)**, 62965916, established in RENTEMESTERVEJ 8, KOBENHAVN 2400, Denmark, DK62965916,

3. **DANMARKS METEOROLOGISKE INSTITUT (DANMARKS METEOROLOGISKE INSTITUT)**, 18159104, established in Lyngbyvej 100, KOBENHAVN 2100, Denmark, DK18159104,

4. **VEETEEDE AMET (Veeteede Amet)**, 70002414, established in VALGE T 4, TALLINN 11413, Estonia, EE100220188,

5. **LIIKENNEVIRASTO (LIIKENNEVIRASTO)**, 1015471, established in OPASTINSILTA 12A, HELSINKI 00520, Finland, FI10105471,

6. **URZAD MORSKI W GDYNI (Maritime Office in Gdynia)**, established in UL. CHRZANOWSKIEGO 10, GDYNIA 81 338, Poland, PL5860014932,

7. **INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY (INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY)**, 0000023097, established in UL. SZACHOWA 1, WARSZAWA 04-894 , Poland, PL5250009312,

8. **SWEDISH MARITIME ADMINISTRATION (SWEDISH MARITIME ADMINISTRATION)**, established in , NORRKÖPING 60178 , Sweden, SE202100065401,

9. **CHALMERS TEKNISKA HOEGSKOLA AB (CHALMERS)** AB, 5564795598, established in -, GOETEBORG 41296, Sweden, SE556479559801,

1 Text in *italics* shows the options of the Model Grant Agreement that are applicable to this Agreement.

10. **KOBENHAVNS UNIVERSITET (UCPH)**, 29979812, established in NORREGADE 10, KOBENHAVN 1165, Denmark, DK29979812,

11. **DANMARKS TEKNISKE UNIVERSITET (DTU)**, 30060946, established in Anker Engelundsvej 1, Bygning 101, KONGENS LYNGBY 2800, Denmark, DK30060946,

12. **LATVIJAS JURAS AKADEMIJA (LATVIAN MARITIME ACADEMY)**, 90000040638, established in FLOTES 12 K-1, RIGA LV 1016, Latvia, LV90000040638,

13. **OFFIS EV (OFFIS EV)** EV, VR1956, established in ESCHERWEG 2, OLDENBURG 26121, Germany, DE811582102,

14. **THE BALTIC AND INTERNATIONAL MARITIME COUNCIL/BIMCO (BIMCO)** DK1, 62480610, established in BAGSVAERDVEJ 161, BAGSVAERD 2880, Denmark, DK62480610,

15. **COMITE INTERNATIONAL RADIO MARITIME- (CIRM) (CIRM)** GB5, 02494458, established in 202 LAMBETH ROAD, LONDON SE1 7JW, United Kingdom, GB547917504,

16. **ASSOCIATION INTERNATIONALE DE SIGNALISATION MARITIME (IALA)** FR20, 784670812/0305974, established in 10 RUE DES GAUDINES, SAINT GERMAIN EN LAYE 78100, France,

17. **Europas Maritime Udviklingscenter (MDCE)** DK1, 1004919694, established in amaliegade 33b, copenhagen 1256 , Denmark, DK21415332 ,

18. **SSPA SWEDEN AB. (SSPA)** AB, 5562241918, established in Chalmers Tvaergata 10, GOETEBORG 40022, Sweden, SE556224191801,

19. **FORCE TECHNOLOGY (FORCE TECHNOLOGY)** DK1, 55117314, established in PARK ALLE 345, BRONDBY 2605, Denmark, DK55117314,

20. **COLLECTE LOCALISATION SATELLITES SA (CLS)** FR39, 338034390, established in RUE HERMES 8, RAMONVILLE ST AGNE 31520, France, FR95338034390,

21. **DANELEC ELECTRONICS AS (Danelec Marine)** AS, 18630877, established in BLOKKEN 44, BIRKEROD 3460, Denmark, DK18630877,

22. **FREQUENTIS AG (FREQUENTIS)** AG, FN72115B, established in Innovationsstrasse 1, WIEN 1100, Austria, ATU14715600,

23. **Furuno Finland Oy (FUR)**, 17546608, established in Niittyrinne 7, Espoo 2270, Finland, FI17546608,

24. **GateHouse A/S (GateHouse A/S)** AS, DK26040299, established in Lindholm Brygge 31, NORRESUNDBY 9400, Denmark, DK26040299,

25. **LITEHAUZ APS (Litehauz ApS)** APS, 30557328, established in BROFOGEDVEJ 10 ST, KOBENHAVN NV 2400, Denmark, DK30557328,

26. **LYNGSO MARINE AS (LYNGSO MARINE AS)** AS, 63053112, established in LYNGSO ALLE 2, HORSHOLM 2970, Denmark, DK63053112 ,

27. **MARSEC-XL INTERNATIONAL LTD (MARSEC-XL)** LTD, C55913, established in Fuq San Pawl, Cospicua BML1910, Malta, MT20781036,

28. **ROCKETBROTHERS.DK APS (Rocket Brothers)** APS, 34480362, established in ABOGADE 15, AARHUS N 8200, Denmark, DK34480362,

29. **THRANE & THRANE AS (Thrane & Thrane A/S)** AS, 65724618, established in LUNDTOFTEGARDSVEJ 93D, KONGENS LYNGBY 2800, Denmark, DK65724618,

30. **TRANSAS MARINE INTERNATIONAL AB (Transas Marine International AB)** AB, 5564892866, established in DATAVAGEN 37, ASKIM 436 32, Sweden, SE556489286601,

31. **VISSIM AS (Vissim AS)** AS, 946671975, established in VOLLVEIEN 5, HORTEN 3138, Norway, NO946671975MVA,

32. **UNITED KINGDOM HYDROGRAPHIC OFFICE (UKHO)**, established in ADMIRALTY WAY, TAUNTON TA1 2DN, United Kingdom, GB888805264,

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator.

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

Terms and Conditions

Annex 1 Description of the action

Annex 2 Estimated budget for the action

Annex 3 Accession Forms

Annex 4 Model for the financial statements

Annex 5 Model for the certificate on the financial statements

Annex 6 Model for the certificate on the methodology

TERMS AND CONDITIONS

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CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

CHAPTER 2 ACTION

ARTICLE 2 — ACTION TO BE IMPLEMENTED

The grant is awarded for the action entitled '***EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea — EfficienSea 2***' **('action')**, as described in Annex 1.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be ***36*** **months** as of *01/05/2015* ('**starting date of the action**').

ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS

4.1 Estimated budget

The '**estimated budget**' for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary and budget category (see Articles 5, 6).

4.2 Budget transfers

The estimated budget breakdown indicated in Annex 2 may be adjusted by transfers of amounts between beneficiaries or between budget categories (or both). This does not require an amendment according to Article 55, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

CHAPTER 3 GRANT

ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS

5.1 Maximum grant amount

The '**maximum grant amount**' is **EUR 9,822,818.16** (nine million eight hundred and twenty two thousand eight hundred and eighteen EURO and sixteen eurocents).

5.2 Form of grant, reimbursement rates and forms of costs

The grant reimburses ***100% of the eligible costs of the beneficiaries that are non-profit legal entities and 70% of the eligible costs of the beneficiaries that are profit legal entities*** (see Article 6) (‘**reimbursement of eligible costs grant**’) (see Annex 2).

The estimated eligible costs of the action are EUR **11,482,500.89** (eleven million four hundred and eighty two thousand five hundred EURO and eighty nine eurocents).

Eligible costs (see Article 6) must be declared under the following forms ('**forms of costs**'):

(a) for **direct personnel costs**:

- as actually incurred costs (‘**actual costs**’) or
- on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices (‘**unit costs**’).

Personnel **costs for SME owners** or **beneficiaries that are natural persons** not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2 (**unit costs**);

(b) for **direct costs for subcontracting**: as actually incurred costs (**actual costs**);

(c) for **direct costs of providing financial support to third parties**: *not applicable;*

(d) for **other direct costs**: as actually incurred costs (**actual costs**);

(e) for **indirect costs**: on the basis of a flat-rate applied as set out in Article 6.2, Point E (‘**flat-rate costs**’);

(f) ***specific cost category(ies):*** *not applicable.*

5.3 Final grant amount — Calculation

The ‘**final grant amount**’ depends on the actual extent to which the action is implemented in accordance with the Agreement’s terms and conditions.

This amount is calculated by the *Agency* — when the payment of the balance is made (see Article 21.4) — in the following steps:

Step 1 – Application of the reimbursement rates to the eligible costs

Step 2 – Limit to the maximum grant amount

Step 3 – Reduction due to the no-profit rule

Step 4 – Reduction due to improper implementation or breach of other obligations

5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries (see Article 20) and approved by the *Agency* (see Article 21).

5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

'**Profit**' means the surplus of the amount obtained following Steps 1 and 2 plus the action's total receipts, over the action's total eligible costs.

The '**action's total eligible costs**' are the consolidated total eligible costs approved by the *Agency*.

The '**action's total receipts**' are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

(a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;

(b) financial contributions given by third parties to the beneficiary specifically to be used for the action, and

(c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

(a) income generated by exploiting the action's results (see Article 28);

(b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);

(c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

5.3.4 Step 4 — Reduction due to improper implementation or breach of other obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the *Agency* will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the improper implementation of

the action or to the seriousness of the breach of obligations in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the *Agency* rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the '**revised final grant amount**' for the beneficiary concerned by the findings.

This amount is calculated by the *Agency* on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the *Agency* for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary's share in the grant amount reduced in proportion to its improper implementation of the action or to the seriousness of its breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

6.1 General conditions for costs to be eligible

'**Eligible costs**' are costs that meet the following criteria:

(a) for **actual costs**:

(i) they must be actually incurred by the beneficiary;

(ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);

(iii) they must be indicated in the estimated budget set out in Annex 2;

(iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;

(v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices;

(vi) they must comply with the applicable national law on taxes, labour and social security, and

(vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for **unit costs**:

(i) they must be calculated as follows:

{amounts per unit set out in Annex 2 or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A)

multiplied by

the number of actual units};

(ii) the number of actual units must comply with the following conditions:

- the units must be actually used or produced in the period set out in Article 3;
- the units must be necessary for implementing the action or produced by it, and
- the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for **flat-rate costs**:

(i) they must be calculated by applying the flat-rate set out in Annex 2, and

(ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

A. direct personnel costs;
B. direct costs of subcontracting;
C. *not applicable;*
D. other direct costs;
E. indirect costs;
F. *not applicable.*

'Direct costs' are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

'Indirect costs' are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

A. Direct personnel costs

Types of eligible personnel costs

A.1 **Personnel costs** are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action ('**costs for employees (or equivalent)**'). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the **remuneration**, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities[2] may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

(a) it is part of the beneficiary's usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;

(b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

(a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;

(b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or

(c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

{{EUR 8 000

divided by

the number of annual productive hours (see below)},

multiplied by

the number of hours that the person has worked on the action during the year}.

A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:

(a) the person works under the beneficiary's instructions and, unless otherwise agreed with the beneficiary, on the beneficiary's premises;

[2] For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: '**non-profit legal entity**' means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

(b) the result of the work carried out belongs to the beneficiary, and

(c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.3 The **costs of personnel seconded by a third party against payment** are eligible personnel costs, if the conditions in Article 11.1 are met.

A.4 **Costs of owners** of beneficiaries that are small and medium-sized enterprises ('**SME owners**') who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2 multiplied by the number of actual hours worked on the action.

A.5 **Costs of 'beneficiaries that are natural persons'** not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2 multiplied by the number of actual hours worked on the action.

Calculation

Personnel costs must be calculated by the beneficiaries as follows:

{{hourly rate

multiplied by

the number of actual hours worked on the action},

plus

for non-profit legal entities: additional remuneration to personnel assigned to the action under the conditions set out above (Point A.1)}.

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant is:

{the number of annual productive hours for the year (see below)

minus

total number of hours declared by the beneficiary for that person in that year for other EU or Euratom grants}.

The '**hourly rate**' is one of the following:

(a) for personnel costs declared as **actual costs:** the hourly rate is the amount calculated as follows:

{actual annual personnel costs (excluding additional remuneration) for the person

divided by

number of annual productive hours}.

The beneficiaries must use the annual personnel costs and the number of annual productive hours for each financial year covered by the reporting period. If a financial year is not closed at the end of the reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the 'number of annual productive hours', the beneficiaries may choose one of the following:

(i) 'fixed number of hours': 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);

(ii) 'individual annual productive hours': the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

'Annual workable hours' means the period during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

(iii) 'standard annual productive hours': the 'standard number of annual hours' generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the 'standard annual workable hours'.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours;

(b) for personnel costs declared on the basis of **unit costs**: the hourly rate is one of the following:

(i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2 (see Points A.4 and A.5 above), or

(ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:

- the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;

- the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

  The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).

B. Direct costs of subcontracting (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13.1.1 are met.

C. Direct costs of providing financial support to third parties *not applicable.*

D. Other direct costs

D.1 **Travel costs and related subsistence allowances** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

D.2 *The **depreciation costs of equipment, infrastructure or other assets** (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.*

*The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.*

*The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.*

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

D.3 **Costs of other goods and services** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:

(a) purchased specifically for the action and in accordance with Article 10.1.1 or

(b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

D.4 **Capitalised and operating costs of 'large research infrastructure'**[3] *directly used for the action are eligible, if:*

(a) the value of the large research infrastructure represents at least 75% of the total fixed assets (at historical value in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure[4]*);*

*(b) the beneficiary's methodology for declaring the costs for large research infrastructure has been positively assessed by the Commission ('**ex-ante assessment**');*

(c) the beneficiary declares as direct eligible costs only the portion which corresponds to the duration of the action and the rate of actual use for the purposes of the action, and

(d) they comply with the conditions as further detailed in the annotations to the H2020 grant agreements.

E. Indirect costs

Indirect costs are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

(a) costs of subcontracting and

(b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;

(c) *not applicable;*

(d) *not applicable.*

[3] '**Large research infrastructure**' means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

[4] For the definition, see Article 2(6) of Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) (OJ L 347, 20.12.2013 p.104)-('**Horizon 2020 Framework Programme Regulation No 1291/2013**'): '**Research infrastructure**' are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. Where relevant, they may be used beyond research, e.g. for education or public services. They include: major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives or scientific data; e-infrastructures such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation. Such infrastructures may be 'single-sited', 'virtual' or 'distributed'.

Beneficiaries receiving an operating grant[5] financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant.

F. *Specific cost category(ies)*

Not applicable

6.3 Conditions for costs of linked third parties to be eligible

not applicable

6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

In-kind contributions provided free of charge are eligible direct costs (for the beneficiary), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

6.5 Ineligible costs

'**Ineligible costs**' are:

(a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:

(i) costs related to return on capital;

(ii) debt and debt service charges;

(iii) provisions for future losses or debts;

(iv) interest owed;

(v) doubtful debts;

(vi) currency exchange losses;

(vii) bank costs charged by the beneficiary's bank for transfers from the *Agency*;

(viii) excessive or reckless expenditure;

(ix) deductible VAT;

(x) costs incurred during suspension of the implementation of the action (see Article 49);

(b) costs declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the

[5] For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 218, 26.10.2012, p.1) ('**Financial Regulation No 966/2012**'): '**operating grant**' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.

Agency for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period.

6.6 Consequences of declaration of ineligible costs

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES

SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION

ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION

7.1 General obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law.

7.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14).

In these cases, the beneficiaries retain sole responsibility towards the *Agency* and the other beneficiaries for implementing the action.

ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING EU FUNDING

Not applicable

ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES

10.1 Rules for purchasing goods, works or services

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.

The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are 'contracting authorities' within the meaning of Directive 2004/18/EC[6] or 'contracting entities' within the meaning of Directive 2004/17/EC[7] must comply with the applicable national law on public procurement.

10.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT

11.1 Rules for the use of in-kind contributions against payment

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties' costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The *Agency* may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

[6] Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

[7] Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1).

- they are specifically justified in the periodic technical report and

- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE

12.1 Rules for the use of in-kind contributions free of charge

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The *Agency* may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and

- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS

13.1 Rules for subcontracting action tasks

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The *Agency* may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that *the Agency,* the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC or ‘contracting entities’ within the meaning of Directive 2004/17/EC must comply with the applicable national law on public procurement.

13.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES

Not applicable

ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES

15.1 Rules for providing financial support to third parties

Not applicable

15.2 Financial support in the form of prizes

Not applicable

15.3 Consequences of non-compliance

Not applicable

ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE

16.1 Rules for providing trans-national access to research infrastructure

Not applicable

16.2 Rules for providing virtual access to research infrastructure

Not applicable

16.3 Consequences of non-compliance

Not applicable

SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION

ARTICLE 17 — GENERAL OBLIGATION TO INFORM

17.1 General obligation to provide information upon request

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement

Each beneficiary must keep information stored in the 'Beneficiary Register' (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the *Agency* and the other beneficiaries — of any of the following:

(a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's financial interests, in particular:

  (i) changes in its legal, financial, technical, organisational or ownership situation

(b) **circumstances** affecting:

  (i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

17.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION

18.1 Obligation to keep records and other supporting documentation

The beneficiaries must — for a period of *five* years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Articles 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The *Agency* may accept non-original documents if it considers that they offer a comparable level of assurance.

18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

(a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;

(b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, **for direct personnel costs declared as unit costs calculated in accordance with the beneficiary's usual cost accounting practices**, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2, Point A.

The beneficiaries may submit to the Commission, for approval, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions ('**certificate on the methodology**'). If the certificate is approved, costs declared in line with this methodology will not be challenged subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

(c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.

In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the *Agency* may accept alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 19 — SUBMISSION OF DELIVERABLES

19.1 Obligation to submit deliverables

The coordinator must submit the '**deliverables**' identified in Annex 1, in accordance with the timing and conditions set out in it.

19.2 Consequences of non-compliance

If the coordinator breaches any of its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 20 — REPORTING — PAYMENT REQUESTS

20.1 Obligation to submit reports

The coordinator must submit to the *Agency* (see Article 52) the technical and financial reports set out in this Article. These reports include the requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

20.2 Reporting periods

The action is divided into the following '**reporting periods**':

- RP1: from month 1 to month 18
- *RP2: from month 19 to month 36*

20.3 Periodic reports — Requests for interim payments

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

(a) a '**periodic technical report**' containing:

(i) an **explanation of the work carried out** by the beneficiaries;

(ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must also detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated '**plan for the exploitation and dissemination of the results**';

(iii) a **summary** for publication by the *Agency*;

(iv) the answers to the '**questionnaire**', covering issues related to the action implementation and the economic and societal impact, notably in the context of the Horizon 2020 key performance indicators and the Horizon 2020 monitoring requirements;

(b) a '**periodic financial report**' containing:

(i) an '**individual financial statement**' (see Annex 4) from each beneficiary, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex

2). Amounts which are not declared in the individual financial statement will not be taken into account by the *Agency*.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary must **certify** that:

- the information provided is full, reliable and true;
- the costs declared are eligible (see Article 6);
- the costs can be substantiated by adequate records and supporting documentation (see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and
- for the last reporting period: that all the receipts have been declared (see Article 5.3.3);

(ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary, for the reporting period concerned;

(iii) *not applicable;*

(iv) a '**periodic summary financial statement**' (see Annex 4), created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the **request for interim payment**.

20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

(a) a '**final technical report**' with a **summary** for publication containing:

(i) an overview of the results and their exploitation and dissemination;

(ii) the conclusions on the action, and

(iii) the socio-economic impact of the action;

(b) a '**final financial report**' containing:

(i) a '**final summary financial statement**' (see Annex 4), created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the **request for payment of the balance** and

(ii) a '**certificate on the financial statements**' (drawn up in accordance with Annex 5) for each beneficiary , if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2, Point A).

20.5 Information on cumulative expenditure incurred

Not applicable

20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries with accounting established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

20.8 Consequences of non-compliance — Suspension of the payment deadline — Termination

If the reports submitted do not comply with this Article, the *Agency* may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder sent by the *Agency*, the Agreement may be terminated (see Article 50).

ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

21.1 Payments to be made

The following payments will be made to the coordinator:

- one **pre-financing payment**;

- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and

- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the *EU* until the payment of the balance.

The amount of the pre-financing payment will be EUR **4,911,409.08** (four million nine hundred and eleven thousand four hundred and nine EURO and eight eurocents).

The *Agency* will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.

An amount of EUR **491,140.91** (four hundred and ninety one thousand one hundred and forty EURO and ninety one eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the *Agency* from the pre-financing payment and transferred into the '**Guarantee Fund**'.

21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The *Agency* will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the *Agency* in the following steps:

Step 1 – Application of the reimbursement rates

Step 2 – Limit to 90% of the maximum grant amount

21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs ; see Article 6) declared by the beneficiaries (see Article 20) and approved by the *Agency* (see above) for the concerned reporting period.

21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

{90% of the maximum grant amount (see Article 5.1)

minus

{pre-financing and previous interim payments}}.

21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the *Agency* will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.

Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the *Agency* by deducting the total amount of pre-financing and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

{final grant amount (see Article 5.3)

minus

{pre-financing and interim payments (if any) made}}.

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;

- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:

    - is positive, it will be paid to the coordinator

    - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiary's consent — against any other amount owed by the beneficiary to the *Agency, the* Commission or an*other* executive agency (under the EU or Euratom budget), up to the maximum EU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

21.5 Notification of amounts due

When making payments, the *Agency* will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

21.6 Currency for payments

The *Agency* will make all payments in euro.

21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the *Agency* from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:

(a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and

(b) to beneficiaries that have acceded to the Agreement (see Article 56).

21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: DANSKE BANK A/S
Address of branch: 2-12, HOLMENS KANAL COPENHAGEN, Denmark
Full name of the account holder: SOFARTFSSTYRELSEN
Full account number (including bank codes):
IBAN code: DK8402164069031625

21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the *Agency* bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

21.10 Date of payment

Payments by the *Agency* are considered to have been carried out on the date when they are debited to its account.

21.11 Consequences of non-compliance

21.11.1 If the *Agency* does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

22.1 Checks, reviews and audits by the *Agency and the* Commission

22.1.1 Right to carry out checks

The *Agency or the* Commission will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the *Agency or the* Commission may be assisted by external persons or bodies.

The *Agency or the* Commission may also request additional information in accordance with Article 17. The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

22.1.2 Right to carry out reviews

The *Agency or the* Commission may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables

and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started **up to two years after the payment of the balance**. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The *Agency or the* Commission may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.

For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a '**review report**' will be drawn up.

The *Agency or the* Commission will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory review procedure**').

Reviews (including review reports) are in the language of the Agreement.

22.1.3 Right to carry out audits

The *Agency or the* Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started **up to two years after the payment of the balance**. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The *Agency or the* Commission may carry out audits directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned

of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The *Agency or the* Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a '**draft audit report**' will be drawn up.

The *Agency or the* Commission will formally notify the draft audit report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory audit procedure**'). This period may be extended by the *Agency or the* Commission in justified cases.

The '**final audit report**' will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.

The *Agency or the* Commission may also access the beneficiaries' statutory records for the periodical assessment of unit costs or flat-rate amounts.

22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013[15] and No 2185/96[16] (and in accordance with their provisions and procedures) the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 161 of the Financial Regulation No 966/2012[17], the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

[15] Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

[16] Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

[17] Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('**Financial Regulation No 966/2012**') (OJ L 298, 26.10.2012, p. 1).

The ECA has the right of access for the purpose of checks and audits.

22.4 Checks, reviews, audits and investigations for international organisations

Not applicable

22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other EU or Euratom grants awarded under similar conditions ('**extension of findings from this grant to other grants**').

Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

22.5.2 Findings in other grants

The *Agency or the* Commission may extend findings from other grants to this grant ('**extension of findings from other grants to this grant**'), if:

(a) the beneficiary concerned is found, in other EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and

(b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

22.5.3 Procedure

The *Agency or the* Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs**: the formal notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings;

(b) the request to submit **revised financial statements** for all grants affected;

(c) the **correction rate for extrapolation** established by the *Agency or the* Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:

(i) considers that the submission of revised financial statements is not possible or practicable or

(ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the *Agency or the* Commission in justified cases.

The amounts to be rejected will be determined on the basis of the revised financial statements, subject to their approval.

If the *Agency or the* Commission does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements, it will formally notify the beneficiary concerned the application of the initially notified correction rate for extrapolation.

If the *Agency or the* Commission accepts the alternative correction method proposed by the beneficiary concerned, it will formally notify the application of the accepted alternative correction method.

22.5.3.2 If the findings concern **improper implementation** or a **breach of another obligation**: the formal notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings and

(b) the flat-rate the *Agency or the* Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

If the *Agency or the* Commission does not receive any observations or does not accept the observations or the proposed alternative flat-rate, it will formally notify the beneficiary concerned the application of the initially notified flat-rate.

If the *Agency or the* Commission accepts the alternative flat-rate proposed by the beneficiary concerned, it will formally notify the application of the accepted alternative flat-rate.

22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

23.1 Right to evaluate the impact of the action

The *Agency or the* Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the *EU* programme.

Evaluations may be started during implementation of the action and up to *five* years after the payment of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The *Agency or the* Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

23.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the *Agency* may apply the measures described in Chapter 6.

SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS

SUBSECTION 1 GENERAL

ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY

23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities[18].

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

23a.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

[18] Commission Recommendation C (2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.

SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND

ARTICLE 24 — AGREEMENT ON BACKGROUND

24.1 Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action ('**agreement on background**').

'**Background**' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

(a) is held by the beneficiaries before they acceded to the Agreement, and

(b) is needed to implement the action or exploit the results.

24.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

25.1 Exercise of access rights — Waiving of access rights — No sub-licensing

To exercise access rights, this must first be requested in writing ('**request for access**').

'**Access rights**' means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

25.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

(a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or

(b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

25.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its

background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

'**Fair and reasonable conditions**' means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.4 Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — to affiliated entities[19] established in an EU Member State or '**associated country**' [20], if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.5 Access rights for third parties

Not applicable

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

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[19] [19] For the definition, see Article 2.1(2) of the Rules for Participation Regulation No 1290/2013: '**affiliated entity**' means any legal entity that is under the direct or indirect control of a participant, or under the same direct or indirect control as the participant, or that is directly or indirectly controlling a participant.
'Control' may take any of the following forms:
(a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;
(b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned.
However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:
(a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
(b) the legal entities concerned are owned or supervised by the same public body.

[20] For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: '**associated country**' means a third country which is party to an international agreement with the Union, as identified in *Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.*

SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS

ARTICLE 26 — OWNERSHIP OF RESULTS

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

'**Results**' means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

(a) they have jointly generated them and

(b) it is not possible to:

(i) establish the respective contribution of each beneficiary, or

(ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('**joint ownership agreement**'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

(a) at least 45 days advance notice and

(b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

26.3 Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

26.4 *Agency* ownership, to protect results

26.4.1 *The Agency* may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in any of the following cases:

(a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);

(b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or

(c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the *Agency* and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the *Agency* decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may before the end of this period or, if the *Agency* takes a positive decision, until it has taken the necessary steps to protect the results.

26.4.2 *The Agency* may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

(a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;

(b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the *Agency* at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the *Agency* decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

26.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF EU FUNDING

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

(a) the results can reasonably be expected to be commercially or industrially exploited and

(b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

27.2 *Agency* ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, *The Agency* may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

27.3 Information on EU funding

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the *Agency* requests or agrees otherwise or unless it is impossible — include the following:

> "The project leading to this application has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure '**exploitation**' of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

(a) using them in further research activities (outside the action);

(b) developing, creating or marketing a product or process;

(c) creating and providing a service, or

(d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

28.2 Results that could contribute to European or international standards — Information on EU funding

If results could reasonably be expected to contribute to European or international standards, the beneficiary concerned must — up to four years after the period set out in Article 3 — inform the Agency.

If results are incorporated in a standard, the beneficiary concerned must — unless the *Agency* requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

> "Results incorporated in this standard received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF EU FUNDING

29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — '**disseminate**' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the *Agency* before dissemination takes place.

29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

(a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

(b) ensure open access to the deposited publication — via the repository — at the latest:

(i) on publication, if an electronic version is available for free via the publisher, or

(ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

(c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms *"European Union (EU)" and "Horizon 2020"*;
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

29.3 Open access to research data

Not applicable

29.4 Information on EU funding — Obligation and right to use the EU emblem

Unless the *Agency* requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

(a) display the EU emblem and

(b) include the following text:

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the *Agency*.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

29.5 Disclaimer excluding *Agency* responsibility

Any dissemination of results must indicate that it reflects only the author's view and that the *Agency* is not responsible for any use that may be made of the information it contains.

29.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS

30.1 Transfer of ownership

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

30.2 Granting licenses

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

(a) this does not impede the rights under Article 31 and

(b) *not applicable.*

In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

30.3 *Agency* right to object to transfers or licensing

Not applicable

30.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 31 — ACCESS RIGHTS TO RESULTS

31.1 Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

31.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

31.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.4 Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.5 Access rights for the EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes.

Such access rights are limited to non-commercial and non-competitive use.

This does not change the right to use any material, document or information received from the beneficiaries for communication and publicising activities (see Article 38.2).

31.6 Access rights for third parties

Not applicable

31.7 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 4 OTHER RIGHTS AND OBLIGATIONS

ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS

32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[22], in particular regarding:

- working conditions;
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

32.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 33 — GENDER EQUALITY

33.1 Obligation to aim for gender equality

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

[22] Commission recommendation (EC) No 251/2005 of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.03.2005, p. 67).

33.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 34 — ETHICS

34.1 Obligation to comply with ethical principles

The beneficiaries must carry out the action in compliance with:

(a) ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity[23] — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct) and

(b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

(a) aim at human cloning for reproductive purposes;

(b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or

(c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the '**ethics requirements**' set out in Annex 1.

Before the beginning of an activity raising an ethical issue, the coordinator must submit (see Article 52) to the *Agency* copy of:

(a) any ethics committee opinion required under national law and

(b) any notification or authorisation for activities raising ethical issues required under national law.

If these documents are not in English, the coordinator must also submit an English summary of the submitted opinions, notifications and authorisations (containing, if available, the conclusions of the committee or authority concerned).

[23] The European Code of Conduct for Research Integrity of ALLEA (All European Academies) and ESF (European Science Foundation) of March 2011.
http://www.esf.org/fileadmin/Public_documents/Publications/Code_Conduct_ResearchIntegrity.pdf

If these documents are specifically requested for the action, the request must contain an explicit reference to the action title. The coordinator must submit a declaration by each beneficiary concerned that all the submitted documents cover the action tasks.

34.3 Activities involving human embryos or human embryonic stem cells

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the *Agency* (see Article 52).

34.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 35 — CONFLICT OF INTERESTS

35.1 Obligation to avoid a conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest (‘**conflict of interests**’).

They must formally notify to the *Agency* without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The *Agency* may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

35.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 36 — CONFIDENTIALITY

36.1 General obligation to maintain confidentiality

During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed (‘**confidential information**’).

If a beneficiary requests, the *Agency* may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

(a) need to know to implement the Agreement and

(b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The *Agency* may disclose confidential information to its staff, other EU institutions and bodies or third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU's financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

Under the conditions set out in Article 4 of the Rules for Participation Regulation No 1290/2013[24], the Commission must moreover make available information on the results to other EU institutions, bodies, offices or agencies as well as Member States or associated countries.

The confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party;

(b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;

(c) the recipient proves that the information was developed without the use of confidential information;

(d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or

(e) the disclosure of the information is required by EU or national law.

36.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

[24] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81).

ARTICLE 37 — SECURITY-RELATED OBLIGATIONS

37.1 Results with a security recommendation

Not applicable

37.2 Classified results

Not applicable

37.3 Activities involving dual-use goods or dangerous materials and substances

Not applicable

37.4 Consequences of non-compliance

Not applicable

ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF EU FUNDING

38.1 Communication activities by beneficiaries

38.1.1 Obligation to promote the action and its results

The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the *Agency* (see Article 52).

38.1.2 Information on EU funding — Obligation and right to use the EU emblem

Unless the *Agency* requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

(a) display the EU emblem and

(b) include the following text:

> For communication activities: "This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".
>
> For infrastructure, equipment and major results: "This *[infrastructure][equipment][insert type of result]* is part of a project that has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the *Agency*.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

38.1.3 Disclaimer excluding the *Agency* responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the *Agency* is not responsible for any use that may be made of the information it contains.

38.2 Communication activities by the *Agency*

38.2.1 Right to use beneficiaries' materials, documents or information

The *Agency* may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any other material, such as pictures or audio-visual material that it receives from any beneficiary (including in electronic form).

This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

However, if the *Agency's* use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the *Agency* not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

(a) **use for its own purposes** (in particular, making them available to persons working for the *Agency* or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);

(b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);

(c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);

(d) **translation**;

(e) giving **access in response to individual requests** under Regulation No 1049/2001[25], without the right to reproduce or exploit;

[25] Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.

(f) **storage** in paper, electronic or other form;

(g) **archiving**, in line with applicable document-management rules, and

(h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b),(c),(d) and (f) to third parties if needed for the communication and publicising activities of the *Agency*.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

Where applicable (and if provided by the beneficiaries), the *Agency* will insert the following information:

> "© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the *Innovation and Networks Executive Agency* under conditions."

38.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 39 — PROCESSING OF PERSONAL DATA

39.1 Processing of personal data by the *Agency and the* Commission

Any personal data under the Agreement will be processed by the *Agency or the* Commission under Regulation No 45/2001[26] and according to the 'notifications of the processing operations' to the Data Protection Officer (DPO) of the *Agency or the* Commission (publicly accessible in the DPO register).

Such data will be processed by the '**data controller**' of the *Agency or the* Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the 'service specific privacy statement(s) (SSPS)' that are published on the *Agency and the* Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

[26] Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

39.2 Processing of personal data by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

The beneficiaries must inform the personnel whose personal data are collected and processed by the *Agency or the* Commission . For this purpose, they must provide them with the service specific privacy statement (SSPS) (see above), before transmitting their data to the *Agency or the* Commission .

39.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 39.2, the *Agency* may apply any of the measures described in Chapter 6.

ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE *AGENCY*

The beneficiaries may not assign any of their claims for payment against the *Agency* to any third party, except if approved by the *Agency* on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the *Agency* has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the *Agency*.

CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

41.1 Roles and responsibilities towards the *Agency*

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional EU funding for doing so), unless the *Agency* expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Articles 44, 45 and 46.

41.2 Internal division of roles and responsibilities

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each **beneficiary** must:

(i) keep information stored in the 'Beneficiary Register' (via the electronic exchange system) up to date (see Article 17);

(ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);

(iii) submit to the coordinator in good time:

- individual financial statements for itself and, if required, certificates on the financial statements (see Article 20);
- the data needed to draw up the technical reports (see Article 20);
- ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);
- any other documents or information required by the *Agency or the* Commission under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the *Agency or the* Commission.

(b) The **coordinator** must:

(i) monitor that the action is implemented properly (see Article 7);

(ii) act as the intermediary for all communications between the beneficiaries and the *Agency* (in particular, providing the *Agency* with the information described in Article 17), unless the Agreement specifies otherwise;

(iii) request and review any documents or information required by the *Agency* and verify their completeness and correctness before passing them on to the *Agency*;

(iv) submit the deliverables and reports to the *Agency* (see Articles 19 and 20);

(v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);

(vi) inform the *Agency* of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the *Agency*.

The coordinator may not delegate the above-mentioned tasks to any other beneficiary or subcontract them to any third party.

41.3 Internal arrangements between beneficiaries — Consortium agreement

*The beneficiaries must have internal arrangements regarding their operation and co-ordination to ensure that the action is implemented properly. These internal arrangements must be set out in a written '**consortium agreement**' between the beneficiaries, which may cover:*

- *internal organisation of the consortium;*

- *management of access to the electronic exchange system;*

- *distribution of EU funding;*

- *additional rules on rights and obligations related to background and results (including whether access rights remain or not, if a beneficiary is in breach of its obligations) (see Section 3 of Chapter 4);*

- *settlement of internal disputes;*

- *liability, indemnification and confidentiality arrangements between the beneficiaries.*

The consortium agreement must not contain any provision contrary to the Agreement.

41.4 Relationship with complementary beneficiaries — Collaboration agreement

Not applicable

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable

CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

42.1.1 The *Agency* will — at the time of an **interim payment, at the payment of the balance** or **afterwards** — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

42.1.2 The rejection may also be based on the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the *Agency* rejects costs **without reduction of the grant** (see Article 43) or **recovery of undue amounts** (see Article 44), it will formally notify the coordinator or beneficiary concerned the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or beneficiary concerned may — within 30 days of receiving notification — formally notify the *Agency* of its disagreement and the reasons why.

If the *Agency* rejects costs **with reduction of the grant** or **recovery of undue amounts** , it will formally notify the rejection in the '**pre-information letter**' on reduction or recovery set out in Articles 43 and 44.

42.3 Effects

If the *Agency* rejects costs at the time of an **interim payment** or **the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the *Agency* — **after an interim payment but before the payment of the balance** — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the *Agency* rejects costs **after the payment of the balance**, it will deduct the amount rejected from the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

ARTICLE 43 — REDUCTION OF THE GRANT

43.1 Conditions

43.1.1 The *Agency* may — **at the payment of the balance** or **afterwards** — reduce the maximum grant amount (see Article 5.1), if the action has not been implemented properly as described in Annex 1 or another obligation under the Agreement has been breached.

43.1.2 The *Agency* may also reduce the maximum grant amount on the basis of the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the improper implementation of the action or to the seriousness of the breach.

Before reduction of the grant, the *Agency* will formally notify a '**pre-information letter**' to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and

- inviting it to submit observations within 30 days of receiving notification

If the *Agency* does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

43.3 Effects

If the *Agency* reduces the grant at the time of **the payment of the balance**, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).

If the *Agency* reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the *Agency* will recover the difference (see Article 44).

ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

44.1 Amount to be recovered — Calculation — Procedure

The *Agency* will — after **termination of the participation of a beneficiary, at the payment of the balance** or **afterwards** — claim back any amount that was paid but is not due under the Agreement.

Each beneficiary's financial responsibility in case of recovery is limited to its own debt, except for the amount retained for the Guarantee Fund (see Article 21.4).

44.1.1 Recovery after termination of a beneficiary's participation

If recovery takes place after termination of a beneficiary's participation (including the coordinator), the *Agency* will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) *Not applicable;*

(c) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial regulation No 966/2012.

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC[27] applies.

44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the *Agency* will formally notify a '**pre-information letter**' to the coordinator:

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the *Agency* decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is positive** or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the *Agency* by the date in the debit note and has not submitted the report on the distribution of payments: the *Agency or the* Commission will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the *Agency* by the date in the debit note, but has submitted the report on the distribution of payments: the *Agency* will:

(a) identify the beneficiaries for which the amount calculated as follows is negative:

{{{ {beneficiary's costs declared in the final summary financial statement and approved by the *Agency* multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)},

[27] Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).

minus

{pre-financing and interim payments received by the beneficiary}}.

(b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

{{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount set out in the debit note formally notified to the coordinator}.

If payment is not made by the date specified in the debit note, the *Agency* will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **drawing on the Guarantee Fund**. The *Agency or the* Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) *not applicable;*

(ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the *Agency*.

The beneficiary's share of the final grant amount is calculated as follows:

{{{beneficiary's costs declared in the final summary financial statement and approved by the *Agency* multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)}.

If the coordinator has not distributed amounts received (see Article 21.7), the *Agency* will also recover these amounts.

The *Agency* will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the *Agency* decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency* will **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **drawing on the Guarantee Fund**. The *Agency or the* Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) *not applicable;*

(ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the date for payment in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

ARTICLE 45 — ADMINISTRATIVE AND FINANCIAL PENALTIES

45.1 Conditions

Under Articles 109 and 131(4) of the Financial Regulation No 966/2012, the *Agency* may impose **administrative** and **financial penalties** if a beneficiary:

(a) has committed substantial errors, irregularities or fraud or is in serious breach of its obligations under the Agreement or

(b) has made false declarations about information required under the Agreement or for the submission of the proposal (or has not supplied such information).

Each beneficiary is responsible for paying the financial penalties imposed on it.

Under Article 109(3) of the Financial Regulation No 966/2012, the *Agency or the* Commission may — under certain conditions and limits — publish decisions imposing administrative or financial penalties.

45.2 Duration — Amount of penalty — Calculation

Administrative penalties exclude the beneficiary from all contracts and grants financed from the EU or Euratom budget for a maximum of five years from the date the infringement is established by the *Agency*.

If the beneficiary commits another infringement within five years of the date the first infringement is established, the *Agency* may extend the exclusion period up to 10 years.

Financial penalties will be between 2% and 10% of the maximum EU contribution indicated, for the beneficiary concerned, in the estimated budget (see Annex 2).

If the beneficiary commits another infringement within five years of the date the first infringement is established, the *Agency* may increase the rate of financial penalties to between 4% and 20%.

45.3 Procedure

Before applying a penalty, the *Agency* will formally notify the beneficiary concerned:

- informing it of its intention to impose a penalty, its duration or amount and the reasons why and
- inviting it to submit observations within 30 days.

If the *Agency* does not receive any observations or decides to impose the penalty despite of observations it has received, it will formally notify **confirmation** of the penalty to the beneficiary concerned and — in case of financial penalties — deduct the penalty from the payment of the balance or formally notify a **debit note**, specifying the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission may **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

SECTION 2 LIABILITY FOR DAMAGES

ARTICLE 46 — LIABILITY FOR DAMAGES

46.1 Liability of the *Agency*

The *Agency* cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The *Agency* cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

46.2 Liability of the beneficiaries

46.2.1 Conditions

Except in case of force majeure (see Article 51), the beneficiaries must compensate the *Agency* for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

Each beneficiary is responsible for paying the damages claimed from it.

46.2.2 Amount of damages - Calculation

The amount the *Agency* can claim from a beneficiary will correspond to the damage caused by that beneficiary.

46.2.3 Procedure

Before claiming damages, the *Agency* will formally notify the beneficiary concerned:

- informing it of its intention to claim damages, the amount and the reasons why and
- inviting it to submit observations within 30 days.

If the *Agency* does not receive any observations or decides to claim damages despite the observations it has received, it will formally notify **confirmation** of the claim for damages and a **debit note**, specifying the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the *Agency or the* Commission may **recover** the amount:

(a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the *Agency, the* Commission or an*other* executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the *Agency* may offset before the payment date specified in the debit note;

(b) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the *Agency or the* Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

SECTION 3 SUSPENSION AND TERMINATION

ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

47.1 Conditions

The *Agency* may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

(a) it does not comply with the provisions of the Agreement (see Article 20);

(b) the technical reports or financial reports have not been submitted or are not complete or additional information is needed, or

(c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

47.2 Procedure

The *Agency* will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day notification is sent by the *Agency* (see Article 52).

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the *Agency* if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the *Agency* may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(l)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The *Agency* may — at any moment — suspend, in whole or in part, the pre-financing payment and interim payments for one or more beneficiaries or the payment of the balance for all beneficiaries, if a beneficiary:

(a) has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement or

(b) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

48.2 Procedure

Before suspending payments, the *Agency* will formally notify the coordinator:

- informing it of its intention to suspend payments and the reasons why and

- inviting it to submit observations within 30 days of receiving notification.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will **take effect** the day the confirmation notification is sent by the *Agency*.

If the conditions for resuming payments are met, the suspension will be **lifted**. The *Agency* will formally notify the coordinator.

During the suspension, the periodic report(s) (see Article 20.3) must not contain any individual financial statements from the beneficiary concerned. When the *Agency* resumes payments, the coordinator may include them in the next periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

49.1 Suspension of the action implementation, by the beneficiaries

49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

49.1.2 Procedure

The coordinator must immediately formally notify to the *Agency* the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the *Agency*.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the *Agency* and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

49.2 Suspension of the action implementation, by the *Agency*

49.2.1 Conditions

The *Agency* may suspend implementation of the action or any part of it:

(a) if a beneficiary has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement;

(b) if a beneficiary has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations

that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2), or

(c) if the action is suspected of having lost its scientific or technological relevance.

49.2.2 Procedure

Before suspending implementation of the action, the *Agency* will formally notify the coordinator:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received by the coordinator (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the *Agency* (see Article 46).

Suspension of the action implementation does not affect the *Agency's* right to terminate the Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES

50.1 Termination of the Agreement by the beneficiaries

50.1.1 Conditions and procedure

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the *Agency* (see Article 52), stating:

- the reasons why and
- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the *Agency* considers the reasons do not justify termination, the Agreement will be considered to have been '**terminated improperly**'.

The termination will **take effect** on the day specified in the notification.

50.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a periodic report (for the open reporting period until termination; see Article 20.3) and

(ii) the final report (see Article 20.4).

If the *Agency* does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The *Agency* will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries

50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the *Agency* (see Article 52) and inform the beneficiary concerned.

If the coordinator's participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary

concerned is the coordinator. In this case, the request for amendment must propose a new coordinator.

If this information is not given or if the *Agency* considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

(i) a report on the distribution of payments to the beneficiary concerned and

(ii) if termination takes effect during the period set out in Article 3, a '**termination report**' from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the *Agency*, (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the *Agency*, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The *Agency* will **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's EU contribution (calculated by applying the reimbursement rate(s) to the eligible costs declared by the beneficiary and approved by the *Agency*). Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

- If the payments received **exceed the amounts due**:

  - if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The *Agency* will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the *Agency* will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - in all other cases (in particular if termination takes effect after the period set out in Article 3), the *Agency* will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due

and the *Agency* will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:

  - termination is after an interim payment and

  - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

  In this case, the *Agency* will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due. The *Agency* will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

• If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the *Agency* does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the *Agency* does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that

- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the *Agency*

50.3.1 Conditions

The *Agency* may terminate the Agreement or the participation of one or more beneficiaries, if:

(a) one or more beneficiaries do not accede to the Agreement (see Article 56);

(b) a change to their legal, financial, technical, organisational or ownership situation is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;

(c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);

(d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:

(i) resumption is impossible, or

(ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;

(e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;

(f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;

(g) a beneficiary does not comply with the applicable national law on taxes and social security;

(h) the action has lost scientific or technological relevance;

(i) *not applicable;*

(j) *not applicable;*

(k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity affecting the EU's financial interests;

(l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has — in the award procedure or under the Agreement — committed:

(i) substantial errors, irregularities, fraud or

(ii) serious breach of obligations, including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles;

(m) a beneficiary has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant ('**extension of findings from other grants to this grant**').

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the *Agency* will formally notify the coordinator:

- informing it of its intention to terminate and the reasons why and

- inviting it, within 30 days of receiving notification, to submit observations and — in case of Point (l.ii) above — to inform the *Agency* of the measures to ensure compliance with the obligations under the Agreement.

If the *Agency* does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), and (l.ii) above: on the day specified in the notification of the confirmation (see above);

- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received by the coordinator.

50.3.3 Effects

(a) for **termination of the Agreement**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a periodic report (for the last open reporting period until termination; see Article 20.3) and

(ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit the reports (see Articles 20.8 and 50.3.1(l)), the coordinator may not submit any reports after termination.

If the *Agency* does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The *Agency* will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the *Agency's* right to reduce the grant (see Article 43) or to impose administrative and financial penalties (Article 45).

The beneficiaries may not claim damages due to termination by the *Agency* (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

(b) for **termination of the participation of one or more beneficiaries**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a report on the distribution of payments to the beneficiary concerned;

(ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if

necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and

(iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the *Agency* (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the *Agency*, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The *Agency* will **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's EU contribution (calculated by applying the reimbursement rate(s) to the eligible costs declared by the beneficiary and approved by the *Agency*). Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

- If the payments received **exceed the amounts due**:

  - if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The *Agency* will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the *Agency* will draw upon the Guarantee Fund to pay the coordinator and then notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - in all other cases, in particular if termination takes effect after the period set out in Article 3, the *Agency* will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due and the *Agency* will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);

  - if the beneficiary concerned is the former coordinator, it must repay the new coordinator the amount unduly received, unless:

    - termination takes effect after an interim payment and

- the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7)

In this case, the *Agency* will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the *Agency* the amount due. The *Agency* will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

- If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the *Agency* does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the *Agency* does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned, and that
- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38 and 40) continue to apply.

SECTION 4 FORCE MAJEURE

ARTICLE 51 — FORCE MAJEURE

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of third parties involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,
- labour disputes or strikes, or
- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

CHAPTER 7 FINAL PROVISIONS

ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES

52.1 Form and means of communication

Communication under the Agreement (information, requests, submissions, 'formal notifications', etc.) must:

- be made in writing and
- bear the number of the Agreement.

Until the payment of the balance: all communication must be made through the electronic exchange system and using the forms and templates provided there.

After the payment of the balance: formal notifications must be made by registered post with proof of delivery ('formal notification on paper').

Communications in the electronic exchange system must be made by persons authorised according to the 'Terms and Conditions of Use of the electronic exchange system'. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'Legal Entity Appointed Representative (LEAR)'. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Terms and Conditions of Use of the electronic exchange system).

If the electronic exchange system is temporarily unavailable, instructions will be given on the *Agency and* Commission websites.

52.2 Date of communication

Communications are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

Formal notifications through the **electronic** exchange system are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

52.3 Addresses for communication

The **electronic** exchange system must be accessed via the following URL:

https://ec.europa.eu/research/participants/portal/desktop/en/projects/

The *Agency* will formally notify the coordinator and beneficiaries in advance any changes to this URL.

Formal notifications on paper (only after the payment of the balance) addressed **to the *Agency*** must be sent to the following address:

Innovation and Networks Executive Agency
TRANSPORT RESEARCH
W 910
B-1049 Brussels Belgium

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the 'Beneficiary Register'.

ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

53.2 Privileges and immunities

Not applicable

ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71[28], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

[28] Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).

Amendments may be requested by any of the parties.

55.2 Procedure

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why;
- the appropriate supporting documents;
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The *Agency* may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the *Agency* has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

ARTICLE 56 — ACCESSION TO THE AGREEMENT

56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the *Agency's* right to terminate the Agreement (see Article 50).

56.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55. It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

57.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

57.2 Dispute settlement

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

As an exception, if such a dispute is between the Agency and VISSIM AS, the competent Belgian courts have sole jurisdiction.

If a dispute concerns administrative or financial penalties, offsetting or an enforceable decision under Article 299 TFEU (see Articles 44, 45 and 46), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU. *Actions against enforceable decisions must be brought against the Commission (not against the Agency).*

ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT

The Agreement will enter into force on the day of signature by the *Agency* or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

Karoline LUNDHOLT with ECAS id nlunkaro signed in the Participant Portal on 21/04/2015 at 11:30:06 (transaction id SigId-2703-1jrYnaSAY1fr04TwaJic5GkMvG3IQ1e466PTt8SaXEyfV1f0r8pdovUE0vJVH9qfHKvsSM8rP9mV556C6UZeLG-Jj71zxYb8yrsWziRzxU0uBm-QM3cOfKzICdyCvrlkbk49arpgEy7MuvzVzzs66R62637). Timestamp by third party at
Tue Apr 21 12:30:13 CEST 2015

For the *Agency*

Dirk BECKERS with ECAS id beckedi signed in the Participant Portal on 22/04/2015 at 16:00:15 (transaction id SigId-5855-Y7gChT3H3Oa7zG8zNqOOFeERl9pVpEmLwYnWcYmYwdAsE4a4jzUqBzXifzkLgXzGil3qEpSN2CzTgHMFj53moLZ4-Jj71zxYb8yrsWziRzxU0uBm-0rHSJZ2yTW691TGbJ9I9enxmX8YlO7sd8GVIMjJ7I8y). Timestamp by third party at
Wed Apr 22 17:00:19 CEST 2015

EUROPEAN COMMISSION

Innovation and Networks Executive Agency

TRANSPORT RESEARCH

ANNEX 1 (part A)

Innovation action

NUMBER — 636329 — EfficienSea 2

Table of Contents

1.1. The project summary

Project Number [1]	636329	Project Acronym [2]	EfficienSea 2

One form per project

General information	
Project title [3]	EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea
Starting date [4]	01/05/2015
Duration in months [5]	36
Call (part) identifier [6]	H2020-MG-2014_TwoStages
Topic	MG-4.2-2014 Safer and more efficient waterborne operations through new technologies and smarter traffic management
Fixed EC Keywords	Maritime services, Traffic management and surveillance, Navigation and communication, Maritime safety, Waterborne transport
Free keywords	e-maritime, e-navigation, Arctic, emergency response, emission monitoring, Maritime Cloud, Route exchange, standards, VDES, Robust communication, MSI, infrastructure, SOx, SafeSeaNet, single window

Abstract [7]

The trend in navigational accidents no longer appears to decrease. In a Formal Safety Assessment (IMO NAV59-6, Annex 1) 5.544 navigational and 7.275 other accidents resulted in the loss of 6.264 lives (2001-2010). The coincide of EU policies on safer and more efficient waterborne operations and in particular the e-maritime initiative with IMO's strategy for e-navigation opens a unique window of opportunity to influence the maritime sector and make substantial impact. Funding of EfficienSea 2 will enable the consortium to exploit this window of opportunity, supporting EU policies and marine traffic management through services to: 1. Improve navigational safety and efficiency2. Improve Arctic navigation and emergency response3. Decrease administrative burdens4. Improve environmental monitoring & enforcementLasting impact will be ensured by five enabling actions: 1. Development of the Maritime Cloud – a communication framework for both e-maritime and e-navigation - enabling efficient sharing of information between all maritime stakeholders2. Maturing emerging communication technologies, improving ships connectivity3. Proactive facilitation of standardisation to maximize adoption and impact4. Showcasing solutions in two very different geographic areas. Web-based initial implementation of the services will be done in the Arctic and the Baltic5. Ensure an ambitious upgrade of international maritime safety regimes through a strong participation in regulatory bodies including EU and IMOEfficienSea 2 has gathered a unique level of competence in a consortium of 32 partners from 10 countries representing authorities, academia, international organisations as well as equipment manufacturers combining all the right capacities for effectively achieving these ambitious objectives.

1.2. List of Beneficiaries

Project Number [1]	636329	Project Acronym [2]	EfficienSea 2

List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
1	SØFARTSSTYRELSEN	SØFARTSSTYRELSEN	Denmark	1	36
2	GEODATASTYRELSEN	KMS	Denmark	1	36
3	DANMARKS METEOROLOGISKE INSTITUT	DANMARKS METEOROLOGISKE INSTITUT	Denmark	1	36
4	VEETEEDE AMET	Veeteede Amet	Estonia	1	36
5	LIIKENNEVIRASTO	LIIKENNEVIRASTO	Finland	1	36
6	URZAD MORSKI W GDYNI	Maritime Office in Gdynia	Poland	1	36
7	INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Poland	1	36
8	SWEDISH MARITIME ADMINISTRATION	SWEDISH MARITIME ADMINISTRATION	Sweden	1	36
9	CHALMERS TEKNISKA HOEGSKOLA AB	CHALMERS	Sweden	1	36
10	KOBENHAVNS UNIVERSITET	UCPH	Denmark	1	36
11	DANMARKS TEKNISKE UNIVERSITET	DTU	Denmark	1	36
12	LATVIJAS JURAS AKADEMIJA	LATVIAN MARITIME ACADEMY	Latvia	1	36
13	OFFIS EV	OFFIS EV	Germany	1	36
14	THE BALTIC AND INTERNATIONAL MARITIME COUNCIL/BIMCO	BIMCO	Denmark	1	36
15	COMITE INTERNATIONAL RADIO MARITIME-(CIRM)	CIRM	United Kingdom	1	36
16	ASSOCIATION INTERNATIONALE DE SIGNALISATION MARITIME	IALA	France	1	36
17	Europas Maritime Udviklingscenter	MDCE	Denmark	1	36
18	SSPA SWEDEN AB.	SSPA	Sweden	1	36
19	FORCE TECHNOLOGY	FORCE TECHNOLOGY	Denmark	1	36
20	COLLECTE LOCALISATION SATELLITES SA	CLS	France	1	36

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
21	DANELEC ELECTRONICS AS	Danelec Marine	Denmark	1	36
22	FREQUENTIS AG	FREQUENTIS	Austria	1	36
23	Furuno Finland Oy	FUR	Finland	1	36
24	GateHouse A/S	GateHouse A/S	Denmark	1	36
25	LITEHAUZ APS	Litehauz ApS	Denmark	1	36
26	LYNGSO MARINE AS	LYNGSO MARINE AS	Denmark	1	36
27	MARSEC-XL INTERNATIONAL LTD	MARSEC-XL	Malta	1	36
28	ROCKETBROTHERS.DK APS	Rocket Brothers	Denmark	1	36
29	THRANE & THRANE AS	Thrane & Thrane A/S	Denmark	1	36
30	TRANSAS MARINE INTERNATIONAL AB	Transas Marine International AB	Sweden	1	36
31	VISSIM AS	Vissim AS	Norway	1	36
32	UNITED KINGDOM HYDROGRAPHIC OFFICE	UKHO	United Kingdom	1	36

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number [9]	WP Title	Lead beneficiary [10]	Person-months [11]	Start month [12]	End month [13]
WP1	Measures to maximize impact	1 - SØFARTSSTYRELSEN	84.40	1	36
WP2	Novel communication technologies	29 - Thrane & Thrane A/S	330.10	1	36
WP3	Maritime Cloud	1 - SØFARTSSTYRELSEN	185.50	1	36
WP4	e-navigation services	1 - SØFARTSSTYRELSEN	247.50	1	36
WP5	Administrative burdens and exhaust emissions	14 - BIMCO	83.60	1	36
WP6	Advanced e-navigation solutions in the Arctic and Baltic Sea Region	8 - SWEDISH MARITIME ADMINISTRATION	198.50	1	36
WP7	Project Management	1 - SØFARTSSTYRELSEN	34.90	1	36
		Total	1,164.50		

1.3.2. WT2 list of deliverables

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D1.1	Project website	WP1	1 - SØFARTSSTYRELSEN	Websites, patents filing, etc.	Public	3
D1.2	Plan for dissemination, exploitation and communication	WP1	1 - SØFARTSSTYRELSEN	Report	Public	18
D1.3	Final report on dissemination, exploitation and communication	WP1	1 - SØFARTSSTYRELSEN	Report	Public	36
D1.4	Report on relevant ongoing external projects and testbeds	WP1	16 - IALA	Report	Public	6
D1.5	Report on ongoing standardization work relevant to the project	WP1	16 - IALA	Report	Public	6
D1.6	Recommendation on governance and future perspectives of solutions	WP1	1 - SØFARTSSTYRELSEN	Report	Public	36
D1.7	Minimum four meetings, workshops, etc. involving HLUG	WP1	17 - MDCE	Demonstrator	Public	36
D1.8	Final usability evaluation report	WP1	9 - CHALMERS	Report	Public	33
D1.9	IPR strategy	WP1	1 - SØFARTSSTYRELSEN	Report	Public	6
D2.1	Report on status on development of VDES	WP2	29 - Thrane & Thrane A/S	Report	Public	18
D2.2	Field demonstration of a prototype VDES	WP2	29 - Thrane & Thrane A/S	Demonstrator	Public	33
D2.3	Report on technical characteristics and limitations achieved for VDES	WP2	29 - Thrane & Thrane A/S	Report	Public	36
D2.4	Analysis report on available and emerging communications technologies	WP2	20 - CLS	Report	Public	9
D2.5	Report on space weather effects on communication and positioning services	WP2	20 - CLS	Report	Public	18

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D2.6	report on space weather forecast warning service	WP2	20 - CLS	Report	Public	30
D2.7	Concept and specification for seamless roaming	WP2	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	9
D2.8	Specification of the interface to maritime cloud	WP2	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	18
D2.9	Results of simulation and onboard testing	WP2	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	33
D2.10	Onboard system integration architecture	WP2	21 - Danelec Marine	Report	Public	12
D2.11	Specification of protocols for ship-to-shore communication	WP2	21 - Danelec Marine	Report	Public	24
D2.12	Prototype demonstration of ship-to-shore communication roaming	WP2	21 - Danelec Marine	Demonstrator	Public	36
D3.1	Analysis report	WP3	1 - SØFARTSSTYRELSEN	Report	Public	6
D3.2	Conceptual model	WP3	22 - FREQUENTIS	Report	Public	9
D3.3	Input to international fora on conceptual model	WP3	1 - SØFARTSSTYRELSEN	Demonstrator	Public	18
D3.4	Service specification, including MSDL	WP3	22 - FREQUENTIS	Report	Public	12
D3.5	Review report on service specification	WP3	1 - SØFARTSSTYRELSEN	Report	Public	18
D3.6	Standard proposal for Maritime Cloud service specification	WP3	22 - FREQUENTIS	Report	Public	18
D3.7	Technical specification of the Maritime Cloud	WP3	13 - OFFIS EV	Report	Public	18

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D3.8	Reviewed technical specification	WP3	1 - SØFARTSSTYRELSEN	Report	Public	33
D3.9	Alpha release – source code and documentation	WP3	1 - SØFARTSSTYRELSEN	Report	Public	18
D3.10	Final beta release – source code and documentation	WP3	1 - SØFARTSSTYRELSEN	Report	Public	36
D3.11	Guidelines for deployment of the Maritime Cloud	WP3	1 - SØFARTSSTYRELSEN	Report	Public	36
D3.12	Prototypical instances of the Maritime Cloud (alpha release M18, beta release M36)	WP3	1 - SØFARTSSTYRELSEN	Demonstrator	Public	36
D3.13	Tests and demonstration report	WP3	1 - SØFARTSSTYRELSEN	Report	Public	36
D4.1	Prototype operational framework supporting ArcticWeb and BalticWeb	WP4	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D4.2	Final documentation of operational framework	WP4	1 - SØFARTSSTYRELSEN	Report	Public	30
D4.3	Operational MSI/ NM(T&P) service	WP4	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D4.4	Documentation of MSI/NM (T&P) service	WP4	1 - SØFARTSSTYRELSEN	Report	Public	30
D4.5	Operational METOC service	WP4	3 - DANMARKS METEOROLOGISKE INSTITUT	Demonstrator	Public	24
D4.6	Documentation of METOC service	WP4	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	30
D4.7	A prototype service for delivering nautical charts and updates in S101 format	WP4	2 - KMS	Demonstrator	Public	18
D4.8	Results for tests with sensor data and analysis	WP4	6 - Maritime Office in Gdynia	Report	Public	30
D4.9	A prototype route optimisation service	WP4	18 - SSPA	Demonstrator	Public	33

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D4.10	Operational ice chart service	WP4	3 - DANMARKS METEOROLOGISKE INSTITUT	Demonstrator	Public	24
D4.11	Documentation of ice chart service	WP4	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	30
D5.1	Draft S-100 product specification for common port reporting	WP5	24 - GateHouse A/S	Report	Public	18
D5.2	Demonstration of prototype application for automated port reporting	WP5	24 - GateHouse A/S	Demonstrator	Public	33
D5.3	Development of a new common port database concept and structure	WP5	24 - GateHouse A/S	Demonstrator	Public	10
D5.4	Online tests of ship data transfer. Report on the results	WP5	14 - BIMCO	Report	Public	30
D5.5	Prototype database on online port data	WP5	25 - Litehauz ApS	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	34
D5.6	Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement	WP5	25 - Litehauz ApS	Report	Public	10
D5.7	Report on online land-based system tests and ship-based tests	WP5	25 - Litehauz ApS	Report	Public	30
D5.8	Working prototype of online sensor with cloud-based algorithm	WP5	25 - Litehauz ApS	Demonstrator	Public	35
D6.1	Basic route handling/ exchange service	WP6	5 - LIIKENNEVIRASTO	Demonstrator	Public	18
D6.2	Route reporting to VTS service	WP6	5 - LIIKENNEVIRASTO	Demonstrator	Public	24

Deliverable Number [14]	Deliverable Title	WP number [9]	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D6.3	Service for reporting VTS information and forwarding and sharing information between VTS centres	WP6	8 - SWEDISH MARITIME ADMINISTRATION	Demonstrator	Public	30
D6.4	Service for SRS reporting	WP6	8 - SWEDISH MARITIME ADMINISTRATION	Demonstrator	Public	30
D6.5	Improved route handling/exchange capabilities in ArcticWeb	WP6	9 - CHALMERS	Demonstrator	Public	30
D6.6	Report on the progress/experience in live position sharing and crowd-sourcing	WP6	18 - SSPA	Report	Public	30
D6.7	ArcticWeb expanded to include self-organised emergency response capabilities	WP6	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D6.8	Report on human factor aspects of e-navigation services	WP6	9 - CHALMERS	Report	Public	33
D6.9	Report on studies of the use of "comfort-zone" and "no-go areas"	WP6	9 - CHALMERS	Report	Public	24
D6.10	A report on the advancements in METOC models and uncertainty estimates	WP6	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	33
D7.1	Project management plan	WP7	1 - SØFARTSSTYRELSEN	Report	Public	3

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	**Lead beneficiary** [10]	1 - SØFARTSSTYRELSEN
Work package title	Measures to maximize impact		
Start month	1	**End month**	36

Objectives

The sole objective of WP1 is to keep the project's focus on the desired impact.
The WP will be responsible for the dissemination, exploitation and communication plan. This includes strategic planning of standardization, fostering liaison with other projects and securing adoption of so-lutions in the maritime community. The WP will also be responsible for the project innovation strategy and innovation process. It will support the technical work in the other WPs, while constantly keeping focus on the user need, securing that suitable innovation methods are used throughout the project.

Description of work and role of partners

WP1 - Measures to maximize impact [Months: 1-36]
SØFARTSSTYRELSEN, KMS, CHALMERS, LATVIAN MARITIME ACADEMY, OFFIS EV, CIRM, IALA, MDCE , FORCE TECHNOLOGY, UKHO
WP 1 will address dissemination and communication activities and ensure support for internal and external liaison and coordination of strategic output to international bodies, standardization activities, etc. One part-ner (MDCE) is specifically tasked with a role of coordinating activities with the High Level User Group to ensure that project activities remain focused on user and market needs.

Plan for communication, dissemination and exploitation of the project's results
Success for the initiatives in EfficienSea 2 is dependent on adoption. Dissemination, exploitation and communication are integrated tasks of WP1, dealing with measures to maximize impact that enable both regional and, in some cases, global adoption. In this respect it is not a goal in itself to brand the project, but focus is on selling the project's insights and solutions to the maritime world.

Task 1.1 Communication

Task Lead: DMA
Contributor: DGA

Communication activities will be closely linked to dissemination. As much communication as possible should be dialog based to promote understanding and feedback from the audiences.
Defined target groups and communication objectives are:
- Regulating authorities and bodies → Convince them of the value of the common framework and promote regulation where relevant.
- Standard setting organisations and their members → Promote the value of standardising service provision via the Maritime Cloud.
- Service and data providers primarily in BSR and Arctic secondary globally → Persuade them to deliver their services in the standards developed by the project.
- Equipment manufacturers → Get them to adopt the new standards in their products.
- Other related projects → Promote harmonization and standardization.
- Use the conceptual model and prototypes to demonstrate the concepts and value.
This task will act as the marketing and sales function in the project. Main focus is on ensuring that measures to maximise impact are effective in disseminating the project results and paving the way for the innovations to reach the market. This task will ensure that innovation activities are known to all targeted audiences.
- Developing and maintaining the 'Plan for dissemination, exploitation and communication'
- Working with all partners in particular the commercial partners on identifying and dealing with the issues associated with exploitation and bringing the innovations to market
- Mapping key stakeholders and specific gatekeepers for adoption
- Developing communication material for appropriate media platforms
- Strategy for influencing international maritime safety regimes

- Working together with relevant organisations in making different promotional material targeting manufacturers and end users and distributing it through partner organisations like CIRM, BIMCO and the HLUG member ICS as well are other relevant organisations.
/ /
Task 1.2 Liaison and coordination with other projects and test beds

Lead: IALA
Contributors: CIRM, OFFIS, DMA

- Identifying and initiating liaison with related European projects
- Initiating liaison with relevant European institutions, such as EMSA
- Mapping and keeping track of other ongoing initiatives that could be of relevance to coordination and harmonization (to be updated internally at regular intervals)
- Organising and executing workshops and other coordination activities
- Integration strategy with other projects and test beds regionally and globally.
/ /
Task 1.3 Coordinating standardization of solutions

Task Lead: IALA
Contributors: CIRM, UKHO

Standardization is of paramount importance for getting adoption and penetration for interoperable services and equipment. It thus plays a vital role in the project. The work with the relevant standardization organisations on the individual standards is primarily performed in the other individual work packages. WP 1 is responsible for overview and coordination. This is of paramount importance because of interdependencies of the standards. E.g. for one service to function, standards may be needed for data structures, portrayal and operational scope, as well as communication and equipment.
WP1 will map the ongoing standardization work and follow the progress in relevant standardization bodies, and develop a strategic standardization plan, to be updated regularly. Such reports will place the project in a wider context and ensure that project standardization work is in harmony with industry standardization work. This overview will be accessible to the project partners as well as other parties interested in the subject.
/ /
Task 1.4 Governance and future perspectives of solutions

Task Lead: DMA
Contributors: IALA, CIRM, MDCE

This task will work with strategic/political, legal and financial issues in bringing concepts and demonstrations to market – e.g. governance and business model for Maritime Cloud (feasibility studies). The work will be done in collaboration with relevant WPs and involve the maritime com-munity e.g. through workshops. Both sceptical and supportive actors will be invited to discuss the is-sues.
The task will also identify and conceptualise future uses and applications of the developed solutions. This could for instance be how the Maritime Cloud could be utilized on a personal level. As an ex-ample, could it help document seafarers' sailing time to be used for issuing personal certificates.
//
Task 1.5 Ensuring inputs from High Level User Group

Task Lead: MDCE
Contributor: DMA

EfficienSea 2 has established a High Level User Group (HLUG) consisting of specific maritime stakeholders such as shipowners, pilots, ports, agents or their respective organisations. This group will be expanded dynamically during the project and will be invited regularly to comment on the results of or participate in project activities related to concept development, user- and field testing, evaluation, legal and governance aspects and needs for training. One project partner, the MDCE, will be specifically tasked to liaise with this group.
//
Task 1.6 Ensuring the proper methodology is used for identifying and solving user needs

Task Lead: CHALM – Contribution: FORCE, MDCE, DMA

This task will be responsible for ensuring that the proper methodology is used for identifying and solving user needs. IMO's Human Element Vision, Principles and Goals, Res. A.947(23), draft guidelines on human-centred design and Test Beds will be used as reference. The task will harmonise human element and usability aspects across the project, especially the services related to WP4, WP5 and WP6. Particular focus will be on measuring the influence and impact of the proposed services and their potential to support users in strategic and tactical decision-making. The task will coordinate both design and evaluation activities involving actual users. The task will educate project partners by preparing guideline documents on human factors and arranging and performing workshops for project partners in human factor principles.
Finally, the task will assist other WPs in actual user involvement in field test and simulator test cam-paigns.
//
Task 1.7 Ensuring the relevant innovation methodology is used throughout the project:

Task Lead: DMA

This task will be responsible for the innovation strategy and innovation process (see also figure 1).
1. Ensuring inputs from High Level User Group
2. Ensuring the proper methodology is used for identifying and solving user needs
3. Ensuring that the relevant innovation methodology is used throughout the project
In collaboration with WP7, this task will monitor progress in the project and assess changes and new opportunities allowing the project to act appropriate on these. The task will facilitate ideation, concept development, etc. with advice and support to processes, workshops and meetings. Responsibility for IPR strategy and management will also be included in this task.

Participation per Partner

Partner number and short name	WP1 effort
1 - SØFARTSSTYRELSEN	23.60
2 - KMS	0.50
9 - CHALMERS	12.00
12 - LATVIAN MARITIME ACADEMY	2.00
13 - OFFIS EV	5.00
15 - CIRM	4.50
16 - IALA	18.50
17 - MDCE	10.80
19 - FORCE TECHNOLOGY	6.50
32 - UKHO	1.00
Total	84.40

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D1.1	Project website	1 - SØFARTSSTYRELSEN	Websites, patents filling, etc.	Public	3
D1.2	Plan for dissemination,	1 - SØFARTSSTYRELSEN	Report	Public	18

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
	exploitation and communication				
D1.3	Final report on dissemination, exploitation and communication	1 - SØFARTSSTYRELSEN	Report	Public	36
D1.4	Report on relevant ongoing external projects and testbeds	16 - IALA	Report	Public	6
D1.5	Report on ongoing standardization work relevant to the project	16 - IALA	Report	Public	6
D1.6	Recommendation on governance and future perspectives of solutions	1 - SØFARTSSTYRELSEN	Report	Public	36
D1.7	Minimum four meetings, workshops, etc. involving HLUG	17 - MDCE	Demonstrator	Public	36
D1.8	Final usability evaluation report	9 - CHALMERS	Report	Public	33
D1.9	IPR strategy	1 - SØFARTSSTYRELSEN	Report	Public	6

Description of deliverables

Deliverables: D1.1 Project website (M3) D1.2 Plan for dissemination, exploitation and communication (M18) D1.3 Final report on dissemination, exploitation and communication (M36) D1.4 Report on relevant ongoing external projects and testbeds (M6) D1.5 Report on ongoing standardization work relevant to the project (M6) D1.6 Recommendation on governance and future perspectives of solutions (M36) D1.7 Minimum four meetings, workshops, etc. involving HLUG D1.8 Final usability evaluation report, including recommendations on training needs as well as methods for measuring impact (M33) D1.9 IPR strategy (M6)

D1.1 : Project website [3]

Project website

D1.2 : Plan for dissemination, exploitation and communication [18]

Plan for dissemination, exploitation and communication

D1.3 : Final report on dissemination, exploitation and communication [36]

Final report on dissemination, exploitation and communication

D1.4 : Report on relevant ongoing external projects and testbeds [6]

Report on relevant ongoing external projects and testbeds

D1.5 : Report on ongoing standardization work relevant to the project [6]

Report on ongoing standardization work relevant to the project

D1.6 : Recommendation on governance and future perspectives of solutions [36]

Recommendation on governance and future perspectives of solutions

D1.7 : Minimum four meetings, workshops, etc. involving HLUG [36]
Minimum four meetings, workshops, etc. involving HLUG

D1.8 : Final usability evaluation report [33]
Final usability evaluation report

D1.9 : IPR strategy [6]
IPR strategy

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP2	Lead beneficiary [10]	29 - Thrane & Thrane A/S
Work package title	Novel communication technologies		
Start month	1	End month	36

Objectives

Information services for ships related to safety or administrative routines are limited by availability, cost and ease of communication. The carriage requirement for GMDSS (Global Maritime Distress and Safety System) is primarily based on voice communication and broadcast or point-to-point telex services. Internet connectivity at sea is only fitted voluntarily, based on expensive satellite links, providing limited bandwidths. This work package will develop innovative and cost-effective solutions based on novel communication technology to address the challenge of getting robust information exchange to and from ships, including node to node communication. The technologies will improve the availability and robustness of communication, especially in remote places like the Arctic.

Description of work and role of partners

WP2 - Novel communication technologies [Months: 1-36]
Thrane & Thrane A/S, SØFARTSSTYRELSEN, INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY, DTU, OFFIS EV, CIRM, IALA, CLS, Danelec Marine, FUR, LYNGSO MARINE AS, Transas Marine International AB
Major user challenge to be solved:
When introducing e-maritime and e-navigation services, a major challenge to ships relates to communication with systems ashore. Increased availability and robustness of communication systems is a clearly identified user need – in particular in the Arctic. Cost of communication is a concern of shipping com-panies, with the introduction of modernized information services. Also, there are significant security concerns associated with integrating internet connections into safety critical navigation systems.

Current state of the art solution to the user challenge:
Ships subject to the SOLAS (Safety of Life at Sea) Convention are required to carry equipment defined by the GMDSS (Global Maritime Distress and Safety System), depending on their area of operation. GMDSS is based on low speed basic satellite data and terrestrial voice and telex messaging capabilities. No internet connectivity is guaranteed; such capabilities are voluntary as business demands or crew welfare require. Manual switching between communication options may be required. INMARSAT is the only satellite service recognized for the GMDSS; however, IRIDIUM has just applied for recognition into GMDSS and is being evaluated by the IMO. Other satellite systems – for instance GALILEO – provide similar capabilities, and cellular mobile network services can be used in port or coastal environments. However, where such links are used, standards are not in place to integrate ships' navigation systems safely with different links and to share the capacity with other onboard needs or procedures for routing of information towards ships roaming across different, unstable links. As a result, shore-to-ship information transfer is typically limited to one specific communication link depending on information content, or has to be based on ships polling for information when capable.

Our proposed concept:
This WP will evaluate existing and emerging technologies relevant to shipping and categorize their ap-plicability or limitations, compared to user cases of information services. One emerging system – VDES – which could become a common digital communication system in the maritime domain will be put into development, demonstration and evaluation, promoting standards for devices that would offer no-cost point-to-point communication to shipping and support actual products to go on the market just a few years beyond the project lifetime. Further, a concept for robust and seamless roaming, supporting the information services defined by other WPs, will be developed and demonstrated. Secure integration of communication into the safety critical navigation systems will be addressed. For all these developments, relevant efforts towards development and adoption of international standards will be sought.

The consortium:
This WP will gather highly competent equipment and system vendors, research institutes and authorities for the definition of strategies, design, development and live testing, enabling demonstration of concepts. With the aid of international organizations such as IALA and CIRM, the results of the project can be harmonized with the global maritime community, just as input for relevant standards and legal regimes can be prepared and promoted.

Task 2.1 VDES (VHF Data Exchange System):
Lead partner: Thrane & Thrane A/S (development of hardware prototypes, testing, standards drafting)
Contributors: NIT (propose and develop technical specifications , channel coding, modulation, access schemes and protocols, testing)
CLS (liaison with ESA satellite VDES project)
DMA (support frequency allocation, test planning and liaison with international bodies, etc.)
CIRM (support standardization work inside the project and carry the results to IALA, IEC, ITU, etc.)
FURUNO (development of hardware prototypes, testing, standards drafting)

This task will provide momentum into the introduction of a globally interoperable and potentially cost free ship-to-ship and ship-to-shore digital communication link based on VDES, a novel system related to the existing AIS system, for which the frequency allocations are available for testing, and expected to be confirmed by the World Radio Conference 2015.
This communication links is envisaged to be dedicated to data transfer, in particular the reception of public service safety information and operational data exchange related to the safety and efficiency of shipping. It may also play a significant role in the modernization of the GMDSS through the review process initiated by the IMO. Work is underway in ITU WP5B and IALA on the requirements and radio technical standards and protocols using the existing marine VHF band for the exchange of ship-to-ship and ship-to-shore data, both terrestrially and over satellite.
Sub-tasks:
• Develop proposals and tests for channel access, modulation techniques and communication pro-tocols.
• Develop and test hardware prototypes in a lab environment as well as in live sea trials.
• Demonstrate basic communication parameters in real-life scenarios, such as coverage area and factors influencing the coverage area, the effect of other nearby transmitters, and the bandwidth available under changing conditions. Propose and provide input to performance standards as well as equipment testing standards.
• Liaise through the IALA e-navigation committee with any other related initiatives worldwide on VDES, including the ESA ARTES 1 programme, which intends to fly a satellite demonstration mission during the project timeframe.
Current TRL 2 – Target TRL 6-7
//
Task 2.2 Evaluation of communication technologies:

Lead partner: CLS (satellite AIS, NAVDAT, VDES, GNSS, Iridium, space weather)
Contributors: DTU (space weather, Galileo)
Thrane & Thrane (Iridium, INMARSAT, VDES)

The characteristics of available and emerging communication technologies, such as quality of service, bandwidth, availability, robustness or vulnerability, will be considered for technologies such as AIS, INMARSAT, Iridium, Argos, V-Sat, VDES, NAVDAT and the Galileo return link or other relevant systems. These characteristics will be compared with the requirements of services developed in other work packages of this project. In order to promote the competitive availability of satellite communication services, and thus lower costs, special attention will be paid to the evaluation of the Iridium satellite service, currently seeking introduction into the GMDSS.
Space weather is known to have a significant impact on satellite as well as terrestrial communication systems. Vulnerabilities of communication services in the arctic region is of particular interest when addressing the coverage for broadcast of Maritime Safety Information and the quality of positioning services such as the European GNSS system Galileo. The NAVDAT or VDES are also likely to be affected by space weather. For the first time, observation campaigns will be performed to evaluate simultaneously the level of the impact of space weather on the maritime positioning and communi-cations multiband systems. Research on the correlation between space weather and the performance of various communication or positioning services will be conducted, with the aim to trial and evaluate the provision of a space weather forecast service that may predict limitations in communication or positioning services in the North polar region.
Subtasks:
• Define characteristics relevant to information service provision and inclusion in the GMDSS, in liaison with other work packages.
• Describe expected characteristics of available technologies based on literature.
• Test and verify characteristics and any time- and geographical variations of existing and, so far as possible, new technologies through gathering of time series of field data, with special focus on the Arctic.
• Report findings on the observed characteristics and their match with desired characteristics for service provision as defined by WP3 to task 2.3.
• Report findings on the observed characteristics of the Iridium satellite service and their match with the requirements of the GMDSS to relevant international bodies.

• Perform a vulnerability study on the positioning and communication correlation with space weather phenomena, with special focus on the Arctic.
• Develop a concept for a forecast warning service for predicting restrictions in positioning- and communication services, including the development of a rapid prototype, test and evaluation of the feasibility and relevance of a space weather warning service in liaison with WP6.
//
Task 2.3 Robust & seamless roaming:

NIT (hybrid network concept & switching algorithm development & testing)
Contributors: OFFIS (semantic compression techniques, protocols for transparent switching)
TRANSAS (support as provider of onboard systems for testbed trials, synchronization with task 2.4 and WPs 4 and 6)

With radio communication systems integrated into a network, it will be possible to route information and data through the most feasible or lowest cost external communication channel. Based on a study of existing and new solutions and requirements, strategies will be developed for hybrid solutions for compression, queuing and channel selection based on availability, cost, restrictions in bandwidth and other technical parameters, but also content priority.
The introduction of more than one satellite service into GMDSS raises questions related to how Rescue Coordination Centres and providers of Maritime Safety Information will relate to these services, the cost impact for authorities, and how interoperability between more than one satellite communication provider can be achieved. This activity will, based on the concept from WP3, carry out simulations or, to the extent possible, trials to demonstrate that ships can switch automatically and seamlessly between IP protocol based links, AIS, INMARSAT and Iridium satellite services and potentially other links, and that information can be exchanged between ship- and shore-based users, as the availability of links permit. The transfer of a text message can be used as a generic use case, which may be expanded to the transfer of more advanced data and interactions, depending on the capabilities of data links. Methods for ensuring a high availability and quick restore of failures, ensuring robust connectivity at reduced cost of communication, will be explored and recommendations on the design of robust information services that allow smart utilization of different types of data links will be developed.
Current TRL 2 – Target TRL 4-5
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Task 2.4 Shipboard system integration, onboard networks:

Lead partner: DANELEC MARINE
Contributors: CIRM, LYNGSØE MARINE, FURUNO, TRANSAS, DTU, DMA (Liaison w. WP3)

This task will address the shipboard systems integration, in terms of cyber security, onboard network integration and firewalling, as well as the integration of systems with the shipboard component of the Maritime Cloud concept, in liaison with Work Package 3.
Improved ship-to-ship and ship-to-shore data integration is rapidly evolving, driven by the needs for fuel effective operations, reduced administrative burdens, as well as for increased safety. Big data considerations, especially in the automation systems of ships, will expectedly result in large volumes of data to be exchanged between ship and shore in the near future, as well as other high-volume applications: Chart updates, video support for emergency medical conditions, complicated maintenance operations and other services enabled by the Maritime Cloud. Presently, there is little standardization of onboard data infrastructures, apart from what is given for navigation sensors in the IEC 61162 series of standards (covering serial and network-based communications between sensors and data users such as radar, ECDIS, VDR and AIS), and within both the navigation, automation and communication domains in ships, proprietary solutions are dominant. Furthermore, it is not expected that the advent of the Maritime Cloud will change this substantially, considering both the magnitude of the installed base, which it in any case should be possible to integrate into the Maritime Cloud, but also the very substantial effort which has been put into establishing and maintaining the present effective, efficient and safe data platforms.
Task 2.4 is directed towards providing the foundations for gateway solutions between the generic onboard client components of the Maritime Cloud (WP3, tasks 3.3 and 3.4) and the present regime of customized and proprietary onboard solutions.
In parallel with Work Package 3, input will be developed towards the definition of a harmonized onboard architecture, including the generic Maritime Cloud client components, as well as for gateway mechanisms which in combination promote the integration of interoperable radio communication devices with today's and tomorrow's Integrated Navigation Systems (INS), automation systems and other electronic data processing systems in a reliable and safe manner, using intelligent network controllers to separate the networks. Current TRL 2 – target TRL 7

Participation per Partner

Partner number and short name	WP2 effort
1 - SØFARTSSTYRELSEN	1.40
7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	58.20
11 - DTU	16.00
13 - OFFIS EV	7.00
15 - CIRM	5.50
16 - IALA	4.00
20 - CLS	29.90
21 - Danelec Marine	40.00
23 - FUR	36.30
26 - LYNGSO MARINE AS	12.00
29 - Thrane & Thrane A/S	107.80
30 - Transas Marine International AB	12.00
Total	330.10

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D2.1	Report on status on development of VDES	29 - Thrane & Thrane A/S	Report	Public	18
D2.2	Field demonstration of a prototype VDES	29 - Thrane & Thrane A/S	Demonstrator	Public	33
D2.3	Report on technical characteristics and limitations achieved for VDES	29 - Thrane & Thrane A/S	Report	Public	36
D2.4	Analysis report on available and emerging communications technologies	20 - CLS	Report	Public	9
D2.5	Report on space weather effects on communication and positioning services	20 - CLS	Report	Public	18
D2.6	report on space weather forecast warning service	20 - CLS	Report	Public	30

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D2.7	Concept and specification for seamless roaming	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	9
D2.8	Specification of the interface to maritime cloud	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	18
D2.9	Results of simulation and onboard testing	7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	Report	Public	33
D2.10	Onboard system integration architecture	21 - Danelec Marine	Report	Public	12
D2.11	Specification of protocols for ship-to-shore communication	21 - Danelec Marine	Report	Public	24
D2.12	Prototype demonstration of ship-to-shore communication roaming	21 - Danelec Marine	Demonstrator	Public	36

Description of deliverables

Deliverables: D2.1. Report on status on development of VDES technical specifications, a conceptual description of the communication protocols and access codes to be used on the airlink. Description of trials and results achieved, including evaluation of feasibility, barriers to and planned measures to promote the introduction of terrestrial and satellite VDES (M18). D2.2. A field demonstration of a prototype VDES onboard system and its capabilities for data transfer (M33). D2.3. A report on relevant technical characteristics and limitations achieved for the VDES system, including a summary of tests (in laboratory and in real conditions) of the VDES onboard system prototype. Further realistic user cases and categories of VDES devices, including feasibility, path to market, barriers and cost estimates. Input to a draft radiotechnical standard and a draft device specification, including interfacing of a shipborne VDES device (M36). D2.4 A report on available and emerging communication technologies and analysis of relevance with respect to maritime services requirements, including GMDSS and surveillance (M9). D2.5 A report describing the effects of space weather on communication and positioning services, and the criticality for safety of navigation and maritime surveillance (M18), D2.6. A report on the evaluated feasibility and relevance of a space weather forecast warning ser-vice for polar regions and arctic navigation (M30). D2.7 Concept and specification for seamless roaming for onbard products (M9) D2.8 Specification of the interface to the Maritime Cloud platform (M18) D2.9 Results of simulation and testing of seamless roaming (M33) D2.10 A conceptual description of the onboard system integration architecture and how cyber se-curity can be addressed. Identification of requirements for ship-to-shore communication for the different types of equipment on the ship (M12) D2.11 Specification of protocols to be used for ship-to-shore communication for the different types of equipment on the ship (M24) D2.12 Implementation of a prototype which demonstrates ship-to-shore communication for at least two different types of equipment using the protocols defined in D2.4.2 (M36)

D2.1 : Report on status on development of VDES [18]

Report on status on development of VDES technical specifications, a conceptual description of the communication protocols and access codes to be used on the airlink. Description of trials and results achieved, including evaluation of feasibility, barriers to and planned measures to promote the introduc-tion of terrestrial and satellite VDES

D2.2 : Field demonstration of a prototype VDES [33]

A field demonstration of a prototype VDES onboard system and its capabilities for data transfer

D2.3 : Report on technical characteristics and limitations achieved for VDES [36]

A report on relevant technical characteristics and limitations achieved for the VDES system, including a summary of tests (in laboratory and in real conditions) of the VDES onboard system prototype. Further realistic user cases and categories of VDES devices, including feasibility, path to market, barriers and cost estimates. Input to a draft radiotechnical standard and a draft device specification, including interfacing of a shipborne VDES device.

D2.4 : Analysis report on available and emerging communications technologies [9]

A report on available and emerging communication technologies and analysis of relevance with respect to maritime services requirements, including GMDSS and surveillance

D2.5 : Report on space weather effects on communication and positioning services [18]

A report describing the effects of space weather on communication and positioning services, and the criticality for safety of navigation and maritime surveillance

D2.6 : report on space weather forecast warning service [30]

A report on the evaluated feasibility and relevance of a space weather forecast warning service for polar regions and arctic navigation

D2.7 : Concept and specification for seamless roaming [9]

Concept and specification for seamless roaming for onbard products

D2.8 : Specification of the interface to maritime cloud [18]

Specification of the interface to the Maritime Cloud platform

D2.9 : Results of simulation and onboard testing [33]

Results of simulation and testing of seamless roaming

D2.10 : Onboard system integration architecture [12]

A conceptual description of the onboard system integration architecture and how cyber security can be addressed. Identification of requirements for ship-to-shore communication for the different types of equipment on the ship.

D2.11 : Specification of protocols for ship-to-shore communication [24]

Specification of protocols to be used for ship-to-shore communication for the different types of equipment on the ship.

D2.12 : Prototype demonstration of ship-to-shore communication roaming [36]

Implementation of a prototype which demonstrates ship-to-shore communication for at least two different types of equipment using the protocols defined in D2.?

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	Milestone month 9	1 - SØFARTSSTYRELSEN	9	The more conceptual and non-technical aspects of the output from WPs 2 and 3 will be evaluated by the High Level User Group. More technical output will be evaluated by technical project

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				participants not directly involved in these work packages.
MS3	Milestone month 18	1 - SØFARTSSTYRELSEN	18	The descriptive foundation for using the Maritime Cloud for service development exits. Both shore-side (WP3) and ship-side (WP2). The descriptions/ models will be assessed by service developers in WPs 4, 5 and 6 in order to evaluate their adequateness. This is the most important milestone in the project and much effort will be put into the evaluation.

Work package number [9]	WP3	**Lead beneficiary** [10]	1 - SØFARTSSTYRELSEN
Work package title	Maritime Cloud		
Start month	1	**End month**	36

Objectives

Based on a consolidation of user requirements, to develop, standardize and implement an innovative and ground breaking communication and service provision framework (the Maritime Cloud) that will connect all maritime stakeholders and users with maritime information services of all kinds. This novel framework will enable interoperability between existing and future communication and information systems. The framework will enhance information sharing in and around the maritime sector for smarter traffic management and facilitate a comprehensive e-maritime and e-navigation environment, enabling a maritime internet of things. A regional instance of the Maritime Cloud will be operated to support demonstration and first generation integrated provision of e-navigation and e-maritime services in the BSR and arctic regions.

Description of work and role of partners

WP3 - Maritime Cloud [Months: 1-36]
SØFARTSSTYRELSEN, KMS, LIIKENNEVIRASTO, SWEDISH MARITIME ADMINISTRATION, UCPH, OFFIS EV, IALA, FREQUENTIS, GateHouse A/S , Litehauz ApS, LYNGSO MARINE AS, MARSEC-XL, Rocket Brothers, Transas Marine International AB, Vissim AS, UKHO
Major user challenge to be solved:
Based on the experiences from a number of previous EU testbed projects, a few essential services are prerequisites for taking e-navigation from testbeds to real-life implementation in harmonization with e-maritime, reaping the innovation potential and supporting European maritime policy. Observer user needs include improved ability to discover relevant information services, to avoid multiple logon procedures and to enable secure authentication and transfer of confidential information.

Current state of the art solution to the user challenge:
Today, e-maritime systems depend on the availability of internet connectivity. No internet connectivity is guaranteed by the SOLAS requirements. Safety of navigation is often tied to more or less outdated communication links, and IP connectivity is only available as business demands or crew welfare require. E-mail is the most common way of addressing a ship – but e-mail is not a requirement, and cyber security concerns prevent the utilization of IP connectivity to push Maritime Safety Information onto ships' safety critical navigation systems.

Our proposed concept:
We propose to develop a ground breaking communication and service provision framework that will facilitate secure information services, based on the user needs and concepts derived from previous pro-jects.

The consortium:
The DMA will lead a consortium of authorities and highly competent IT academic and industrial partners, under the scrutiny of industrial manufacturers of shipboard as well as shore based maritime equipment and systems. With the aid of IALA and CIRM, global harmonization and standardization of the framework will promote adoption within the global shipping community.

Task 3.1 Requirement, analysis and conceptual model
Lead partner: FREQUENTIS
Contributors: GATEHOUSE (analysis of requirements, investigation of lessons learned from other domains and information sharing solutions)
OFFIS (focus on concepts for (1) interfaces for providing maritime services, (2) orchestration of services, (3) business-to-business provision of maritime services, as well as (4) geo-spatial look-up for services)
LYNGSØE MARINE (ensure compatibility with existing industry standards)
DMA (input from previous projects and IMO work on e-navigation, gathering and consolidation of user requirements from WPs, EMSA and other stakeholders on e-maritime, etc.)
IALA (support gathering of user requirements)
FTA (input to user requirements, related information sharing environments, developing the conceptual model)
DGA (Transfer of knowledge from conceptual models in the geospatial domain)

This task will gather inputs from work packages 4, 5 and 6 as well as the maritime community via IALA's e-navigation committee and CIRM on requirements relevant to the design of the Maritime Cloud, and related requirements (bandwidth, latency, QoS, etc.) for communication links supporting ship-to-shore interaction, for provision of maritime information services. These requirements will be analysed and consolidated into a manageable set of core user requirements for the Maritime Cloud. Liaison with WP 2 will provide iterations of defining which requirements are relevant for communication links to support different categories or variants of maritime services.
Existing and related solutions will be investigated for lessons learned from both within and outside the maritime domain, such as partial/regional information sharing solutions and regimes, or neighbouring domains (e.g. SWIM/SESAR, Public Safety NENA NG911).
Needs or opportunities identified in relation to governance or business models for operating the Maritime Cloud will be reported to the task in WP1 that deals with these issues at a strategic level.
Based on the requirements identified, a conceptual model will be developed, describing the key concepts, data flows and components forming the Maritime Cloud. Visualisations and communication will be done in collaboration with WP1 communication.
It will be a point of reference for all subsequent more technical tasks, but still be targeted at both a technical and a non-technical audience. Sample user cases will be illustrated on a high level system architecture, using a basic and simple domain model.
The conceptual model aims to be an executive summary facilitating a common understanding of the Maritime Cloud not only between the project partners but also between the project and possible future stakeholders in Europe as well as around the globe.
Current TRL 2 – Target TRL 6-7

Task 3.2 Service specification
Lead partner: FREQUENTIS
Contributors: DMA (input and experience from ACCSEAS project, including concepts for MSDL)
VISSIM (review of data models, protocols and user functionality design, and verification against existing standards and recommendations)
OFFIS (contribute to the definition of the MSDL, providing concepts on how to capture service parameters in the specification language)
LYNGSØE MARINE (ensure compatibility with existing industry standards)
IALA (potential future custodian of a standard for the Maritime Cloud)
UKHO (review and S-100 expertise and support)
FTA (input and experience from other projects related to maritime information exchange)

The concept of a service is central to the Maritime Cloud. With a strong focus on interoperability and seamless service roaming, this task will develop a standard for making service specifications that will support all services using the Maritime Cloud as an entry point. A service specification includes: Data modelling, protocols and user functionality description. Data modelling will be done according to the IHO S-100 standard. For other aspects of a service specification, standardized methods like UML will be considered. Furthermore, it is envisioned that parts of a service specification can be defined in a machine-readable format called the Maritime Service Definition Language (MSDL). This will allow automatic generation of source code and automatic testing.
Given that other work packages in EfficienSea 2 concentrate on lifting existing services as well as innovating novel services, an early available technical specification of services is essential for the overall project schedule.
As the conceptual model created in task 3.2, the service specification is targeted both at project partners and possible future stakeholders, but at a more technical level.
The task will take into account current work by IALA and IHO on the S-100 standard and work on the IMO concept of Maritime Service Portfolios (MSP). An international workshop organized by IALA and the task lead will support European and international harmonization. The task will provide input on preliminary work to relevant international organisations.
Current TRL 2 – Target TRL 6 – 7

Task 3.3 Technical specification
Lead partner: OFFIS (service oriented architecture and technical specification of the Maritime Cloud.)
Contributors: DMA (input and experience from ACCSEAS project, including security considerations, reviewing technical specifications, resolving questions relating to implementation)
FREQUENTIS (security issues)
MARSEC (software and system architecture experience from MonaLisa projects)

DIKU (review from an IT academic perspective)
LYNGSØE MARINE (ensure compatibility with existing industry standards)
VISSIM (review of cloud client component specification, commercial applicability)
TRANSAS (review of cloud client component specification, commercial applicability)
FTA (review from an administrative perspective, based on experience from other projects related to maritime information exchange)

Based on the requirements identified in task 3.1, the conceptual model in task 3.2, this task concentrates on the development of the technical architecture for the Maritime Could. The Maritime Cloud will be based on a service-oriented architecture (SOA) that will provide an easy-to-use method to publish, provide and use e-maritime and e-navigation services. Since these services can be routine information services as well as safety critical services, the Maritime Cloud is a safety critical system itself. To consider this aspect, we will investigate concepts like contract-based design and requirement traceability. Furthermore, the Maritime Cloud is also a cyber-physical system since, via this platform, numerous systems are connected to each other and to the internet, continuously interacting with their environment. Therefore, we will also investigate architectural principles of cyber-physical systems for the development. We will investigate the re-use of established technologies and platforms with respect to extensibility, maintainability and flexibility like dependency injection and OSGi concepts. This will facilitate adding new services and systems into the Maritime Cloud.

The Maritime Cloud will be specified as modules separated into different categories:
Administration services – for the management of the Maritime Cloud platform itself. These services include administration & configuration management, public key infrastructure management, application performance management and system monitoring.
Central platform services – the key services for technically realizing the Maritime Cloud concept. Basic features for identity management, authentication, authorization and a service registry and repository. These central platform services will allow maritime players to have a single identity and to easily provide, find and use e-maritime and e-navigation services in the areas covered by the Maritime Cloud. Service providers can use the central platform services so that they do not have to consider how to implement basic features like registering, login/logout mechanisms, authentication, etc. These services will therefore decrease market entry barriers for service providers and service users since, for example, they do not have to register for each new service to be used.
Business Support Services (BSS) could include product management (version and variant management, customer management, order management), service level agreement management as well as business activity monitoring components. So, the BSS will provide basic services making it easy for service providers to publish and provide their services on the platform.

Besides these services, interfaces to external users, systems and end-user services will be technically specified. This includes API specifications for the usage of the central platform services and the business support services by external services. Also an API will be specified to allow service providers to orchestrate other existing services to new value added services. For this, existing concepts and technologies like business process modelling and process consistency checking will be evaluated for usage in this API.
Current TRL 2 – Target TRL 6 – 7

Task 3.4 Implementation
Lead partner: DMA (open source project management, administrative services)
Contributors: DIKU (implementation of property-based testing and contribution to the implementation of central platform services)
MARSEC (implementation of open source instance of cloud client component)
GATEHOUSE (demonstrate integration of concepts into existing maritime surveillance system)
FREQUENTIS (show case: mobile end user distress message solution, IETF RFC 5222 LoST Server (Location to Service Translation), Maritime Cloud enabled module in existing solution to handle distress messages)
TRANSAS (implement support for cloud client in onboard products, test and evaluate products of WPs 2, 4 and 6)
ROCKET BROTHERS (client library related to prototype display platform to support other WPs)

Using a state of the art and agile software development approach, this task will, in parallel and tight collaboration with task 3.3 and other WPs, implement the identified modules and interfaces that constitute the Maritime Cloud. A cooperative open source software development environment will be set up by the DMA, including:
• Source code repository with version control for collaborative development.
• A Continuous Integration (CI) environment to prevent integration problems and automate testing and staged deployment.

• A project management tool for planning and organizing the software development process.
• Coding conventions and automated tools to check compliance.
• A team collaboration platform for documentation and discussions.
Management of the development process will be based on best practices from open source software projects. The task will develop both software components for server deployment and client components that will allow easy integration into Maritime Cloud services and services provisioned through the cloud. This includes development of code generation tools for the Maritime Service Definition Language. The task will cooperate with task 3.6 to accommodate deployment and operational aspects. The Maritime Cloud will potentially offer safety critical services and therefore the stability and reliability of components is crucial. To address this issue, automated tests will be developed, and a property-based testing (PBT) test suite and tools considered, for both services and applications in the Maritime Cloud. The test-suite will consist of QuickCheck models that allow automatic testing of conformity to the Maritime Cloud communication protocols. Also PBT tools and techniques for automatic test generation for Maritime Cloud services described by the Maritime Service Definition Language will be developed.
For test and demonstration purposes, the task will implement an end-to-end high TRL Maritime Cloud showcase: MC based e-safety solutions with a mobile end user solution creating distress messages that can be handled within a cloud enabled Maritime Rescue Coordination Center.
Current TRL 2 – Target TRL 6-7

Task 3.5 Deployment and testing
Lead partner: DMA (preparing the implementation for deployment)
Contributors:
GATEHOUSE (deploy the concepts developed in this WP in parallel with existing operational maritime surveillance system in order to gain experience for preparation of full scale use).
OFFIS (deploy, test & evaluate the Maritime Cloud concepts in the German test bed eMIR. This will allow for the testing of seamless provision of the service across different testbeds and regions).
FREQUENTIS (host one Maritime Cloud node, deploy cloud enabled module into existing (production ready) FRQ solution).

This task focuses on deployment and testing of the Maritime Cloud in its later environment. The Maritime Cloud will be deployed in a testbed in the Baltic Sea and in the e-maritime Integrated Reference Platform (eMIR – testbed at the German coast). Services will be installed using the same approach as will be used by end users later on. Afterwards, a test campaign will be conducted. This will include testing the look-up of services in a registry, authentication of end users and the seamless switching of services while sailing in different regions. Having installed the first version of the Maritime Cloud midterm of the project, it will be incrementally enhanced and improved in the second half of the project. Technical tests in simulated and real-life environments will be conducted as a proof of concept of the developed solutions. For the aspects of the Maritime Cloud with direct user interaction, user functionality tests with focus on human factors and usability will be conducted.
The task will furthermore evaluate and demonstrate the functionality of the Maritime Cloud and how the developed solutions fulfil the core requirements and the conceptual model from task 3.1.
Current TRL 2 – Target TRL 6-7

Participation per Partner

Partner number and short name	WP3 effort
1 - SØFARTSSTYRELSEN	43.70
2 - KMS	1.00
5 - LIIKENNEVIRASTO	0.50
8 - SWEDISH MARITIME ADMINISTRATION	2.00
10 - UCPH	19.20
13 - OFFIS EV	24.00
16 - IALA	4.00
22 - FREQUENTIS	41.90

Partner number and short name	WP3 effort
24 - GateHouse A/S	16.00
25 - Litehauz ApS	2.00
26 - LYNGSO MARINE AS	6.00
27 - MARSEC-XL	13.00
28 - Rocket Brothers	2.00
30 - Transas Marine International AB	6.10
31 - Vissim AS	3.10
32 - UKHO	1.00
Total	185.50

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D3.1	Analysis report	1 - SØFARTSSTYRELSEN	Report	Public	6
D3.2	Conceptual model	22 - FREQUENTIS	Report	Public	9
D3.3	Input to international fora on conceptual model	1 - SØFARTSSTYRELSEN	Demonstrator	Public	18
D3.4	Service specification, including MSDL	22 - FREQUENTIS	Report	Public	12
D3.5	Review report on service specification	1 - SØFARTSSTYRELSEN	Report	Public	18
D3.6	Standard proposal for Maritime Cloud service specification	22 - FREQUENTIS	Report	Public	18
D3.7	Technical specification of the Maritime Cloud	13 - OFFIS EV	Report	Public	18
D3.8	Reviewed technical specification	1 - SØFARTSSTYRELSEN	Report	Public	33
D3.9	Alpha release – source code and documentation	1 - SØFARTSSTYRELSEN	Report	Public	18
D3.10	Final beta release – source code and documentation	1 - SØFARTSSTYRELSEN	Report	Public	36

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D3.11	Guidelines for deployment of the Maritime Cloud	1 - SØFARTSSTYRELSEN	Report	Public	36
D3.12	Prototypical instances of the Maritime Cloud (alpha release M18, beta release M36)	1 - SØFARTSSTYRELSEN	Demonstrator	Public	36
D3.13	Tests and demonstration report	1 - SØFARTSSTYRELSEN	Report	Public	36

Description of deliverables

Deliverables: D3.1 Analysis report, including a list of consolidated requirements (M6) D3.2 Conceptual model – report and web wiki (M9) D3.3 Input to relevant international fora (M18) D3.4 Service specification, including MSDL (M12) D3.5 Review report on Service Specification (M18) D3.6 Standard proposal for Maritime Cloud service specification description (M18) D3.7 Technical architecture and specification of the Maritime Cloud (M18) D3.8 Report on reviewed technical architecture and specification (M33) D3.9 First stable prototype version (alpha release) – source code and documentation, including essential central platform services, administrative services and cloud client component enabling demonstration of services by other Work Packages (M18) D3.10 Implementation source code and documentation – final beta release, reference implementation of the administrative and central platform services, plus cloud client components (M36) D3.11 Guidelines for deployment of the Maritime Cloud (M36) D3.12 Prototypical instances of the Maritime Cloud operated to provide a continuous demonstration environment in preparation for full operation – alpha release (M18), beta release (M36) D3.13 Tests and demonstration report (M36)

D3.1 : Analysis report [6]

Analysis report, including a list of consolidated requirements

D3.2 : Conceptual model [9]

Conceptual model – report and web wiki

D3.3 : Input to international fora on conceptual model [18]

Input to relevant international fora

D3.4 : Service specification, including MSDL [12]

Service specification, including MSDL

D3.5 : Review report on service specification [18]

Review report on service specification

D3.6 : Standard proposal for Maritime Cloud service specification [18]

Standard proposal for Maritime Cloud service specification

D3.7 : Technical specification of the Maritime Cloud [18]

Technical architecture and specification of the Maritime Cloud

D3.8 : Reviewed technical specification [33]

Report on reviewed technical architecture and specification

D3.9 : Alpha release – source code and documentation [18]

First stable prototype version (alpha release) – source code and documentation, including es-sential central platform services, administrative services and cloud client component enabling demonstration of services by other Work Packages.

D3.10 : Final beta release – source code and documentation [36]

Implementation source code and documentation – final beta release, reference implementa-tion of the administrative and central platform services, plus cloud client components.

D3.11 : Guidelines for deployment of the Maritime Cloud [36]

Guidelines for deployment of the Maritime Cloud

D3.12 : Prototypical instances of the Maritime Cloud (alpha release M18, beta release M36) [36]

Prototypical instances of the Maritime Cloud operated to provide a continuous demonstra-tion environment in preparation for full operation – alpha release (M18), beta release (M36).

D3.13 : Tests and demonstration report [36]

Tests and demonstration report

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	Milestone month 9	1 - SØFARTSSTYRELSEN	9	The more conceptual and non-technical aspects of the output from WPs 2 and 3 will be evaluated by the High Level User Group. More technical output will be evaluated by technical project participants not directly involved in these work packages.
MS3	Milestone month 18	1 - SØFARTSSTYRELSEN	18	The descriptive foundation for using the Maritime Cloud for service development exits. Both shore-side (WP3) and ship-side (WP2). The descriptions/ models will be assessed by service developers in WPs 4, 5 and 6 in order to evaluate their adequateness. This is the most important milestone in the project and much effort will be put into the evaluation.
MS5	Milestone month 30	1 - SØFARTSSTYRELSEN	30	Most project elements should be in place, and the capability of the project to achieve its longterm goals will be assed. This includes the capability to establish an

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				operational framework of service provision beyond the framework of the project, and the capability to reach the desired impact on international standards and safety regimes.

Work package number [9]	WP4	Lead beneficiary [10]	1 - SØFARTSSTYRELSEN
Work package title	e-navigation services		
Start month	1	End month	36

Objectives

Develop a range of e-navigation services and deploy a subset of these at least on web-based platforms, aiming for global standardisation of the services, based on S100 data models to the extent possible. Enable delivery of services on regional web-based platforms and in prototypes of commercial navigational systems.

Description of work and role of partners

WP4 - e-navigation services [Months: 1-36]
SØFARTSSTYRELSEN, KMS, DANMARKS METEOROLOGISKE INSTITUT, Veeteede Amet, LIIKENNEVIRASTO, Maritime Office in Gdynia, SWEDISH MARITIME ADMINISTRATION, LATVIAN MARITIME ACADEMY, SSPA, FORCE TECHNOLOGY, FUR, GateHouse A/S , Rocket Brothers, Transas Marine International AB, UKHO
Work package 4 focuses primarily on finalizing standardization of e-navigation services. Most of the services in this WP have been matured in testbed environments (based on projects such as EfficienSea, MONALISA and ACCSEAS). It will be possible to push these services to a very high technological readiness level close to market. Part of the scope of this task WP will be to establish an operational framework enabling provision of these services as a continuous first generation demonstration, enabling adoption and commercial product support soon after the project.
The services will be developed based on the Maritime Cloud framework (WP3), and services will be organized according to the Maritime Service Portfolio (MSP) defined in the IMO e-navigation strategy. To the extent possible, services will be standardized according to IHO S100 data models.
Services will be delivered on two different platforms; a web-based platform (BalticWeb and ArcticWeb) enabling operational demonstration and promoting early use and adoption, and further incorporated and tested in an e-navigation/ e-maritime prototype display (EPD), and prototype commercial systems.
Since we aim to provide services as part of the IMO e-navigation framework, which is naturally intended to be available worldwide, it will be an important part of the work to seek adoption of the services by an appropriate standardisation organisation. This work will be done in collaboration with WP1.
The WP consortium primarily consists of service providers, authorities and the system/equipment industry. As the human factor element has already been considered in other projects, testing in this work package will focus on live testing by navigators on vessels and technical performance of delivery mechanism using the Maritime Cloud and a variety of physical communication channels. The human factor effects of this will be the focus of LMA for several services.

Task 4.1 – Establishing an operational framework for service provision
Task Lead: DMA (all aspects of this task)
Contributors: DMI (technical, servicer side, METOC, ice services)
SMA, FTA, MOG, EMA (respective national authorities' requirements with regard to operational framework)

A major goal of the project is to establish a number of operational services on web-based platforms and, to some extent, through commercial navigational systems to a large number of users in two different geographical areas (the Arctic & Baltic). In order to accomplish this, there are various operational aspects that need to be in place, which is the focus of this activity.
The operational framework of web platforms will initially be established as a prototype environment delivering prototype services along with the Maritime Cloud (WP3). Gradually the framework and services will be matured during the course of the project, and at the end of the project a number of services will be operational. The operational framework needs to be active after the end of the project, and thus the relevant organisations need to ensure that the necessary resources will also be available after the termination of the project.
The elements that need to be addressed include:
• Design of website, user interface and user functionality
• User administration, user requests, support
• Servers, software maintenance, bug fixing, monitoring
Each service provider needs to set up a service specific operational framework (in most cases part of something already existing). In addition to this, an operational framework for running the web platform itself needs to be established.

This activity covers the web platform(s) and the operational e-navigation services. Close liaison will be sought with WP3, task 3.5, focusing on an operational framework for the Maritime Cloud.

Task 4.2 – MSI and NM (T&P) service
Task lead: DMA (develop software and data modelling)
Contributors: EMA, FTA, MOG, SMA (provide data)
TRANSAS, FURUNO (implement service in commercial systems)
UKHO (data modelling)
LMA (testing with specific focus on a variety of physical data carriers)

Based on the outcome of previous projects (ACCSEAS), a S100 product specification will be validated and promoted. Procedures for service provision will be drafted, and authorities and service providers will cooperate to develop an open source reference implementation of a single window system for registering MSI and NM (T&P) that can be customized to fit organizational procedures and workflow, and implemented by relevant MSI and NM providers. This will allow for reuse of information as an event may evolve into first a current navigational warning, later into a longer term highly quality assured NM and potentially further move toward a longer term chart/publication correction. The reference implementation will enable early operational service provision. User presentation standards will be drafted, user evaluated and promoted, and commercial product manufacturers will implement presentation of the service in upgrades of relevant display systems. Operational service provision will be available in the web-based platforms (ArcticWeb and BalticWeb) and commercial systems. This will achieve a reference implementation of 'MSP 5' as defined in the IMO e-navigation strategy implementation plan.

Task 4.3 – METOC service
Task lead: DMI (data modelling, service development and provision, participation on client side on web platforms)
Contributors: UKHO (assist with data modelling)
DMA (assist with service development, servicer side with Maritime Cloud usage and client side on web based platform)
TRANSAS, FURUNO (implement service in commercial system)
LMA (test services in relation to different physical communication channels)
EMA (possible integration with Estonian METOC provision)
SSPA (ensure METOC service usefulness in supporting route optimisation)

This service will be made available on the web-based platform (ArcticWeb and BalticWeb) and tested on prototypes of commercial systems. The METOC (Meteorological and Oceanographic) service will be evolved in versions. New versions with improved quality, derived from research activities in WP6, will be implemented in operation for upgraded versions. For the Baltic Sea, an ensemble prediction approach will be used to generate forecast products of improved quality and to estimate the forecast uncertainties. For the Arctic region, new forecasts of ice and waves from the DMI operational forecasting system will be used; the iceberg data (both individual and statistics) derived from synthetic aperture radar will be included. In METOC Version 0, forecasts of wind, air/sea temp, currents and ice in the Arctic will be provided; for the Baltic, wind, sea level, visibility, waves, air/sea temperature and ice forecast will be provided. In METOC Version 1, for the Arctic, new products of forecast of waves, icing index and higher resolution sea ice will be provided; for the Baltic, uncertainty estimate of METOC based on ensemble forecast will be provided. In METOC Version 2, forecast with ice-chart assimilation will be available.
The aim will be to develop a standardized METOC service based on the framework delivered from WP3 and S100. A framework for different service providers will be tested. Collaboration with relevant organizations (WMO, IHO, IEC) will be sought to promote a standardised service.
METOC information relating to a vessel's route will be developed, based on basic route handling/exchange functionality developed in task 6.1. This service will aim to implement 'MSP 14' as defined in the IMO e-navigation strategy implementation plan.

Task 4.4 – Sea charts in the e-navigation era
Task lead: GST (data modelling, data provider, server side service development)
Contributors: UKHO (data modelling, trial data)
RB (S101 rendering engine in EPD and possibly other platforms)
FURUNO, TRANSAS (implement service in prototype commercial systems)
LMA (test services with relation to different physical communication channels)

The service will deliver charts in selected areas in which S101 data will be generated. Data will be made available on EPD and commercial prototypes. A prototype service for delivering sea charts and updates will be developed. The service will build on the generic service framework delivered by WP3 and will be based on S101. The task will cover

generation of trial S101 data, possibly converted from existing S57 data, the development of a prototype service for delivering the data, and rendering of the information in both the EPD and prototypes of commercial systems.
Investigation into the possible provision of bathymetry data based on S102 will also be conducted. This service will implement MSP 11 as defined in the IMO e-navigation strategy implementation plan.

Task 4.5 Smart buoy service
Task lead: MOG (all aspects of this task)
Contributors: DMA (assist with service development, Maritime Cloud usage and data modelling)
EMA (wave height and visibility modelling and assist with smart buoy service)

In this task an experimental service for interaction with smart buoys will be developed, based on the framework delivered by WP3. An outline data model based on S100 for buoy data will be made. Information exchange will both cover access to sensor data (meteorological and hydrological) from buoys to end users such as navigators, but also information to AtoN management in order to monitor and control buoy parameters such as light intensity/power consumption remotely. The aim will be a first description of a future standardized service for secure interaction with smart buoys and/or relevant off-shore installations. Experiments with prototype services and installations will be conducted and the results will be captured in a test report (deliverable). In addition, analytic work on wave height modelling and atmospheric visibility of relevance to smart buoys will be conducted.

Task 4.6 – Route optimisation services, including arctic challenges
Task lead: SSPA (all aspects of this task)
Contributors: FORCE, GH (service development and provision)
DMI (METOC service supporting route optimisation)
UKHO (data modelling)
DMA (assist with service development, Maritime Cloud usage)
LMA (test services with relation to different physical communication channels)
TRANSAS, FURUNO (implement service in prototype commercial systems)

This task will develop a prototype service for route optimisation based on the framework developed in WP3. The service will use the IEC adopted route format and take its outset in concepts and methods from the MONALISA projects. The prototype service will be made available on EPD and prototype commercial systems.
A proposed standard will be developed and multiple providers (SSPA, FORCE, GH) will provide route optimisation using the same service interface. The service will build on other services developed in the project, such as METOC, ice charts and route exchange.
Special features will include route optimisation for ice infested and shallow waters and the possibility of using crowd-sourced information about ice conditions.

Task 4.7 – Ice chart service
Task lead: DMI (data modelling, service development and provision, participate on client side on web platforms)
Contributors: DMA (assist with service development, server side with Maritime Cloud usage and client side on web-based platform)
FURUNO, TRANSAS (implement service in commercial system)
UKHO (data modelling)

An ice chart service will be provided in the Arctic and BSR. The service will be delivered on a web platform (ArcticWeb and BalticWeb) and prototype commercial systems. The ice chart service will be an operational service, and will evolve in versions. New features derived from research activities in WP6 will be implemented in operation for upgraded versions. For the Baltic Sea, ice charts will be taken from the Copernicus Marine Service, which will be steadily improved through versions. For the Arctic Ocean, the existing ice chart service will be provided and upgraded through versions during the project period. Planned upgrades include extending the domains of the existing DMI ice charting area to cover the entire Greenland waters, with increased frequency and using more data from Sentinel 1 for the production; transferring iceberg related research into operation to produce iceberg concentrations with higher resolution and individual iceberg information of higher quality.
As with other services, this will be prepared for multiple service providers using the standardised framework from WP3. The task will aim for a proposal for an S100 based standardized service which could be adopted by appropriate standardization organisations. This service will implement MSP 13 as defined in the IMO e-navigation strategy implementation plan.

Participation per Partner

Partner number and short name	WP4 effort
1 - SØFARTSSTYRELSEN	40.10
2 - KMS	25.40
3 - DANMARKS METEOROLOGISKE INSTITUT	16.20
4 - Veeteede Amet	6.00
5 - LIIKENNEVIRASTO	0.50
6 - Maritime Office in Gdynia	35.00
8 - SWEDISH MARITIME ADMINISTRATION	4.50
12 - LATVIAN MARITIME ACADEMY	11.00
18 - SSPA	8.10
19 - FORCE TECHNOLOGY	6.00
23 - FUR	36.30
24 - GateHouse A/S	9.00
28 - Rocket Brothers	18.30
30 - Transas Marine International AB	13.00
32 - UKHO	18.10
Total	247.50

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D4.1	Prototype operational framework supporting ArcticWeb and BalticWeb	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D4.2	Final documentation of operational framework	1 - SØFARTSSTYRELSEN	Report	Public	30
D4.3	Operational MSI/ NM(T&P) service	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D4.4	Documentation of MSI/NM (T&P) service	1 - SØFARTSSTYRELSEN	Report	Public	30
D4.5	Operational METOC service	3 - DANMARKS METEOROLOGISKE INSTITUT	Demonstrator	Public	24

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D4.6	Documentation of METOC service	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	30
D4.7	A prototype service for delivering nautical charts and updates in S101 format	2 - KMS	Demonstrator	Public	18
D4.8	Results for tests with sensor data and analysis	6 - Maritime Office in Gdynia	Report	Public	30
D4.9	A prototype route optimisation service	18 - SSPA	Demonstrator	Public	33
D4.10	Operational ice chart service	3 - DANMARKS METEOROLOGISKE INSTITUT	Demonstrator	Public	24
D4.11	Documentation of ice chart service	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	30

Description of deliverables

Deliverables: D4.1 Prototype operational framework supporting ArcticWeb and BalticWeb (M24) D4.2 Final documentation of operational framework (M30) A description of the physical infrastructure of the services. Allocation of the resources needed in order to maintain service provision also after project termination. D4.3 Operational MSI/NM(T&P) service (M24) D4.4 Documentation of MSI/NM(T&P) service (M30) D4.5 Operational METOC service (M24) D4.6 Documentation of METOC service (M30) D4.7 A prototype service for delivering nautical charts and updates in S101 format (M18) D4.8 Results of tests with sensor data and analysis (M30) D4.9 A prototype route optimisation service (M33) D4.10 Operational ice chart service (M24) D4.11 Documentation of ice chart service (M30)

D4.1 : Prototype operational framework supporting ArcticWeb and BalticWeb [24]

Prototype operational framework supporting ArcticWeb and BalticWeb.

D4.2 : Final documentation of operational framework [30]

A description of the physical infrastructure of the services. Allocation of the resources needed in order to maintain service provision also after project termination.

D4.3 : Operational MSI/NM(T&P) service [24]

Operational MSI/NM(T&P) service

D4.4 : Documentation of MSI/NM (T&P) service [30]

Documentation of MSI/NM (T&P) service

D4.5 : Operational METOC service [24]

Operational METOC service

D4.6 : Documentation of METOC service [30]

Documentation of METOC service

D4.7 : A prototype service for delivering nautical charts and updates in S101 format [18]

A prototype service for delivering nautical charts and updates in S101 format

D4.8 : Results for tests with sensor data and analysis [30]
Results for tests with sensor data and analysis

D4.9 : A prototype route optimisation service [33]
A prototype route optimisation service

D4.10 : Operational ice chart service [24]
Operational ice chart service

D4.11 : Documentation of ice chart service [30]
Documentation of ice chart service

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS4	Milestone month 24	1 - SØFARTSSTYRELSEN	24	The first batch of e-navigation/e-maritime services will be available on web platforms. Services will be tested on board vessels and in simulators. The High Level User Group will evaluate the results. Proposed standards (including the Maritime Cloud itself) will be matured, and the status of their promotion to appropriate international organisations will likewise be assessed.
MS5	Milestone month 30	1 - SØFARTSSTYRELSEN	30	Most project elements should be in place, and the capability of the project to achieve its longterm goals will be assed. This includes the capability to establish an operational framework of service provision beyond the framework of the project, and the capability to reach the desired impact on international standards and safety regimes.

Work package number [9]	WP5	Lead beneficiary [10]	14 - BIMCO
Work package title	Administrative burdens and exhaust emissions		
Start month	1	End month	36

Objectives

This work package will deliver new solutions to two important challenges: Administrative burdens and exhaust emissions:
A. The WP will develop, test and, where possible, implement administrative e-maritime solu-tions for automated reporting to ports and for transferring port information from the port to the ship and other maritime stakeholders.
B. This WP will develop solutions for monitoring emissions with focus on SOx and conduct vali-dation trials in the Baltic Sea Region.

Description of work and role of partners

WP5 - Administrative burdens and exhaust emissions [Months: 1-36]
BIMCO, SØFARTSSTYRELSEN, GateHouse A/S , Litehauz ApS, UKHO
Major user challenges to be solved:
Reporting related to port calls is often pointed out as the greatest single source of administrative burden for mariners. In addition to being inefficient, reporting increases the cognitive load on navigators, taking their attention away from navigation. Ports have developed their own procedures and forms without consistency or a common standard.
Good nautical and commercial port information is the foundation for efficient and safe port calls, yet the availability of recently and consistently updated port information can be challenging.
Exhaust emissions from ships have a large impact on the environment. Regulations are continuously strengthened and more environmentally friendly solutions are available, but come at a high economic cost to shipowners. Enforcement is challenging for the authorities, yet little enforcement gives incentives not to comply with the regulations.

Current state of the art solutions to the user challenge:
No uniform international standards are available for port reporting. Ships entering a port are often required to use multiple forms, repeating data, to multiple agencies – even written in local languages. Shipowners and seafarers recognise that there is a movement towards increased digitalisation in this field, but BIMCO believes that the potential for relieving the administrative burdens relating to port calls has not been fully utilised yet. The crew, rightly, often find it difficult to see the rationale behind manual handling of information already available in digital form. Differences in forms used by different countries and ports handling the same data add to the complexity. A “one single electronic reporting window” is to be developed under the auspices of the IMO to ensure an easy, simple and uniform reporting. Such a reporting window could alleviate part of the administrative burden imposed on all stakeholders and thus contribute to maintaining focus on promoting maritime safety, security and environmental protection.
Information about accessing a port is presented in books or via the internet. Generic safety information for ships is available to all users; however, processed information is available on a commercial basis only. The updating process of port information is in general slow for books but the update rate of web applications may be slow as well due to inconsistent templates, etc. Information regarding changes in port information is often communicated on a person-to-person basis.
Today Port State Control (PSC) manually conducts enforcement of emission reductions. This burden will increase in the future as more environmental pollutants fall under control schemes.
The first step of emission monitoring is taken under EU MRV for GHG.

Our proposed concept and/or approach to solve the user challenge:
Building on the successes of the e-maritime initiative and projects like ANNA and BLAST, the coming national single window targeted to be available in 2015 seems to take leaps forward in terms of standardizing the exchange of information between systems and stakeholders ashore. EfficienSea 2 will provide an easy connection right through to the e-navigation enabled ship. The project will include services aimed at reducing the administrative burdens, for instance by enabling automation of certain reporting functions. Solutions of global relevance, such as FAL reporting, will be investigated, specific solutions for the Baltic Sea Region will be identified and developed, and operational pilot implementation will be made available for the Baltic Sea Region. This work will be linked to existing elements such as SafeSeaNet and national single windows. A successful implementation will not only reduce delays, decrease turn-around times and improve cost-effectiveness, but also lower the distraction of navigators.

Standardised templates and reporting forms for port information will support an efficient exchange of data by streamlining the information flow. This will at the same time reduce the administrative burden of sending updates to ports.
With regard to emission monitoring for SOx, a decrease in administrative burdens and cost could be achieved by on-line access to monitoring data, thus enabling authorities to streamline inspections.

Task 5.1 – Automated port reporting
Task lead: GH (development of services, servicer in client side on web platform)
Contributors: UKHO (data modelling, user needs, user involvement, standardisation, participate in service development)
BIMCO (user needs, user involvement, harmonisation of user needs in region)
DMA (assist with service development, Maritime Cloud usage)

Based on the requirement to provide reports prior to port entry, the various reporting parameters need to be defined, analysed and a data model needs to be developed, based on the work on IMO FAL forms. This data model will be based on S-100 concepts. An S-100 type product specification will be developed to provide a standard definition of how the information should be structured. The necessary features will be registered in the IHO feature concept dictionary.

Objectives: Development of a prototype application of an automated port reporting system – easing the mariners' administrative burdens in regards to reporting when entering ports.
• Problem definition, concept development
• Development of standards for data modelling and S-100 type product specification
• Reach general approval of the draft standard
• Development of the IHO registry to include required port reporting feature definitions
• Technical development & testing, human factors, user test and validation based on the S-100 format
• Develop a service delivery standard
Current TRL 4 – Target TRL 8

Task 5.2 – Efficient port information/port information in a digital world
Task Lead: BIMCO (all aspects of this task)
Contributors: UKHO (data modelling, integration with port database)
DMA (assist with service development, servicer side with Maritime Cloud usage and client side on web-based platform)

EfficienSea 2 will develop vital changes to today's way of gathering port safety and port logistics and access information by establishing an easily accessible service based on the Maritime Cloud platform. This will help the shipping industry to remain competitive compared to other modes of transport. The solution will be evolved to fit into an e-maritime concept based on an electronic world of updates and information exchange. The various reporting parameters need to be defined and analysed as part of the project.
The data model should be based on the S-100 concept as developed by the International Hydrographic Organisation (IHO) and recognised by the International Maritime Organisation (IMO) as a cornerstone of e-navigation. As the S-100 type product specification will provide a standard definition of how the information is to be structured, the information uploaded to the cloud solution may be updated much quicker than today.
Based on existing port databases, the plan is to develop the data modelling required to draft an S-100 type product specification. The revision and development will take place in coordination with ports, port organisations, agents and other commercial entities, as well as other port authorities (not involved with the project) in order to reach a general acceptance of the whole concept as well as the level of information and format.

Activities and sub-tasks
Objectives: Develop an efficient port database in accordance with the international recommendations of the International Harbour Master Association providing validated nautical information.
• Fact finding and description of user requirements
• Development of an appropriate information package to be used as a commercial product where the user segment will have restricted access.
• Framework development for data transfer between various stakeholders in the port information chain.
• Test both open source information and information with restricted access on the Maritime Cloud with entities ashore and on board the ship.
Current TRL 3 – Target TRL 8

Task 5.3 – Emission monitoring solution
Task Lead: LH (all aspects of this task)
Contributors: GH (assist in service development, service and client side – web-based)

BIMCO (user involvement, ship-owners perspective)
DMA (assist with service development, servicer side with Maritime Cloud usage and client side on web-based platform)
DANELEC (will liaise from WP2, task 2.4 on integrating sensor data collection)

This task will work with new emission monitoring concepts to be used by both shipowners and authorities. The starting case will be SOx emissions in the Baltic Sea Region and the initial thinking is to combine onboard sensor data with external sensor data in order to validate models and strategies for compliance monitoring. The project will evaluate possible incentive structures that could counteract the economic incentive of non-compliance due to the lower cost of undesirable fuels. A new effective solution will help level the competitive playing field of shipping companies.
It is assumed that continuous monitoring will encourage shipowners to fully comply with emission regulations compared to a setup with rare occasional inspections. For the righteous shipping line, automated and continuous emission reporting will contribute to fairer competition, by making fuel/emission fraud more difficult.
An automated compilation and distribution of emission reports from exhaust gas cleaning equipment will lift a new administrative burden from the ship's master and shipping line.

Activities and sub-tasks
Subtask 5.3.1 Incentives and enforcement
A business model allowing for voluntary participation in a reporting mechanism to ports and authorities will provide an incentive through reduced PSC inspections when data are accessible in advance of entry into the EEZ/ports.
Important issues, such as data ownership, data access, encryption, confidentially, reliability and other typical challenges of cloud based data analysis, will be included.

Subtask 5.3.2 Definition of sensor and monitoring concepts
Identification of the current status of existing SOx measurement technologies is part of the initiating work on defining sensor and monitoring concepts.
Evaluation and identification of available monitoring technologies will lead to a conceptual design and prototyping of an emission control system, namely software that can collect, analyze and send data to the cloud, where emissions are measured and geocoded in SECA (Sulphur Emission Control Area) zones. When using exhaust gas cleaning systems, sulphur oxide (SOx) emissions must be logged by the equipment and made available for inspection. It is suggested that such an approach is enhanced with an automatic emission report sent from the ship or the equipment supplier on a regular basis. The economic gain from deliberate non-compliance with the legislation calls for a very secure and thorough compliance control apparatus and/or extremely high penalties. Documenting emissions during all trips and in all sea areas gives the authorities an ability to map the precise geospatial emission.
The standards applicable in sensor technologies and the possible proxies feasible for monitoring will be assessed in light of the 2015 introduction of new sulphur reductions for shipping in European SECAs as well as the designation of European waters as a SECA in 2020. Also the use of scrubbers when operating on HFO or the use of MgO to reduce sulphur emissions can be monitored (automated or manually) and the results stored onboard or in a central data repository.

Subtask 5.3.3 Mapping of sensor technologies and monitoring networks
Monitoring of sulphur related performance indicators in shipping is still under development, but early stage sensor technologies are commercially available for stack emissions and for oil sulphur content. However, the sampling mechanisms, the detector standardization, the data transfer formats and data management are still in transition phases.
Based on our existing software architecture, it is the plan to develop the data transfer and storage framework in open source code and supply a display platform with near real time emission data (for scrubber sensors) and recalculated voyage emission data for fuel switch users (subject to reporting).

Subtask 5.3.4 Field testing, demonstration and evaluation
Field tests will be carried out on land-based lab/full-scale facilities as well as on the ships where the monitoring device has been installed. During the tests, the monitoring efficiency, data transfer and analysis will be demonstrated and evaluated.
The system will be tested, demonstrated and evaluated on board a vessel.

Subtask 5.3.5 Recommendations
The system will allow shipowners and PSC authorities to screen the volunteers for sulphur regulatory compliance. The recommendations for the framework to be applied will be presented.
The data submission and analysis mechanisms will be prepared for and may (in future applications) be developed for emission data of many more pollutants and for correlation of the performance indicators of the ship, primarily speed, load, fuel consumption, etc., but may also include geoposition as well as hydrological and meteorological parameters.

This unique collection of data will facilitate data mining, pattern recognition algorithms and the options for other business models through subscriptions.

Current TRL and target TRL
The base sensors are already available in functional prototypes or even commercially. Thus, for these fundamental requisites and the hardware for local data transfer, the technology is TRL 7 or more. For the software we are testing a working prototype for the same application in ballast water monitoring and the TRL is 4-5. Our aim is to reach TRL 7 for the application for SOx.

Participation per Partner

Partner number and short name	WP5 effort
1 - SØFARTSSTYRELSEN	7.60
14 - BIMCO	20.00
24 - GateHouse A/S	21.00
25 - Litehauz ApS	24.00
32 - UKHO	11.00
Total	83.60

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D5.1	Draft S-100 product specification for common port reporting	24 - GateHouse A/S	Report	Public	18
D5.2	Demonstration of prototype application for automated port reporting	24 - GateHouse A/S	Demonstrator	Public	33
D5.3	Development of a new common port database concept and structure	24 - GateHouse A/S	Demonstrator	Public	10
D5.4	Online tests of ship data transfer. Report on the results	14 - BIMCO	Report	Public	30
D5.5	Prototype database on online port data	25 - Litehauz ApS	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	34

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D5.6	Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement	25 - Litehauz ApS	Report	Public	10
D5.7	Report on online land-based system tests and ship-based tests	25 - Litehauz ApS	Report	Public	30
D5.8	Working prototype of online sensor with cloud-based algorithm	25 - Litehauz ApS	Demonstrator	Public	35

Description of deliverables

Deliverables: D5.1 Draft S-100 product specification for common port reporting (M18) D5.2 Demonstration of prototype application for automated port reporting (M33) D5.3 Development of a new common port database concept and structure (M10) D5.4 Online tests of ship data transfer of data. Report on the results (M30) D5.5 Prototype database of online port data (M34) D5.6 Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement (M10) D5.7 Report on online land-based system tests and ship-based tests (M30) D5.8 Working prototype of online sensor with cloud-based algorithm (M35)

D5.1 : Draft S-100 product specification for common port reporting [18]

Draft S-100 product specification for common port reporting

D5.2 : Demonstration of prototype application for automated port reporting [33]

Demonstration of prototype application for automated port reporting

D5.3 : Development of a new common port database concept and structure [10]

Development of a new common port database concept and structure

D5.4 : Online tests of ship data transfer. Report on the results [30]

Online tests of ship data transfer. Report on the results

D5.5 : Prototype database on online port data [34]

Prototype database on online port data

D5.6 : Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement [10]

Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement

D5.7 : Report on online land-based system tests and ship-based tests [30]

Report on online land-based system tests and ship-based tests

D5.8 : Working prototype of online sensor with cloud-based algorithm [35]

Working prototype of online sensor with cloud-based algorithm

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS4	Milestone month 24	1 - SØFARTSSTYRELSEN	24	The first batch of e-navigation/e-maritime services will be available on web platforms. Services will be tested on board vessels and in simulators. The High Level User Group will evaluate the results. Proposed standards (including the Maritime Cloud itself) will be matured, and the status of their promotion to appropriate international organisations will likewise be assessed.
MS5	Milestone month 30	1 - SØFARTSSTYRELSEN	30	Most project elements should be in place, and the capability of the project to achieve its longterm goals will be assed. This includes the capability to establish an operational framework of service provision beyond the framework of the project, and the capability to reach the desired impact on international standards and safety regimes.

Work package number [9]	WP6	**Lead beneficiary** [10]	8 - SWEDISH MARITIME ADMINISTRATION
Work package title	Advanced e-navigation solutions in the Arctic and Baltic Sea Region		
Start month	1	**End month**	36

Objectives

Further mature advanced e-navigation services in the following areas:
- Reporting
- Route exchange
- Safety of navigation in the Arctic

Ensure the human factor in the development and integration of services.

Description of work and role of partners

WP6 - Advanced e-navigation solutions in the Arctic and Baltic Sea Region [Months: 1-36]
SWEDISH MARITIME ADMINISTRATION, SØFARTSSTYRELSEN, DANMARKS METEOROLOGISKE INSTITUT, LIIKENNEVIRASTO, CHALMERS, DTU, LATVIAN MARITIME ACADEMY, SSPA, FORCE TECHNOLOGY, CLS, FUR, Transas Marine International AB, Vissim AS, UKHO
Like work package 4, this work package will develop e-navigation services. In distinction to WP4, this WP will focus on advanced services and services of special relevance to the Arctic and/or ice infested waters. Some of these services are less mature than those in WP4 and will therefore not be taken to the same high technology readiness level. Dealing with less mature services also means that there will be more focus on human factors, and user evaluations will to a large extent involve the use of simulators. Some services will be taken to an operational level, accessible on BalticWeb and ArcticWeb in cooperation with WP4, whereas others will be tested on experimental platforms such as the EPD and prototype commercial systems.

Task 6.1 – Route exchange, reporting and negotiation
Task lead: FTA (all aspects of this task)
Contributors: SMA (service development, background info from MONALISA, route sharing between BSR VTS centres and Sound VTS)
DMA (assist with service development, servicer side with Maritime Cloud usage and client side on web-based platform and EPD if appropriate, pilot vessel route exchange)
VISSIM, TRASAS, FURUNO (implement service in prototype commercial systems)

In this task, development will be made on services capable of handling and exchanging information with regard to vessels' routes and voyage plans in line with HELCOM Recommendation 34E/2. The task will build on the framework for MSP developed in WP3. The task will develop a basic route handling/exchange functionality which will be used both to develop more advanced solutions in this task and in other tasks that need a basic route handling/exchange functionality such as 'route optimisation' and 'decision support for ice navigation'.
The basic service will use the already adopted IEC standard for route format, extended into an S100 product specification if deemed relevant.
The advanced service in this task will cover the ability to send vessels' route to VTS centres as done in the current ENSI system. The aim will be to have this functionality in onboard systems and in BalticWeb (merged with the current ENSI system). Route plans and results from basic safety checks will be made available for all VTS centres in the BSR. This will allow VTS centres to monitor the vessel's movements according to its planned route, to perform additional automatic safety checks of the route and to provide guidance to the vessel if needed.
Another element of this task will be to mature the concept for route negotiation developed by the MONALISA projects. This will mainly be done on experimental platforms like the EPD and commercial prototype systems.
A specific case of route negotiation between a vessel and a pilot, prior to a pilot going on board the vessel, will be tested.

Task 6.2 – VTS and SRS reporting
Task lead: SMA (all aspect of this task)
Contributors: FTA (assist in ENSI integration)
DMA (assist with service development, servicer side with Maritime Cloud usage and client side on web-based platform)
FURUNO, TRANSAS, VISSIM (implement service in prototype commercial systems)

This task will develop services for reporting to VTS centres and SRS, in coordination with WP5, task 5.1. The service will build on the framework from WP3 and will take elements from the MONALISA projects and the existing ENSI system to achieve this task. It will be possible to submit the necessary reporting information to the BalticWeb platform, and the aim is that this only needs to be done once for the entire BSR. The information will then be made available to all necessary authorities, either through the appropriate national single window system, SafeSeaNet or directly based on the Maritime Cloud.
A proposal for a common standardised S100 based format for VTS and SRS reports will be promoted in the appropriate standardisation organisations, taking into account the potential value and relevance of the existing VTS data exchange protocol (I-VEF). The work will involve all appropriate authorities in the region.

Task 6.3 – Self-organising emergency response and decision support for ice navigation
Task lead: CHALM (coordination, human factors, testing)
Contributors: DMA (software development, SAR (VOCT), live positioning using embedded devices, route exchange)
VISSIM (prototype commercial system, live positioning using MICE)
SMA (further development of MICE)
SSPA (crowd-sourcing of ice information)

This task will advance different services with the aim of improving maritime safety in the Arctic. The current ArcticWeb will be used as the baseline. It will be expanded functionally and geographically through the course of the project.
The main target will be to develop means for self-organising emergency response capabilities. This functionality will build on several elements including the route exchange capabilities developed in task 6.1, results from the MICE project and the VOCT (Vessel Operations Coordination Tool) prototype developed in the ACCSEAS project.
The aim will be for vessels to corporate in a SAR operation by exchanging vital information through the ArcticWeb platform, including calculating search patterns for all participating vessels, visualisation and exchange of search patterns and visualisation of already covered areas.
Another important capability to be matured within this task is the ability for vessels to share their current position ("live position"), allowing relevant stakeholders access to this instead of retrieving the information from satellite AIS, which can be delayed for several hours. This would be an excellent improvement of the general situation awareness provided by ArcticWeb, but would in particular dramatically improve the usefulness of the SAR capabilities.
Two approaches to achieving this will be pursued; one being the further maturation of the navigational equipment developed in the MICE project for use on selected vessels (like SAR vessels), and the other being the development of a small inexpensive embedded device which would connect ArcticWeb with the vessel's AIS transponder, thus enabling the vessel's position to be shared.
Another scope of this task will be to expand the very basic route exchange mechanism which is currently available in ArcticWeb and transfer the communication scheme for using the Maritime Cloud as developed in WP3. The further developed route handling functionality will more intelligently support the vessel's route planning with the objective of reducing the maximum distance to other vessels during the entire voyage. The expanded route functionality will build on the basic services developed in T6.1.
Furthermore, this task will develop methods and functionality for crowd-sourcing of information relevant to safe navigation in ice-infested waters, such as the size and position of icebergs and ice thickness. The information will be manually entered in ArcticWeb or automatically measured/calculated and exchanged through the Maritime Cloud.
The information made available to the mariner through this task will enable much better risk assessments for arctic navigation.

Task 6.4 Human factors in integration of e-navigation services
Task Lead: CHALM (coordination, human factors, testing)
Contributors: DMA (no-go area, service development)
SSPA (comfort-zone, service development)
UKHO (no-go area, standards, user needs)
FORCE, LMA (human factors, testing, comparative study between e-navigation systems and existing ECDIS systems)

The human element will be taken into account in all project tasks involved in developing services for the end-user. This task will focus on the human element of using an integrated system in which all services are available where and when they are needed, whether for tactical or strategic decision-making, for navigation, administration or communication between control centres on board. In addition to the study report, this task will give feedback to service developing tasks in order to allow them to take the findings into consideration when further developing the services.
The Maritime Cloud framework aims to provide seamless and efficient flow of information between ship and shore; however, the risk of information overload or miscommunication on board remains. By taking a socio-technical

perspective and trying to support the human as an integral part of the ship-shore system, this sub-task would aim to take a holistic view on the information flow and the e-navigation services to be developed within the project, both the novel services in preceding WPs and the advanced solutions in WP6.
Two case studies will be conducted with two specific services of relevance to information overload: "comfort-zone" and "no-go" area. These are two different approaches to assist the navigator in keeping a safe passage with regard to all relevant parameters such as other vessels, MSI/NM, bathymetry, off-shore installations, etc.
Particular focus will be on making a comparative study of the e-navigation enhanced systems developed in the project (EPD, web, commercial) and existing ECDIS systems.

Task 6.5 – Advancement of METOC data for improving maritime safety
Task lead: DMI (coordination, METOC)
Contributors: CLS, DTU (space weather)

This task has two main goals of specific relevance to the arctic region. The first element is to work with the continuous improvement of the models for forecasting ice conditions. This in turn means improvements to the models of those parameters that effect the ice movements, like current and waves. The improved models developed in this task will be continuously deployed and thereby improve the accuracy of the METOC service in T4.2 and those services relying on the METOC service like the route optimisation task in 4.6.
Another aspect of this will be the inclusion of uncertainty estimates. Future METOC services will thus not only deliver the predicted METOC parameter, but also an indication of the uncertainty of the parameters.
The second element is the development of an experimental space weather forecast service. The service will seek to predict the influence of space weather on positioning and communication equipment. The service will be based on data and technical validation in WP2 and evaluated for usability in this WP.

Lead partner: DMI
Contributors: CLS, DTU

Participation per Partner

Partner number and short name	WP6 effort
1 - SØFARTSSTYRELSEN	23.40
3 - DANMARKS METEOROLOGISKE INSTITUT	13.00
5 - LIIKENNEVIRASTO	11.20
8 - SWEDISH MARITIME ADMINISTRATION	46.10
9 - CHALMERS	22.90
11 - DTU	2.00
12 - LATVIAN MARITIME ACADEMY	5.00
18 - SSPA	16.20
19 - FORCE TECHNOLOGY	3.90
20 - CLS	10.00
23 - FUR	3.00
30 - Transas Marine International AB	17.00
31 - Vissim AS	18.50
32 - UKHO	6.30
Total	198.50

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D6.1	Basic route handling/exchange service	5 - LIIKENNEVIRASTO	Demonstrator	Public	18
D6.2	Route reporting to VTS service	5 - LIIKENNEVIRASTO	Demonstrator	Public	24
D6.3	Service for reporting VTS information and forwarding and sharing information between VTS centres	8 - SWEDISH MARITIME ADMINISTRATION	Demonstrator	Public	30
D6.4	Service for SRS reporting	8 - SWEDISH MARITIME ADMINISTRATION	Demonstrator	Public	30
D6.5	Improved route handling/exchange capabilities in ArcticWeb	9 - CHALMERS	Demonstrator	Public	30
D6.6	Report on the progress/ experience in live position sharing and crowd-sourcing	18 - SSPA	Report	Public	30
D6.7	ArcticWeb expanded to include self-organised emergency response capabilities	1 - SØFARTSSTYRELSEN	Demonstrator	Public	24
D6.8	Report on human factor aspects of e-navigation services	9 - CHALMERS	Report	Public	33
D6.9	Report on studies of the use of "comfort-zone" and "no-go areas"	9 - CHALMERS	Report	Public	24
D6.10	A report on the advancements in METOC models and uncertainty estimates	3 - DANMARKS METEOROLOGISKE INSTITUT	Report	Public	33

Description of deliverables

Deliverables: D6.1 Basic route handling/exchange service (M18) (This service will be a basic service used by other services and different platforms. It will not directly be used on end user platforms.) D6.2 Route reporting to VTS service (M24) (This will be an operational service provided on BalticWeb.) D6.3 Service for reporting VTS information and forwarding and sharing information between VTS centres (M30) D6.4 Service for SRS reporting (M30) Both services will be made available on BalticWeb and prototype commercial systems. D6.5 Improved route handling/exchange capabilities in ArcticWeb (M30) D6.6 Report on the progress/experience in live position sharing and crowd-sourcing (M30) D6.7 ArcticWeb expanded to include self-organised emergency response capabilities (M24) D6.8 Report on human factor aspects of e-navigation services (M33) D6.9 Report on studies of the use of "comfort-zone" and "no-go areas" (M24) D6.10 A report on the advancements in METOC models and uncertainty estimates (M33)

D6.1 : Basic route handling/exchange service [18]

Basic route handling/exchange service (This service will be a basic service used by other services and different platforms. It will not directly be used on end user platforms.)

D6.2 : Route reporting to VTS service [24]

Route reporting to VTS service (This will be an operational service provided on BalticWeb.)

D6.3 : Service for reporting VTS information and forwarding and sharing information between VTS centres [30]

Service for reporting VTS information and forwarding and sharing information between VTS centres

D6.4 : Service for SRS reporting [30]

Service for SRS reporting

D6.5 : Improved route handling/exchange capabilities in ArcticWeb [30]

Improved route handling/exchange capabilities in ArcticWeb

D6.6 : Report on the progress/experience in live position sharing and crowd-sourcing [30]

Report on the progress/experience in live position sharing and crowd-sourcing

D6.7 : ArcticWeb expanded to include self-organised emergency response capabilities [24]

ArcticWeb expanded to include self-organised emergency response capabilities

D6.8 : Report on human factor aspects of e-navigation services [33]

Report on human factor aspects of e-navigation services

D6.9 : Report on studies of the use of "comfort-zone" and "no-go areas" [24]

Report on studies of the use of "comfort-zone" and "no-go areas"

D6.10 : A report on the advancements in METOC models and uncertainty estimates [33]

A report on the advancements in METOC models and uncertainty estimates

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS4	Milestone month 24	1 - SØFARTSSTYRELSEN	24	The first batch of e-navigation/e-maritime services will be available on web platforms. Services will be tested on board vessels and in simulators. The High Level User Group will evaluate the results. Proposed standards (including the Maritime Cloud itself) will be matured, and the status

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				of their promotion to appropriate international organisations will likewise be assessed.
MS5	Milestone month 30	1 - SØFARTSSTYRELSEN	30	Most project elements should be in place, and the capability of the project to achieve its longterm goals will be assed. This includes the capability to establish an operational framework of service provision beyond the framework of the project, and the capability to reach the desired impact on international standards and safety regimes.

Work package number [9]	WP7	Lead beneficiary [10]	1 - SØFARTSSTYRELSEN
Work package title	Project Management		
Start month	1	End month	36

Objectives

To ensure the sound, responsible and effective daily management of the project via capable project management and management support
To ensure that the tasks assigned to it in the grant agreement as well as in the consortium agreement are performed
To ensure high quality of the project work and project results
To ensure efficient legal, contractual and financial management of the project
To ensure effective monitoring of the WP's work and progress
To ensure the full participation of all beneficiaries and effective and constructive conflict management

Description of work and role of partners

WP7 - Project Management [Months: 1-36]
SØFARTSSTYRELSEN
Description of work:
The Project Manager refers to the Executive Board and must ensure sufficient and regular information to the Executive Board about the project's progress, as defined in the consortium agreement. Furthermore, the Executive Board can instruct the Project Manager on particular management decisions and ask the Project Manager to implement decisions taken by the Executive Board and the General Assembly.

The Project Manager's role is to be responsible for the general coordination and management of the pro-ject and to act as the project's single intermediary between the parties and the funding authority.

WP7 is responsible for the initial establishment of the management structure and the management support team; the effective daily management of the project, and its termination at the end of the project with all deliveries executed. WP7 is led by the Project Manager and a management support team, all part of the DMA staff.

Management activities include adoption of a consortium agreement, coordination between work pack-ages and anticipation, management and resolution of conflicts. In addition, the management is respon-sible for planning and tracking the project and identifying and handling changes.

WP7 will consist of the following roles:

Project Manager:
Responsibilities include:
daily management of the project;
effective management (monitoring and guidance) of all WP Leaders, and the overall progress tracking of the project;
coordination and management of the management support team;
ensuring that all reports to the EC are delivered on time and are of a satisfactory quality;
regular status reports to the Executive Board and the General Assembly on the project's progress;
implementing decisions made by the Executive Board and the General Assembly;
ensuring corrective actions necessary for maintaining schedule and achieving targets.

Management support team:

Project coordinator:
Tasks include: assist the Project Manager with the administrative and legal/contractual management of the project; responsible for communication with EC and partners regarding administrative and legal/contractual matters.

Financial manager:
Tasks include: monitoring the projects overall economy, including partners' financial progress; re-sponsible for preparing the coordinator's financial partner reports; responsible for communication with partners regarding financial questions and problems; management of budget transfer requests; and maintaining all communication regarding financial matters with the H2020.

Participation per Partner

Partner number and short name	WP7 effort
1 - SØFARTSSTYRELSEN	34.90
Total	34.90

List of deliverables

Deliverable Number [14]	Deliverable Title	Lead beneficiary	Type [15]	Dissemination level [16]	Due Date (in months) [17]
D7.1	Project management plan	1 - SØFARTSSTYRELSEN	Report	Public	3

Description of deliverables

D7.1 Project management plan (M3)

D7.1 : Project management plan [3]

Project management plan

Schedule of relevant Milestones

Milestone number [18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Milestone month 3	1 - SØFARTSSTYRELSEN	3	The project management plan will be available.

1.3.4. WT4 List of milestones

Milestone number [18]	Milestone title	WP number [9]	Lead beneficiary	Due Date (in months) [17]	Means of verification
MS1	Milestone month 3	WP7	1 - SØFARTSSTYRELSEN	3	The project management plan will be available.
MS2	Milestone month 9	WP2, WP3	1 - SØFARTSSTYRELSEN	9	The more conceptual and non-technical aspects of the output from WPs 2 and 3 will be evaluated by the High Level User Group. More technical output will be evaluated by technical project participants not directly involved in these work packages.
MS3	Milestone month 18	WP2, WP3	1 - SØFARTSSTYRELSEN	18	The descriptive foundation for using the Maritime Cloud for service development exits. Both shore-side (WP3) and ship-side (WP2). The descriptions/models will be assessed by service developers in WPs 4, 5 and 6 in order to evaluate their adequateness. This is the most important milestone in the project and much effort will be put into the evaluation.
MS4	Milestone month 24	WP4, WP5, WP6	1 - SØFARTSSTYRELSEN	24	The first batch of e-navigation/e-maritime services will be available on web platforms. Services will be tested on board vessels and in simulators. The High Level User Group will evaluate the results. Proposed standards (including the Maritime Cloud itself) will be matured, and the status of their promotion to appropriate international organisations will likewise be assessed.
MS5	Milestone month 30	WP3, WP4, WP5, WP6	1 - SØFARTSSTYRELSEN	30	Most project elements should be in place, and the capability of the project to achieve its longterm goals will be assed. This includes the capability to establish an operational framework of service provision beyond

Milestone number [18]	Milestone title	WP number [9]	Lead beneficiary	Due Date (in months) [17]	Means of verification
					the framework of the project, and the capability to reach the desired impact on international standards and safety regimes.

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
R1	Managing the high number of partners, ensuring alignment and consensus.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	Most partners are restricted to focus their competences in just a few tasks. The management structure is designed to handle any strategic or tactical issues, as explained in section 3.2. Furthermore, an efficient solutions for electronic document and knowledge sharing, supporting progress monitoring and offering on-line meeting facilities will be used by the project, in order to keep travel costs at a minimum.
R2	Internal critical dependencies. The Maritime Cloud is a core element in the project, and most of the deliverables are somehow depending on development on this in WP3.	WP3, WP4, WP5, WP6	Detailed project activity planning pending grant of the project will take this critical path into account. The milestones in the project already have emphasis on this, and any delay/ deviation should be detected. In such case, resources will be reallocated to catch up on developments in WP3. This may temporarily delay deliverables in WP4, 5 or 6, but it appears realistic to bring the overall project deliverables back on track within the project lifetime.
R3	DMA has a huge involvement in many areas of the project. They may not be able to deliver on all aspects.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	DMA is fully aware of this, and has acknowledged that the amount of resources allocated to the project may not be sufficient. DMA is willing and able to contribute to the project beyond the limits stated in the project budget.
R4	Tasks are underestimated, and the project will thus not deliver the output at the expected TRL.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	Budget reallocations or alternative funding or resources will have to be considered for those tasks.
R5	Some tasks turns out to require competences that are not assigned to the task / available in the project.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	A small part of the budget has been allocated to pay direct costs of external expert contributions,

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
			offered by the organisations involved in the High Level User Group. These can be selected for needed competences and assigned to whichever tasks they may be needed in.
R6	Disagreements in the project group.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	The management structure will be able to deal with these, but more importantly, great emphasis will be given to prevent severe disagreements in the preparation of the partnership agreement.
R7	Partner denying to sign partnership agreement, partner failing to deliver, or partner bankruptcy.	WP1, WP2, WP3, WP4, WP5, WP6, WP7	The partnership agreement will address a formal procedure for the General Assembly or Executive board to react to bankruptcy or severe failure to deliver the agreed project results. Most partner competences can be replaced by other project partners, if reallocation of a specific partners budget is still feasible.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total Person/Months per Participant
1 - SØFARTSSTYRELSEN	23.60	1.40	43.70	40.10	7.60	23.40	34.90	174.70
2 - KMS	0.50	0	1	25.40	0	0	0	26.90
3 - DANMARKS METEOROLOGISKE INSTITUT	0	0	0	16.20	0	13	0	29.20
4 - Veeteede Amet	0	0	0	6	0	0	0	6
5 - LIIKENNEVIRASTO	0	0	0.50	0.50	0	11.20	0	12.20
6 - Maritime Office in Gdynia	0	0	0	35	0	0	0	35
7 - INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	0	58.20	0	0	0	0	0	58.20
8 - SWEDISH MARITIME ADMINISTRATION	0	0	2	4.50	0	46.10	0	52.60
9 - CHALMERS	12	0	0	0	0	22.90	0	34.90
10 - UCPH	0	0	19.20	0	0	0	0	19.20
11 - DTU	0	16	0	0	0	2	0	18
12 - LATVIAN MARITIME ACADEMY	2	0	0	11	0	5	0	18
13 - OFFIS EV	5	7	24	0	0	0	0	36
14 - BIMCO	0	0	0	0	20	0	0	20
15 - CIRM	4.50	5.50	0	0	0	0	0	10
16 - IALA	18.50	4	4	0	0	0	0	26.50
17 - MDCE	10.80	0	0	0	0	0	0	10.80
18 - SSPA	0	0	0	8.10	0	16.20	0	24.30
19 - FORCE TECHNOLOGY	6.50	0	0	6	0	3.90	0	16.40
20 - CLS	0	29.90	0	0	0	10	0	39.90

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total Person/Months per Participant
21 - Danelec Marine	0	40	0	0	0	0	0	40
22 - FREQUENTIS	0	0	41.90	0	0	0	0	41.90
23 - FUR	0	36.30	0	36.30	0	3	0	75.60
24 - GateHouse A/S	0	0	16	9	21	0	0	46
25 - Litehauz ApS	0	0	2	0	24	0	0	26
26 - LYNGSO MARINE AS	0	12	6	0	0	0	0	18
27 - MARSEC-XL	0	0	13	0	0	0	0	13
28 - Rocket Brothers	0	0	2	18.30	0	0	0	20.30
29 - Thrane & Thrane A/S	0	107.80	0	0	0	0	0	107.80
30 - Transas Marine International AB	0	12	6.10	13	0	17	0	48.10
31 - Vissim AS	0	0	3.10	0	0	18.50	0	21.60
32 - UKHO	1	0	1	18.10	11	6.30	0	37.40
Total Person/Months	84.40	330.10	185.50	247.50	83.60	198.50	34.90	1164.50

1.3.7. WT7 Tentative schedule of project reviews

Review number [19]	Tentative timing	Planned venue of review	Comments, if any
RV1	19	Brussels	
RV2	36	To be determined	

1.4. Ethics Requirements

Ethics Issue Category	Ethics Requirement Description
HUMANS	- Details on measures to prevent malevolent/criminal/terrorist abuse of research findings must be provided. Confirmation that non EU countries will follow EU and H2020 rules on ethics is required. Please add this in the annex 1 part B.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public

CO Confidential, only for members of the consortium (including the Commission Services)
CI Classified, as referred to in Commission Decision 2001/844/EC

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA if virtual access,
TA-uc if trans-national access with access costs declared on the basis of unit cost,
TA-ac if trans-national access with access costs declared as actual costs, and
TA-cb if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

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EfficienSea 2 – project facts summary:

Project consortium

32 partners from 12 European countries

- 8 governmental institutions (maritime, transport, meteorological and telecom authorities)
- 5 academic institutions (human factors, computer science, communication and space)
- 3 international associations (aids to navigation, equipment manufacturers, shipowners/ports, etc.)
- 13 commercial enterprises (onboard/onshore equipment manufacturers, hydrographic services)
- 3 non-profit organisations (European innovation networks, applied scientific expertise)

Timeframe: 36 months
Total work: 1164 man months
Total project budget: 11.5 M EUR
Total EU funding: 9.8 M EUR

1. History of changes

Time	Place	Change
6/2 2015	Many	Document updated according to instructions
9/2 2015	S2.3.1 item 3	Clarification on how the project will ensure data delivery by service providers.
9/2 2015	S4.4 table 3.4b	Other direct costs of partners 7,15, 16 and 25 explained in greater detail.
10/2 2015	S4.4 table 3.b	Equipment cost for NIT changed to match the overall project budget. This is not changing the budget, only correcting a mistake.
9/2 2015	S2.1.5	Clarification on how the project will ensure that the innovations will reach the market
9/2 2015	WP7	All deliverables deleted (internal reports to the consortium) and replaced by a project management plan at M3.
9/2 2015	WP1	The delivery 'D1.2 Plan for dissemination, exploitation and communication' has changed from M6 to M18
9/2 2015	WP1	The name of D1.8 is shortened to 'Final usability evaluation report'
9/2 2015	WP1	Point added in 'Task 1.1. Communication' about exploitation.
10/2 2015	Appendix A	Added to clarify the major products of the project.
10/2 2015	Appendix B	Appendix added to comment on ethics issues.
10/2 2015	S4.2	Chair of general assembly changed from deputy director general level to director level due to internal changes in DMA's organisation.

10/2 2015	Many	WP0 changed to WP7 in order to be coherent with the participant portal.
10/2 2015	Many	Deliverable numbers changed to match the participant portal.
15/2 2015	S4.1	Removed as requested.
15/2 2015	Appendix C	Appendix added to include explanations of subcontracting.
18/2 2015	Table 3.4b	Details of 'other goods and services' added for Chalmers
24/2 2015	Appendix D	Explanations of 'other direct costs' included as appendix D
26/2 2015	Appendix C	Further explanation on subcontracting for EMA.
27/2 2015	Appendix D	Further explanations of travel for MOG, NIT, CIRM, IALA, CLS, LH and T&T
27/2 2015	Appendix D	Further explanations of Equipment & Material and other costs for SMA, T&T
27/2 2015	Appendix D	Chalmers actually has a rather low travel cost compared to personnel cost (9%, project average 13%). We have increased the foreseen number of travels from 15 to 18 bringing the cost per travel down to 1.500€
27/2 2015	Appendix D	We will reallocate 5.000€ from DIKU to partners with very low travel budgets, bringing DIKU's cost per travel down to 1.500€ The 5.000€ has been distributed to other partners with a very low travel budget as follows: DTU +1.000 FORCE +1000 GH + 2.000 RB + 1.000
28/2 2015	Appendix D	General explanation for travel costs included in beginning of appendix
28/2 2015	Appendix D	IALA's number of estimated travels has been increased from 17 to 20. This will match CIRM's estimate and bring the cost per travel to a comparable 1.700€
28/2 2015	Appendix D	Danelec has a rather low travel cost compared to their personnel cost (8%, project average 13%). Therefore the expected number of travels has been increased from 15 to 17, bringing the cost per travel below 1.500€.
28/2 2015	Appendix D	Correction made in MARSEC budget
2/3 2015	Table 3.4b	Depreciation for NIT expenses explained at the end of table 3.4b
3/3 2015	Table 3.4b	Correction of error in DMA budget and further explanations.
3/3 2015	Table 3.4b + appendix D	Table 3.4b has been deleted, and the information from the table has been merged into the table in appendix D.
3/3 2015	Page 2	Project summary inserted from application.
3/3 2015	Appendix D	Category 'Equipment and materials' corrected to 'Equipment' and 'Other' corrected to 'other goods and services'.

3/3 2015	Appendix D	Explanations for T&T Equipment
10/3	Appendix E	'Members of the consortium' from the application has been included as appendix E.

2. Excellence

1.1. Objectives

The overall objective is to co-create and deploy innovative solutions for safer and more efficient waterborne operations. A carefully selected consortium, encompassing excellent technical and human factor competences, equipment, system- and service providers as well as authorities and international organisations, with expert domain and regulatory knowledge and influence. Supported by a High Level User Group the consortium is in an excellent position to maximise the impact of project innovations. With a total of seven specific objectives all interacting within one framework, the project targets the following:

1. Create and implement a ground-breaking **communication framework – the 'Maritime Cloud'** that will enhance information sharing in and around the maritime sector for smarter traffic management, facilitating a comprehensive e-maritime and e-navigation environment, enabling the maritime internet of things.
2. Identify, develop, test and, where possible, standardise and implement **e-navigation solutions** that will reduce the risk of accidents, especially in dense waterways, as well as increase the efficiency of the transport chain.
3. Develop, test and, where possible, implement **e-maritime solutions** for **automated reporting** and **efficient port information** and, thus, minimise delays and turnaround times as well as administrative burdens.
4. Create and implement navigational support services and a new self-organizing **emergency response solution** in remote and difficult environments such as the Arctic in order to reduce the risk of loss of life.
5. Develop solutions to **monitor emissions** with a focus on SO_x and conduct validation trials in the Baltic Sea Region.
6. Create innovative and cost-effective solutions with **novel communication technology** to deal with ships' challenge of getting access to information services at a reasonable price, especially in remote places such as the Arctic.
7. **Set the technical and governance standard** for the above areas, particularly in regards to e-navigation solutions.

These objectives will be achieved through a wide range of innovations summarized in table 1.1.

Table 1.1 – Tangible deliverables realising project objectives		**Start TRL – Target TRL**
Services to improve navigational safety and efficiency		
Nautical charts based on S-101	Example charts in new internationally agreed format allowing for better update schemes, integration with different data types and better data maintenance schemes	3 – 6
MSI & NM	Maritime Safety Information (MSI) and Notices to Mariners (NM) in a new format allowing for better promulgation and for portrayal on electronic chart display	5 – 8
METOC	Standardized Meteorological and Oceanographic information (METOC) service allowing for integration on multiple platforms	5 – 7
Smart buoy	Service for interaction by authorities and navigators with buoys, light intensity control and access to METOC sensors	2 – 5
Ice charts	Standardised ice chart services allowing for visualisation and electronic chart display on different platforms	5 – 7
Route exchange	Route exchange service for exchanging information about vessels' intended routes, ship-ship, ship-shore and to be used by other services	5 – 7
No-go area/comfort zone	Services to merge a variety of data (draft, bathymetry, tidal levels, etc.) into simpler information indicating where a vessel can safely sail	4 – 6
Generic route optimization services	Standardised, easily accessible service for acquiring an optimised route for a vessel	4 – 6
Services to arctic navigation and emergency response		
Arctic live positioning sharing	Capability to share vessel's position with very low latency (compared to positions gathered from satellite AIS)	4 – 6
Crowd-sourcing of ice information	Service for gathering and sharing information about ice conditions (safe passages, ice thickness, icebergs, etc.)	4 – 6
Arctic SAR tool	Service for acquiring and sharing information relevant for SAR operations such as search patterns, search areas covered and the location of vessels in the area	5 – 7
Space weather forecast	Service for predicting the influence of space weather on communication and positioning equipment and provide early warning of decreased reliability	2 – 5
Services to decrease administrative burdens		
Automated VTS/SRS reporting	Service for automated Vessel Traffic Service (VTS) and Ship Reporting System (SRS) reporting in the Baltic Sea Region (BSR) using a proposed standard to be promoted internationally	5 – 7
Automated port reporting	Service for automated port reporting in the BSR using a proposed standard to be promoted internationally	4 – 6
Reliable port information	Service for making reliable port information in the BSR easily available to vessels using a proposed standard to be promoted internationally	3 – 7
Services to improve environmental monitoring & enforcement		
Emission monitoring solution	Service for monitoring information about vessels' SO_x emissions	4 – 7
Enabling actions to improve availability and accessibility		
Communication framework/Maritime Cloud	Communication framework, including on-board integration for efficient and reliable provision of all above-mentioned services	2 – 7
Communication channels and other technologies	New communication channels to improve connectivity, in particular in the arctic area	2 – 7

1.1.1 *The Maritime Cloud will revolutionize information sharing*

The project will develop, standardise and implement an innovative, open source communication and service provision framework taking its outset in the concept of the 'Maritime Cloud' that will connect all maritime stakeholders and users with maritime information services of all kinds. This novel framework will enable interoperability and transition between existing and future communication and information systems. It is a proposed solution for IMO's e-navigation concept and has the potential to become vital in implementing and accelerating EU's e-maritime initiative. The development will include integration on-board the vessel to a certain degree.

The communication framework has three fundamental pillars:

- **The maritime service portfolio registry** – is the equivalent of the App Store on iPhone or Google Play for Android. One global registry where you can locate all relevant services, including e-navigation and e-maritime solutions.
- **The maritime identity registry** – is the equivalent of a Central Person Registry or a Central Business Registry. One secure and reliable European and global registry for all maritime stakeholders and users that contains relevant information for authorized stakeholders, enabling verification of authenticity, integrity and confidentiality in information transfer processes.
- **The maritime messaging service –** the third pillar is a novel concept and has no direct equivalent. The information broker intelligently transfers information taking into account current geographic position and communication links available to the recipient.

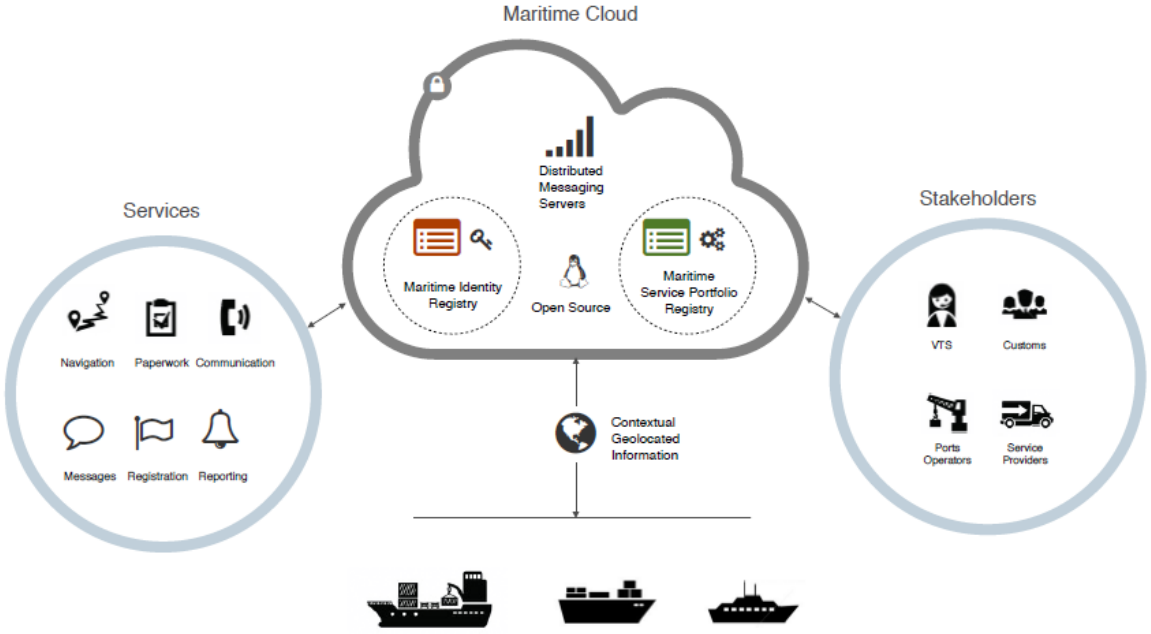


Figure 2.1.1 – The Maritime Cloud – a novel communication framework

The concept of this framework has been derived from former EU projects related to e-navigation by DMA. Here it was evident that this kind of framework is a prerequisite for taking e-navigation from testbeds to real-life implementation and reaping the innovation potential. However, as the concept has been defined and discussed with other parties, it has become clear that the potential impact of the framework is much larger when applied to a wider range of e-maritime areas. Especially ship reporting, which lies at the intersection between e-maritime and e-navigation, stands out as a very significant area in which to exploit the benefits of the Maritime Cloud.

It is thus the ambition of the project to explore and, where possible, to exploit the benefits of this common framework, which has the potential to be a breakthrough technology that can revolutionize the way information is shared in and around the maritime sector.

1.1.2 *New e-navigation solutions will decrease the risk of accidents through increased situational awareness*

Accidents and inefficiency continue to be major challenges for waterborne operations. EfficienSea 2 will work with two categories of solutions. The first category is the rethinking of decades-old services such as Maritime Safety Information and Notices to Mariners, Meteorological (METOC) information and ice charts. Today, these

services are, for the most part, delivered in an ineffective manner using old technology or with modern but proprietary, non-standardised solutions. This gives the user on a ship's bridge a lot of work determining which information is relevant, thus wasting time and possibly overlooking vital information. The project will develop, standardise and demonstrate new solutions that filter out irrelevant information and portray important information in a user-friendly manner, bringing these solutions close to full implementation in commercial equipment.

The second category has to do with ground-breaking services that are new to the market. For these e-navigation services, new technology will be developed and applied to combine multiple information sources and, facilitated by the internet of things and crowd-sourcing of data, to create entirely new services envisioned to increase situational awareness, reduce risk and increase efficiency by, for instance, utilizing new and emerging technologies and applying human factor expertise to users' interaction with multiple different sources of information services. These novel services include value adding services based on intended route of vessels such as decision support in ice navigation, no-go areas and comfort zone as well as smart buoy information useful for navigation.

1.1.3 *Automated reporting and more accurate port information will increase efficiency and decrease administrative burdens*

Reporting related to port calls, ship reporting systems and other VTS reporting are often identified as a great source of administrative burden to mariners. In addition to being quite inefficient, reporting also increases the cognitive load on navigators, thus taking their attention away from navigation in often critical situations. EU's e-maritime initiative "National Single Window" to be implemented in 2015 is expected to take leaps forward in terms of standardizing the exchange of information between systems and stakeholders ashore. EfficienSea 2 will take a step further and provide a connection right through to the ship. This will provide ship-owners and operators who are willing to utilize the Maritime Cloud with the advantage of automated reporting. The EfficienSea 2 project will seek to standardise reporting requirements and influence the regulatory regimes required to achieve real impact in this field, as an enabler of the European Transport Space without Barriers.

1.1.4 *Navigational support services, improved communication links and self-organizing emergency response in the Arctic to mitigate risk*

EfficienSea 2 aims to deliver significant improvements to the safety of ships travelling in the Arctic by innovating and implementing solutions that support domain awareness, risk mitigation and self-organized emergency response in the Arctic. With the outset in the cruise ship segment, an existing web portal called 'ArcticWeb' provides an overview of the nearest SAR resources and realistic time to intercept other ships in this remote region. This makes it possible to qualify ships' own risk estimation and share the location and capabilities of all nearby SAR resources. The services will be improved and a tool for coordinating SAR will be developed. ArcticWeb is currently focused on the waters around Greenland, but this area will be geographically expanded to cover the entire Arcic.

Increased robustness of such services as well as robust communication links that encompass a novel hybrid of existing technologies will have a significant impact on safe passenger shipping in the Arctic and provide a path with low barriers to transfer these concepts to other types of ships or the offshore industry.

Communication and positioning technology in the Arctic is heavily influenced by space weather (solar winds) that can paralyse the communication channels making communication and positioning very unreliable. The project explores the possibility of delivering a service that can forecast the interferences from space weather and provide early warning.

1.1.5 *New emission monitoring solutions will help enforcement and reduce the environmental impact*

Exhaust emissions from ships have a large impact on the environment. Regulations are continuously strengthened and more environmentally friendly solutions are readily available, but too often come at a high economic cost to the ship-owner due to the lower cost of undesirable fuels. Enforcement is challenging for the authorities, and combined with high costs, little enforcement gives few incentives to comply with the regulations.

EfficienSea 2 will work with new emission monitoring concepts to be used by both ship-owners and authorities. The starting case will be SO_x emissions in the Baltic Sea Region and the initial thinking is to combine onboard sensor data with external sensor data in order to validate models and strategies for compliance monitoring. The project will evaluate possible incentive structures that could counteract the economic incentive of non-compliance. A new effective solution will help level the competitive playing field of shipping companies.

1.1.6 *New communication technology solutions make it easier and cheaper to be connected*

A major concern today regarding e-navigation and e-maritime is the current challenges of poor and expensive communication connections, especially in remote areas. Hybrid communication solutions that provide robust digital information transfer in the maritime domain, that facilitate introduction of new communication service providers and that help drive down cost will be demonstrated.

1.1.7 *New standards are the prerequisite for getting value from innovations*

In the EU and around the world, a steady stream of new 'e-navigation solutions' in different shapes and sizes is being produced. In order to gain the full potential of such solutions, a certain level of standardization needs to be introduced. This will enable harmonized services from multiple providers that look the same – for instance, when a ship sails from the Danish Belts through the British Channel and onwards to the Strait of Gibraltar, the navigator can use the same METOC service utilizing different service providers and data sources along the route, throughout the entire voyage.

The partnership behind the project is very strong and cohesive. It unites authorities, service providers and equipment manufacturers, leading academic institutions and international standard-setting interest groups as well as a dedicated high level user group. The aim is to create a consortium that has the experience and capabilities necessary, not only to create new and innovative technology, but also to transform these into international standards and globally accepted best practices as well as getting it all the way out to the users. Direct work by partners in standard-setting organisations such as the IHO, IEC, WMO, ITU and IALA as well as influencing the regulative regimes in the EU and IMO in particular will be important outputs of the project.

2.2 Relation to the work programme

The EfficienSea 2 project targets a number of issues included in the challenge and scope of the work programme:

Specific challenge: I.e. passenger ships in remote regions; and enhanced and new technologies for maritime traffic management

Developing and applying innovative solutions to decrease the risk for **passenger ships** in the waters around Greenland has been a focus area for several years for the Lead Partner DMA. These activities will be intensified and geographically expanded through the project.

The communication framework of the Maritime Cloud to be developed in EfficienSea 2 will play a huge role for the future of maritime traffic management. It will – when fully implemented – link all relevant current and future maritime ICT systems for interoperability. A number of the services developed will increase the domain and situational awareness of the navigator and thus ease the pressure on congested waterways. Also, the project will create services for route exchange enabling improved traffic management.

"Safer shipping through innovative conceptual (hull, general arrangement) and detail designs (exterior and interior) of ships and systems, and through a new approach to emergency response, to risk-based maintenance, and to the human factor."

"New safety devices and their demonstration, including new technologies and operational solutions for the evacuation of large passenger ships…" (text from the call)

The proposed solutions relate to systems supporting self-organized emergency response, particularly in relation to passenger ships in remote areas:

The arctic case. The DMA already has a web-based platform aimed at enhancing safety of navigation for passenger ships in the Greenlandic part of the Arctic. This state of the art solution will be extended further in order to improve risk mitigation, increase the effectiveness of emergency response capabilities as well as increasing the extent of the range of ship types and geographical area covered. This will include:

- More advanced route exchange and portrayal solutions that will improve ships' overview of distances (time to rescue) to other ships along their planned routes.
- Increased availability of information relevant to emergency and evacuation situations for all ships, including but not limited to the location of SAR capabilities, hospitals and helicopter landing sites.
- Better updated information about the position of the nearest ships. Feasibility studies will be conducted using a small and inexpensive device that links ships' AIS via the communication framework, enabling ships to share **live position** with the nearest ships beyond their own AIS range, improving their situational awareness considerably.
- Increased robustness in ship-to-shore connectivity, utilizing the Maritime Cloud. This will enable store & forward and automatic reconnection solutions that will considerably improve reliability in an environment where data connectivity can be difficult.
- Increased connectivity by means of novel communication technologies. The project will focus on maturing communication technologies of relevance to remote areas, including hybrid solutions that use different commercial services, such as Inmarsat and Iridium, as well as new technologies such as VHF Data Exchange System (VDES).
- Space weather forecasting could also be of great relevance to cruise ships when planning their route, for example if a high likelihood of interfering space weather is forecasted. Then they should not take high risk during the parts of their voyage where they are heavily dependent on positioning and communication technologies.

New and improved systems for the surveillance, monitoring and integrated management of waterborne transport and other activities (commercial and non-commercial)

EfficienSea 2 will innovate systems for monitoring waterborne transport and other activities as follows:

- The proposed **emission monitoring** services will be of great relevance, especially for ensuring compliance with the provisions on SO_x emissions in SECA areas.

- **Crowd-sourcing of ice information**. Ships' passage through ice will be monitored and the information gathered will be used to guide subsequent ships through the ice. As a service in the Baltic Sea Region, this is in line with the HELCOM recommendation in this area.
- **The exchange of the planned route** between ships and VTS centres and between VTS centres with the least possible administrative burden and minimal distraction of navigators will be implemented. This will give the VTS centres better possibilities of monitoring ships and time to react if ships are deviating from their intended route.
- Services like **Arctic live positioning and space weather forecast** will have a great potential for surveillance and monitoring purposes for users like the Arctic Command in Nuuk, Greenland.

New and cost-effective European Global Navigation Satellite System (European GNSS)-based procedures for port approach, pilotage and guidance, ICT-enabled shipping lanes and maritime services that will reduce the risk of accidents and incidents in port approaches and dense traffic lanes, and minimise both delays and turn-around times

EfficienSea 2 will identify, develop, mature and, where possible, operationalize services supporting this scope:

Maritime Safety Information/Notices to Mariners – Temporary and Preliminary (MSI/NM T&P). This work aims to improve the collection, promulgation and presentation of maritime safety information. The service is envisaged to improve handling ashore and to enable user friendly graphical presentation that is less time-consuming for the mariner and reduces the risk of human error.

METOC and weather warnings. Valid METOC information such as wind and current can be vital for safe navigation, especially in critical situations like manoeuvring in ports and dense traffic lanes. In EfficienSea 2, a standardized service will be developed and made accessible by the Maritime Cloud.
The standard will enable integration directly into commercial navigation equipment as well as on the web portal, paving the way for making this standardized service available globally.

Administrative services. Today, reporting formalities constitute a significant administrative burden on mariners, lead to inefficiency and may ultimately cause accidents due to the lack of focus on the navigational tasks at critical phases. The project will include services aimed at reducing the administrative burden by enabling automation of certain reporting functions. Services for more accurate port information will be of great potential. A successful implementation will reduce delays, minimise turnaround times and improve cost-effectiveness.

No-go areas. The safety potential is great for service concepts like 'no-go areas' where grounding, other risks or restrictions are relevant as well as 'comfort zones' where ships are offered a visual safety margin (a box) moving along its intended route, within which navigation is 'comfortable' with regard to grounding or collision with ships utilizing the same service. The box is calculated taking all relevant information into account, such as bathymetry, navigational warnings and other traffic.

Route exchange, reporting and negotiation. The project's focus will be on "tactical" route exchange, i.e. assessing the value of exchanging route segments between ships and between ships and shore, and providing standards for these interactions. A specific case will be a pilot negotiating a route with the mariner before the pilot boards the ship. The new way if exchanging routes will ease communication and strengthen understanding in critical parts of the voyage.

For traffic management, solutions that support the extension, integration and optimisation of waterborne transport information and communication systems with the aim of contributing to build a comprehensive "e-

maritime" environment (including e-navigation components that are compatible with existing or emerging international standards)
They should serve the overall objective of building the European Maritime Transport Space without Barriers allowing waterborne transport (including inland navigation) to be used to the full potential of the integrated intermodal logistic chain. Solutions should also provide the foundation for the deployment of autonomous and actively guided ships as well as the possibility to verify all related safety certificates before the ship enters the port.

The Maritime Cloud forms the ideal foundation for any traffic management solution, including the establishment of an integrated intermodal logistic chain, autonomous and actively guided ships and verification of safety certificates. Such solutions require resilient and secure communication, which is exactly what the proposed framework delivers:

- Resilient communication framework that enables the use of a variety of communication channels (fail-over) and robustness in the case of temporary loss of connectivity.
- Secure communication with IDs of stakeholders, certificates and encryption – all of which are technologies known from the financial and other sectors.

1.3. Concept and approach

1.3.1 *Project concept*

This project will utilise a unique window of opportunity for making a lasting impact on the international maritime domain. At this point in time, the European Union's work with e-maritime and in particular the call's focus on safer and more efficient waterborne operations converging with IMO's e-navigation process. This call's specific challenge and a subset of the scope match cornerstones in the IMO's e-navigation Strategy Implementation Plan. The partner consortium will exploit this window of opportunity to solve both sets of challenges in one project.

A basic assumption in the project is that the introduction of a new superior technological solution in the maritime domain does not equal adoption and impact on its own. In order to make a lasting impact, solutions must meet userneeds, be backed by standardisation and preferable European or international support and regulation.

The concordance in time with the IMO's e-navigation process opens an exceptional opportunity to influence the international maritime safety regimes. The EfficienSea 2 partners led by the authorities and interest organisations will use this project to demonstrate the value of new e-maritime and e-navigation solutions in order to get ambitious regulation in place that ensure fast adoption of those measures that have proven to have an impact on maritime safety and efficiency.

The basic idea is to take the cutting edge technologies and solutions in the field to the next level. The project partners have helped set the current level of best practice and will, through the project, push the frontiers in terms of technological development, standardisation and voluntary adoption as well as regulatory support.

1.3.2 *Project technological position and approach*

Figure 1.2 illustrates the project innovation process and its relation to the Technology Readiness Levels (TRL). The figure also illustrates the TRL spectrum that the project will work in. The different technologies in the project will have different starting and ending TRL, but will in general experience a maturation from approximately TRL 3 to TRL 7.

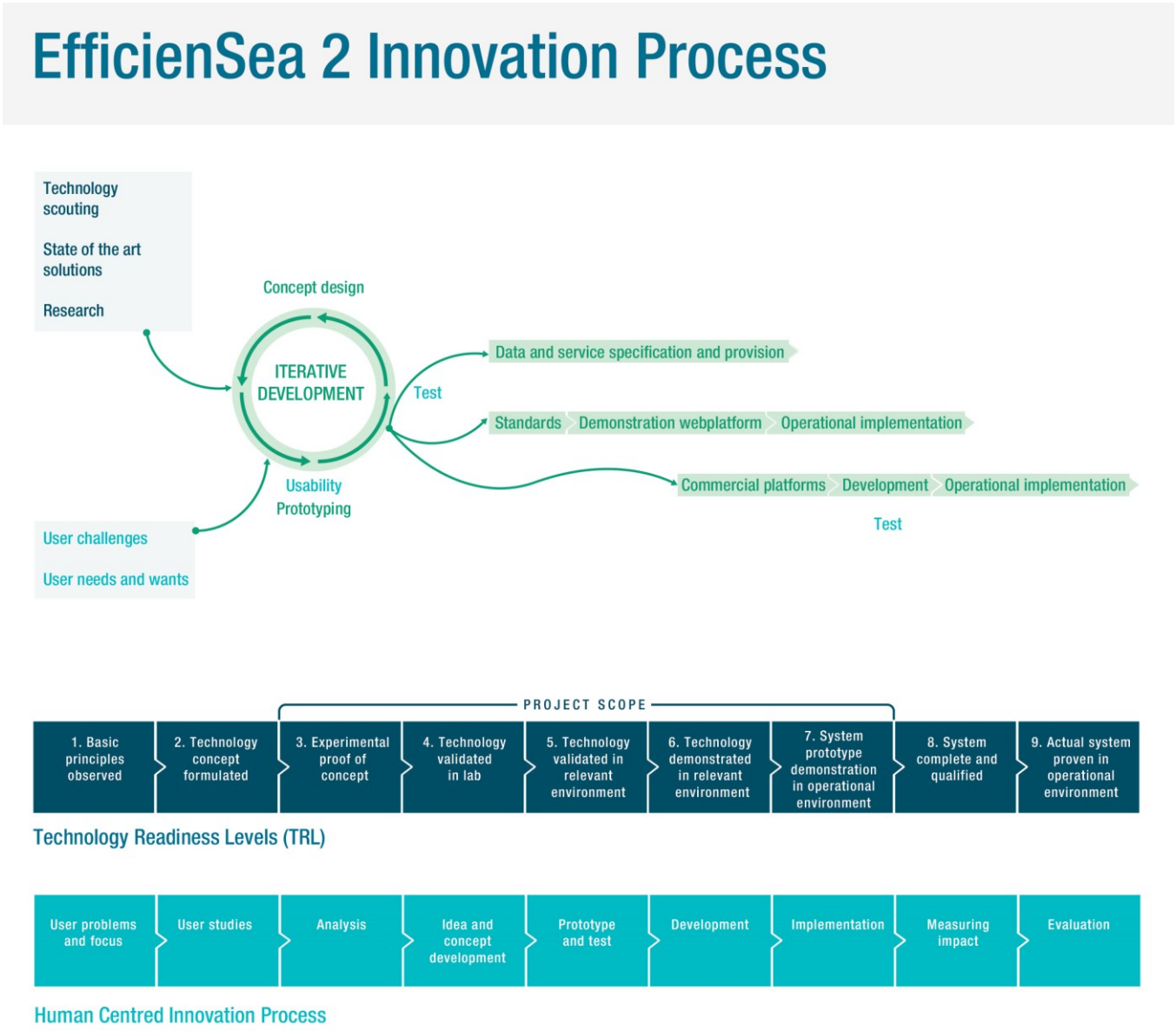


Figure 2.2

In EfficienSea 2, the work packages will work in the spectrum between technology development, as defined by the Technology Readiness Levels, and human centred innovation. Each work package focuses on very different solutions and technologies, and each of them is at different starting points. They also have different ambitions in regards to how far the project can mature the solutions as shown in table 1.1. Nevertheless, most work packages will go through similar workflows and activities, allowing an iterative learning process in the first innovation phases and a more focused development in the later phases.

The aim is that activities should be driven by solving a concrete user need, ensuring a potential market demand when the technology is implemented. All consortium partners have already been through the process of augmenting all tasks in terms of user challenges.

Services at all stages of maturity will, if appropriate, be developed on the E-navigation Prototype Display (EPD) platform developed in former projects. Other platforms may be included where beneficial. The EPD system is used in the 'establishment of a global e-navigation testbed', an initiative taken by Sweden, Denmark and South Korea (with other countries expected to follow).

Some services are expected to go through the full process of:

- Being identified and conceptually solved in the human centred innovation process.

- Being implemented in the prototype platform.
- Being validated (with iterations of implementation) in the testbed(s).
- Developing the necessary standards for the service.
- Launching the operational services in the Baltic Sea Region and/or the Arctic.

Facilitated by the development of the necessary standards, some services will likely also be implemented and tested in upgrades of commercial navigational systems.

1.3.3 *Operational services for the Baltic Sea Region (BSR) and the Arctic*

A number of services will be made operationally available during the project in the Baltic Sea Region and the Arctic. The services will initially be made available on a web-based platform and, where appropriate, on state of the art apps for tablets. Equipment manufacturers in the project will implement a few services in the project.

The two target areas are quite opposites in terms of characteristics as table 1.2 shows. This makes them good reference points for trying out services and other solutions because in combination they represent many user needs, situations and circumstances.

Table: 1.2 The characteristics of the two target areas

	Arctic	**Baltic**
Traffic density	Low	High, especially in straits and ports
Port calls	Few	Many
Communication coverage	Poor. Dependent on satellite with high influence of space weather	Good
Administrative burdens and complexity	Low	High
Surveillance and monitoring	Limited	Strong
SAR capacity	Very little	Good
Number of ships and potential users*	275 SOLAS ships, of these 43 were passenger ships, of these 27 carried more than 250 passengers. 190 other ships.	For HELCOM: 14,000 SOLAS ships 63,000 other ships fitted with AIS For the Baltic there is properly 10,000 SOLAS ships
Target users	Primarily cruise ships, secondarily other commercial vessels	All commercial vessels
Number of potential service providers	Few	Many

* Ship numbers are from 2013 attained from the DMA's AIS database

For the Arctic, a platform already exists and this will be considerably expanded during the project, as described in section 1.2, the Arctic case.

In the Baltic Sea Region, the ambition is to develop a similar solution based on the same technological platform. This will be done in collaboration with the BSR e-navigation forum, which has the participation of all the Baltic Sea Region countries.
The ENSI system, which is already operational in the Gulf of Finland and where ships exchange routes with a VTS centre, will be further developed and merged into a common platform for the Baltic Sea Region (BalticWeb). The services at TRL 7 in table 1.1 will be made operationally available on this platform. Obviously this will not be a navigational system, but rather a web portal with geo-referenced information designed to aid the navigator, demonstrating what can be expected to be implemented in commercial equipment soon after project completion.

With regard to the standardization efforts to be made in the project, it is the vision that the operational services, to the extent possible, will be delivered according to agreed standards and using the same communication framework. This means that when these services have been implemented in manufacturers' navigational equipment, little or no changes will need to be undertaken by the service providers.

1.3.4 *Background and relations to other projects*

Some of the work proposed in EfficienSea 2 builds on the results gained from previous EU projects:

EfficienSea: First Baltic Sea Region project to focus on e-navigation, building the first open source e-navigation prototype display (EPD), experimenting with communication technologies, involving human factor expertise and making both simulations and sea trials of proposed e-navigation solutions.

MONALISA 1+2: Focus of these projects was on Sea Traffic Management, developing Standard Operating Procedure for Sea Traffic Management, and developing a standard format for ships' exchange of voyage plans.

ACCSEAS: Continue development of the open source prototype platform from EfficienSea, maturing the services with a focus on application in the North Sea Region and working with the 'Maritime Cloud' concept.

Other important work that EfficienSea 2 will build upon and further expand includes:

MICE: Swedish national project focusing on applying the results from MONALISA to ice navigation
ENSI: System for exchanging routes between vessels and VTSs in the Gulf of Finland
ArcticWeb: A web-based system to aid safe navigation in the g area developed by the DMA

The output of these projects provides a solid foundation for bringing the elements addressed to fruition. Some elements will be further matured. Although EfficienSea 2 builds on the previous projects and has similar geography, it is not just an extension of the former projects. It is an innovation project aimed at initially impacting the target regions and, subsequently, the rest of the European maritime logistic chain.

A number of other European projects (on-going and potential) address related issues. Specific partner efforts will be allocation to gather experience from or seek the coordination with related initiatives, such as (but not limited

to): MONALISA2; AVANTI; EMAR, SEXTANT; NEPTUN; eMIR; ANNA; CISE; BLAST. Further, liaisons will be sought with the BSR e-navigation forum, HELCOM, the Council of Nordic Ministers on Arctic and Regional Hydrographic Commissions.

Possible synergy between EfficienSea 2 and ESCONA and ESA ARTES 1

The consortium is aware of another similar project proposal named ESCONA. While the DMA and OFFIS are partners in both projects, both project consortia have carefully planned the DMA's and OFFIS's contributions to be mutually exclusive, i.e. neither of these two partners has the same or similar tasks in both projects. Both projects are designed to be capable of achieving their objectives independently. However, if both projects get funded, both consortia's are prepared to engage in an intensive cooperation, enabling about 60 leading maritime partners from all over Europe to join forces working on both the e-maritime and the e-navigation concepts with a view to developing ground-breaking, innovative, integrated and harmonized e-services, allowing information to be seamlessly and effectively exchanged between authorized maritime stakeholders utilizing a secure and reliable communication framework.

Further, the ESA ARTES 1 programme intends within the project timeframe to fly a satellite mission to explore the possibility for a satellite component to the VDES communication system. While the EfficienSea 2 project will focus on the terrestrial component of VDES, input from the ESA project findings can be taken into account and testbed exercises and evaluations can be coordinated to provide a coherent result. A specific partner has been assigned to handle liaison with the ESA ARTES 1 initiative on VDES.

1.3.5 *Communication framework – the Maritime Cloud*

The Maritime Cloud is defined as: *A communication framework enabling efficient, secure, reliable and seamless electronic information exchange between all authorized maritime stakeholders across available communication systems.* The Maritime Cloud is not a 'storage cloud' containing all information about every ship or cargo. Nor does it refer to 'cloud computing'. The Maritime Cloud is proposed to be the realization of the communication strategy for e-navigation described by the IMO and is in line with the EU policies for e-maritime.

The project will develop the Maritime Cloud into a state where it consists of standards, framework and service reference implementations that, together with governance, enable the efficient exchange of information between authorized maritime parties via interoperable information services, utilizing highly automated interfaces for different communication options, enhancing general communication related to berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment.

The framework will contain enabling facilities for handling the maritime identities of all actors involved in maritime transport, ranging from ships to VTS, MRCC, ports, agents, service providers, shipowners, etc.

Based on the framework, the project will define protocols and standards and implement functions that support registration and discovery of information services, which enable definition of e-navigation services based on the IHO S-100 geospatial data modelling framework. This will include work on open source reference implementation of generic information services, which will enable rapid development and deployment of innovative information services. Facilities for registering services based on standardized reporting formats, such as the IMO FAL forms or other relevant standards, will together with authentication support enable automated gateway access to systems such as the modernized National Single Window solutions for SafeSeaNet.

Service providers can use the central platform services, so that they do not have to consider how to implement basic features like registration, login/logout mechanisms, authentication, etc. These services will therefore de-

crease market entry barriers for service providers and service users since for example they do not have to register for each new service to be used

1.3.6 *Novel communication technologies*

Shipboard system integration, onboard networks

By observing and extending existing and evolving international standards, EfficienSea 2 will support the definition of an onboard communication architecture for the integration of radio communication devices with the Integrated Navigation System (INS), platform automation systems and other electronic data processing systems. This will be structured in a reliable and safe manner, using intelligent network controllers to separate the different networks and addressing issues of cybersecurity.

Robust communication

With radio communication systems integrated into a network, it will be possible to direct information and data through the most feasible or lowest cost external communication channel, whether as an Application Specific Message (ASM) via AIS or through Inmarsat, Iridium-Next, Argos, V-Sat, Galileo, VDES, NAVDAT or any other existing or new system. In this context, the project will explore and demonstrate methods for ensuring a high degree of connectivity and quick time to restore failures as well as compression and queuing of data transmissions to achieve reduced cost of communication.

VDES

ITU WP5B, IMO, and IALA are working on the requirements for the VDES and specification of radio technical standards and protocols using the existing marine VHF band to exchange data between ships and from ship to shore, both terrestrially and over satellite. The maximum data speed is estimated to be up to 250 kbps. The concept includes both data transmission and ASM as known from the AIS.

EfficienSea 2 will gather vendors and research institutes around the definition of protocols and live testing of the VDES concept. The tests aim to demonstrate the basic communication parameters in real-life scenarios, such as coverage area and factors influencing the coverage area, the effect of other nearby transmitters, and the bandwidth available under changing conditions. Performance in the Arctic region is of particular interest when addressing the coverage for broadcast of safety information and quality of positioning services (European GNSS). The project will liaise with the ESA initiative under the ARTES 1 programme, which intends to fly a satellite demonstration mission during the project timeframe, and with other initiatives aimed at demonstrating or operationalizing frameworks for VDES.

1.4. Ambition

The EfficienSea 2 project is ground-breaking in a number of ways:

- **The communication framework of the 'Maritime Cloud' will be the first of its kind and reach world adoption of 40 % in 2025** – The communication framework will be the first truly open system that will enable global maritime information sharing in a safe, reliable and secure manner. The framework will carry enormous potential for facilitating new applications.
- **The new standards** – The project will set new standards for framework, services and equipment interfaces related to e-maritime and e-navigation.
- **Taking e-navigation services from test to implementation and impact** – The ambition is to make new basic navigation services accessible to navigators in the Baltic Sea Region and the Arctic. As of today, services like these exist only in testbeds for a limited number of users.
- **Making communication easy –** The project will tackle vital challenges in communication technologies that will make communication more easily accessible to ships.

"The people, who are crazy enough to think that they can change the world, are the ones who do." – Steve Jobs

3. Impact

2.1. Expected impacts

EfficienSea 2 will take state-of-the-art knowledge, apply the expertise and workforce of a unique composition of partners, and provide tangible deliverables such as standards and demonstrated prototypes of products close to market. Together with first generation provision of information services supported by the Maritime Cloud, as well as live demonstrations of the value of modernized information service provision, the partner consortium will be in a very good position to achieve broad adoption in the maritime domain.

2.1.1 *How the project contributes to the desired impacts*

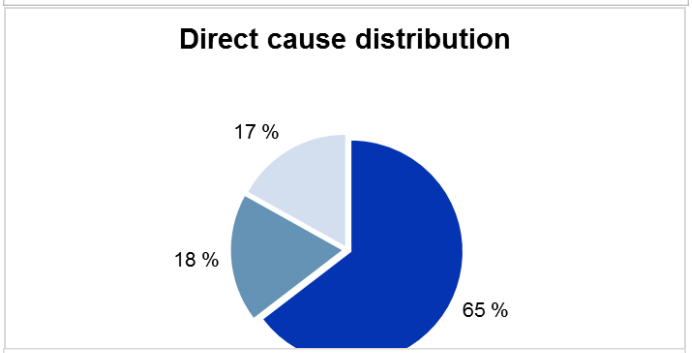
The objectives chosen for this proposal are designed to provide the greatest possible contribution to the desired impact set out in the work programme. The ambition is especially to focus on Impact area 1, *'Achieving significant improvements in terms of navigational efficiency (in particular emission reductions) and safety along the entire waterborne transport logistic chain, and decrease administrative burdens'* and Impact area 3, *'Show a statistically relevant decrease in the number of fatalities caused by maritime accidents, the number of ship losses and specific incidents such as fires or black-outs accompanied, where relevant, by operational empirical evidence.'*

Impact areas 2, *'Facilitate the transfer of new safety concepts from passenger ships to other areas of maritime operations'* as well as Impact area 4, *'Support the upgrading of international maritime safety regimes through relevant inputs'* play a significant role in the project, but they are primarily viewed as vital measures to maximise impact areas 1 and 3.

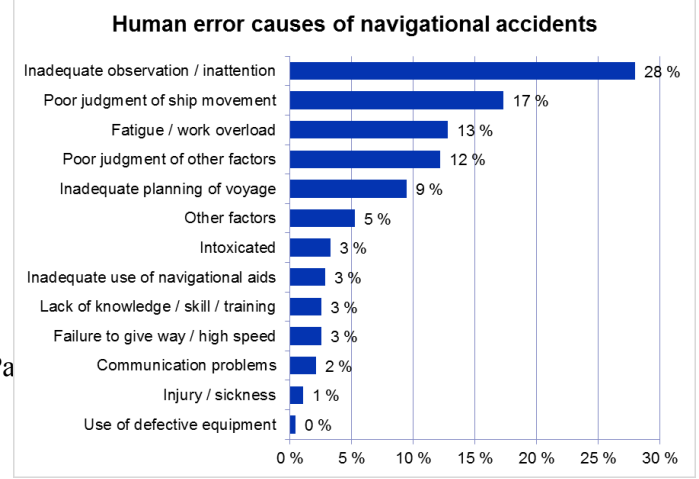
2.1.2 *Quantification of impact*

Carrying 80% of global trade, maritime transport is considered the backbone of trade by the World Trade Organisation.

In a Formal Safety Assessment reported in the IMO in 2013 (NAV 59/6, Annex 1), the trend in navigational accidents has gone from a long-term decrease to an increase since the start of this century. Based on statistics from 2001-2010 on passenger, cargo, oil tanker and offshore vessels, 5.544 navigational accidents (collisions or groundings) and 7.275 other accidents resulted in the loss of 6.264 lives.



65% of accidents are attributed to human error. Of these, inattention and work overload together contribute to more than *10 times* as many accidents as intoxication.



The objectives of this project are specifically designed to address these challenges, by reducing the room for human error and administrative workloads, distracting mariners from the act of navigation. The loss of 25 lives and 22 navigational accidents can be prevented over a period of 10 years; per percent the project contributes to a reduction in navigators' inat-

tention and work overload, assuming the adoption rate is 100%.

Measuring the impact of individual initiatives in regards to navigational safety, efficiency, decrease in emissions and decrease in fatalities is, however, not easy and associated with a high level of uncertainty. In order to improve the measurement of impact, a specific task in the project will address the methodology for measuring impact on navigational safety.

2.1.3 *Impact from deliverables*

Figure 2.1 shows how we expect the project's innovation to impact the maritime domain. The figure groups the project deliverables in terms of which impact the solutions will primarily contribute to. See table 1.1 for details.

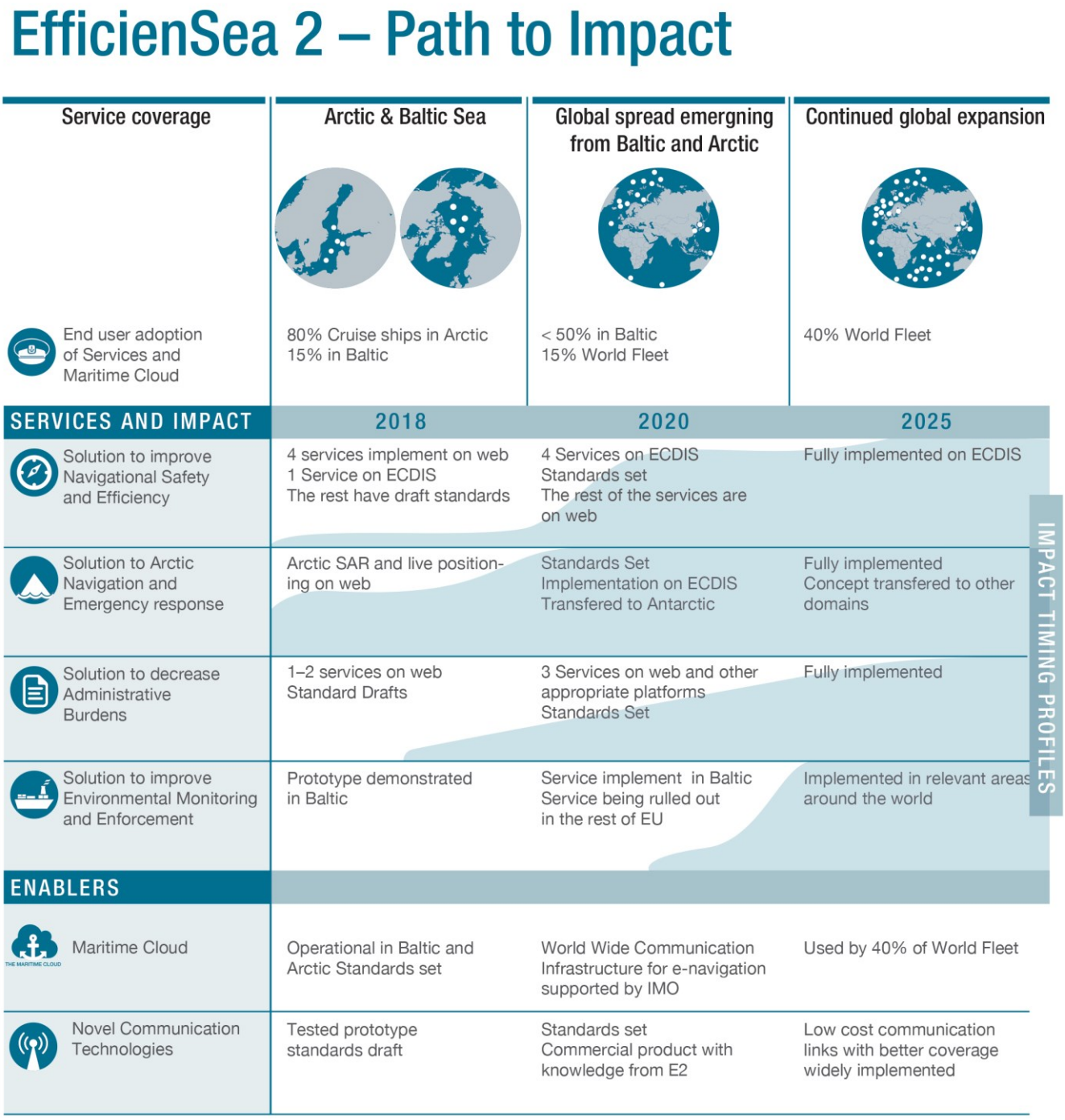


Figure 3.1

The figure is divided into three milestones following the completion of the project:

- 2018 – year one after the project where the impact will be in the two target areas;
- 2020 where the global impact will really begin to appear;
- and 2025 where the impact will have taken off globally.

Initially all services will play out in the two target areas, viz. the Baltic and the Artic. Gradually the service coverage will spread globally fuelled by standardisation and the IMO supporting the Maritime Cloud as the worldwide communication infrastructure for e-navigation. The expected end user adoption of services and the Maritime Cloud is specified in the figure. The timing of global impact is likewise indicated.

Navigational safety: If we look back at the calculation of fatalities in 2.1.2 and use the numbers from the figure, we can get an indication of what the impact of our rolled out services will look like. Assuming that in 2025 we get a global adoption rate of 40% for our navigational services. This includes both direct adoption through consortium partners, but also indirect adoption of services through other service providers that have implemented services through the open standards and the Maritime Cloud. Let us take the conservative assumption that these services will bring about a 5% increase in the reduction of navigators' inattention and work overload. This will, in a ten year timespan, prevent 50 fatalities and 44 navigational accidents. Looking outside the scope of commercial vessel these services will also have a huge safety impact on smaller ships and boats. Especially the leisure boat segment has great potential for impact on navigational safety as well as commercial impact.

Arctic navigational safety: In terms of the impact on arctic navigational safety, the timing will be faster. Already within the project timeframe, the primary target user group will have a high adoption rate and we expect that at least 80% of the cruise ship users will be using the solutions offered in 2018. Hopefully, there will be no emergencies involving cruise ships in the Arctic in the period. Nevertheless, the solution will have a high impact in the form of a decrease in passengers' safety risk. The solutions are expected to have been implemented in the Antarctic by 2020, and the concept will have been transferred to other domains by 2025.

The 'services to **decrease the administrative burden'** will not only increase the efficiency of administrative operations and port calls, but also contribute to the impact on navigational safety as it releases the time and attention of navigators at critical stages during voyage planning and execution.

The **'service to improve environmental monitoring and enforcement'** will focus on monitoring emissions, thereby promoting fuel efficiency monitoring as well as providing environmental monitoring and enforcement capabilities and incentives to adhere to environmental requirements. This will have a great impact on emission reductions, in particular when the SECAs are expanded to all EU waters in 2020.

In addition to the service solutions, the project will produce vital enablers of enhanced information service provision and discovery. The Maritime Cloud will make services easily accessible, promoting fast track adoption and uptake by service providers, equipment manufacturers and end users. The development of robust, reliable and resilient communication, based on speeding up ongoing technology developments and integrating the utilization of different technologies, will further contribute to maximizing the impact of not only project services, but all e-maritime, e-navigation and other safety services that choose to utilise the new framework for the provision of enhanced service solutions.

2.1.4 *Upgrading of international maritime safety regimes through relevant inputs*

The consortium composition puts the project in an ideal position to influence international regimes via the EU, IMO, IHO, ITU, WMO, IALA, IEC, etc., as EfficienSea 2 will gather national authority partners in developing concrete inputs to international organizations on recommendations, guidelines, standards and regulation related to e-navigation, e-maritime and other matters being pursued within the project, supported by the competences of the involved international organisations. The fact that IALA (Aids to Navigation authorities), CIRM (equipment manufacturers, suppliers and service companies) and BIMCO (Baltic and International Maritime Council – shipowners, ports, etc.) are partners in the project means that these organizations will play an active role in turning the

project results into international recommendations, guidelines, standards, good practices and resolutions, promoting a lasting impact.

2.1.5 *Improving innovation capacity, strengthening the competitiveness and growth of companies and bringing innovations to the European and global markets*

The 13 commercial partners in the consortium will be investing their own time and money in the project because it will strengthen their competitiveness and bring them future business opportunities, such as the following:

- **Maritime service providers** will be able to use the Maritime Cloud service specifications and standardization to create value added services. Some will be public service obligations, free of charge, while others will comprise new sources of income. Service providers will also be able to completely rethink service needs and identify new services that target as yet unmet demands. Some of the project partners that are providing services are already familiar with selling their services to the market. In the development of the Maritime Cloud the market aspect will be one of the aspects dealt with. The ambition is to create a whole new market place for services.

- **Maritime equipment and system suppliers** will have a competitive advantage if they are the first to understand and implement the new generation of harmonized, value-adding services in their systems. The project partners in this group will bring the innovations to market by making new generations of their systems or offering retrofits of their existing systems.

- **Communication equipment manufacturers** will have an opportunity to get close to a market with new equipment, enabling new communication channels or intelligent roaming through an integrated network, representing truly user-led and market requested innovations that can contribute to driving down costs of maritime communication. The innovations will be brought to market by the project partners in this group. The partners are already operating in the target market but their offerings will be new.

- **Shipowners** operating in EU waters will be first movers on the solutions delivered by the project. Strengthened efficiency and lower administrative burdens will increase their competitiveness compared to other modes of transportation and other regions.

The three international organisations in the consortium anticipate that the output of this project will have the potential to become a game changer for their members. They are thus participating in the project in order to influence the future market conditions for their members.

2.1.6 *Other environmental and socially important impacts*

Like other sectors, the maritime transport business is experiencing challenges in attracting young talents to the workforce. Life at sea can be challenging and a workplace likely to be fitted with navigation and communication equipment designed in the 1980s and 90s that uses telex for safety and distress communication is having trouble attracting the smartphone generation of young talents.

EfficienSea 2 will pave the way and accelerate the introduction and utilization of modern communication, navigation and administrative systems, which better match business demands of efficiency and increase safety as well as meet the expectations of young European talents who are accustomed to user friendly apps and 'being online'. This can ultimately contribute to making the maritime sector an attractive career path for a generation of European youths.

2.1.7 *Barriers and obstacles to impacts*

The following barriers and related mitigation measures have been identified:

Table 2.2 Barriers to impact and measures to overcome them

Barriers and obstacles to impacts	Measures to overcome barriers
A regulative push is often a prerequisite for technological development and adoption: The adoption of new communication and navigation equipment and technologies in the maritime domain is traditionally driven by a regulatory push by regional or international organisations such as the EU or IMO. Some member	The partners in the consortium are **heavily involved in the regulative processes** for e-navigation. At the latest meeting of the IMO's Sub-Committee on Navigation, Communication and Search and Rescue (NCSR) in July 2014, e-navigation was on the agenda and more than ten of the project partners actively participated.

states in these organisations are typically very sceptical towards any new regulations, fearing that it will place further costs on the shipowners. This could become a barrier to getting regulative support for new solutions.	The mix of national authorities and international organisations as partners in the project puts the project in a position to make an influence in this regard. One of the prime measures by which to validate the benefits of suggested solutions, as well as influence decision makers and convince the sceptics, lies in **demonstration and proof of concept** of real, tangible results, delivered by projects like EfficienSea 2, which will even promote a voluntary uptake *without* regulatory push.
Standards development is often a long and tiresome process with delays: The project will work with standards development for different technologies and services in several standardization and harmonization bodies, including the IHO, ITU, IEC and IALA. The work in these bodies is often interdependent, but without coordinated work plans, thus delaying the impacts of new services.	Many of the partners are already key players in the relevant standardization bodies. With the unique collection of cross-sector expertise, EfficienSea 2 will provide the opportunity as well as the funding to **accelerate** and **coordinate the standardization work between the individual bodies. Project partners** will not only deliver proposals to relevant standardisation bodies, but also participate directly in the appropriate working groups within those bodies, and 'feed' project results to the organisations from within.
Chicken and egg dilemma between service providers and equipment manufacturers and end users: Service and data providers can be reluctant to develop and supply services in new formats when there are few or no users with equipment to receive them. Equipment manufacturers, on the other hand, are reluctant to develop new equipment if no services are yet being provided. Shipowners are reluctant to invest in new equipment if there are no services available.	The project will provide a structure where the **manufacturers and service providers simultaneously and in partnership can co-create the interdependent solutions** needed for the services to succeed, while taking into account human factor expertise and direct user input evolving from rapid prototyping and user testing. The project funding creates a higher degree of risk willingness and an acceptance of a longer return on investment from especially commercial partners.
Competing development projects or investments can interrupt standardization work and global adoption: Development projects in different parts of Europe or the world can solve the same problem in different ways, resulting in different non-interoperable solutions. Such individual or regional investments of monetary or political capital pose a risk of generating opposition to truly globally interoperable implementations on a larger scale. For example, individual National Single Windows may be an obstacle to global reporting solutions.	As a means of avoiding competing regional solutions, the project will **liaise and coordinate** with other initiatives around the world in order to drive **harmonisation** of services and promote the **adoption of the Maritime Cloud** as an enabler of **making best possible reuse of existing systems,** while providing a path to develop and deploy new innovative solutions based on open standards.

2.2 Measures to maximise impact

2.1.8 *Path to market*

In the project, the services will be developed to different technological readiness levels, but they all go through similar innovation processes and thus have similar paths to market. The innovation process is illustrated in figure 1.2.

Within the three year period of this innovation action, most of the services will be taken to a TRL of either around 5 with a tested prototype or to TRL 7 where a system prototype is demonstrated in an operational environment. For most cases, the TRL level 7 means that the service is standardised and made operational on an internet webpage platform with limited regional reach and with only a few service providers providing data.

In order for the services to go from their ending level at project conclusion to full market implementation, several process steps have to be completed:

- Standardisation has to be completed in the relevant bodies.
- Especially for navigational services, equipment manufacturers need to uptake the services and implement them in their systems and deliver them to market.
- For a larger geographic implementation, additional service providers need to provide data in the standardised format.
- Additional authorities need to support and accept the services and solutions.

In addition to the process steps the individual services have to go through to reach the market, the enabling innovations also need to be further developed.

- Governance issues have to be settled and the Maritime Cloud should be implemented with a secure identity registry. This is of particular importance to the services requiring confidential data to flow from the end users for instance on the ship to the authorities.
- The communication technologies have to be fully developed, tested, implemented and adopted. This is of special importance to the services targeting remote areas. But lower cost communication will give a boost to all the services.
- Finally, for e-maritime and e-navigation to really accelerate, the regulatory implications within the IMO and the EU need to support the developments.

2.3.1 *Plan for dissemination and exploitation of the project results*

In order for the impact scenario illustrated in figure 2.1 to be realised successfully, a lot of measures of high importance will be implemented. Dissemination, exploitation and communication are integrated elements of the project which ensure that the project's innovation will reach the market and have the intended long-term impacts. The measures for dissemination and exploitation are as follows:

1. **Coordination and harmonisation with other projects and testbeds** – As introduced in section 1.3.3 and in table 2.2, liaison, coordination and harmonisation with other projects and testbeds are of great importance in the project. Nearly all partners will be involved in sharing knowledge and lessons learned with other projects and initiatives. A smaller group of partners are, however, tasked with managing this work. This task includes:
    a. Identifying and initiating liaison with related European as well as global projects.
    b. Initiating liaison with relevant European institutions, such as EMSA.
    c. Mapping and keeping track of other ongoing initiatives that could be of relevance to coordination and harmonization.
    d. Organising and executing workshops and other activities for coordination and harmonisation.
    e. Developing an integration strategy with other projects and testbeds.

2. **Measures to support and accelerate standardisation** – Standardization is of paramount importance for getting adoption and penetration for interoperable services and equipment. It thus plays a vital role in the project. Working with the relevant standardization organisations on the individual standards is primarily done as an integrated part of the task when developing the solutions. In addition to this, WP1 is responsible for overview and coordination. This is of paramount importance because of the interdependencies of the standards. For example, in order for one service to function, standards may be needed for data structures, portrayal and operational scope as well as communication and equipment.

   WP1 will map the ongoing standardization work and follow the progress made in relevant standardization bodies. Such reports will give a wider context to the project and ensure that the project standardization work is in harmony with the industry standardization work. This overview will be accessible to the project partners as well as publically to other parties interested in the subject.

3. **Ensure data delivery by service providers** – For all services that in Table 1.1 has a target TRL of 7 and 8 project partners also functions as service data providers. All these services will be operational with data from project partners, which naturally are committed to do so. It will be desirable but not critical to get service providers outside the project to deliver services in the required form. During the project, measures such as workshops and collaboration will be taken to ensure as good service coverage in the two target areas as possible through project partners, outreach via the BSR e-navigation forum, Arctic Council or other relevant bodies such as HELCOM. The barriers to data and service delivery will be made as low as possible by developing and providing open standards and a repository of open software source code of value for implementing. In particular the development of the Maritime Service Definition Language will dramatically lower the barrier for service providers to develop and promulgate services for project, by offering a high degree of automation of the work.

4. **Support by national states and authorities** – The measures that will be taken to ensure support from national states and authorities are mostly communicative, demonstrating and promoting the concepts value and impact. It will be a special task to work with strategic/political, legal and financial issues in bringing concepts and demonstrations to the market – e.g. the governance and business model for the Maritime Cloud (feasibility studies). The work will be done in collaboration with the relevant WPs and involve the maritime community, e.g. through workshops. Both sceptical and supportive actors will be invited to discuss the issues. The task will also identify and conceptualise future uses and applications of the developed solutions. This could include handling of ships certificates, feasibility of applicability to autonomous or actively guided ships, or how the Maritime Cloud could be utilized on a personal level. As an example, could it help documenting seafarers' sailing time when issuing personal certificates? This work will be used to gain support from national states and authorities.

5. **Upgrading of international maritime safety regimes –** Work in the standard setting bodies and regulatory organisations are of great importance. We will develop a strategy for influencing international maritime safety regimes. As stated in table 2.2, many of the project partners are already heavily involved in the relevant institution. Here they will provide direct input from the project to the regulating processes. As shown in figure 2.1, it is the aim to get the IMO's support for the Maritime Cloud as the worldwide communication infrastructure for e-navigation.

6. **Uptake by equipment manufacturers –** Another element of great importance for the impact is the uptake and implementation by equipment manufacturers. This uptake will be enabled directly by the commercial project partners, through the standardisation of on-board components and communication technologies and open source software. The transfer to other commercial companies will be facilitated by CIRM.

7. **Adoption by ship-borne and shore-based end users** – This being e.g. ship-owners, navigators, service providers, VTS centres, etc. This will be a communicative measure taken in collaboration with relevant organisations such as ICS, BIMCO, the Nautical Institute and IALA.

2.3.2 *Knowledge management*

Open standards – or proposed standards – will constitute a major part of the deliverables of this project. These are by nature open for public access. Whether standards are available for free or a fee depends on the procedures and business models of relevant standardization bodies.

Where relevant, publication of the results of the project will be sought by the involved academic institutions, supporting wider academic access to the outcome of the project, enabling peer-review and future consolidation and evolution of the work.

Work Package 3 will deliver the Maritime Cloud framework as an extensive open source reference implementation, with unrestricted public access, in the pursuit of global cooperation, recognition and adoption. Other software for prototypes or demonstrations *may* be provided as open source, but will unless explicitly expressed be the

intellectual property of the contributing partner organisation. An IPR strategy will be developed as part for the consortium agreement at the outset of the project.

2.3.3 *Communication activities*

Communication activities will be closely linked to dissemination. As much communication as possible should be dialogue-based to promote understanding and feedback from the audiences. In this respect it is not a goal in itself to brand the project, but focus is on selling the project insights and solutions to the maritime world. Defined target groups and communication objectives are:

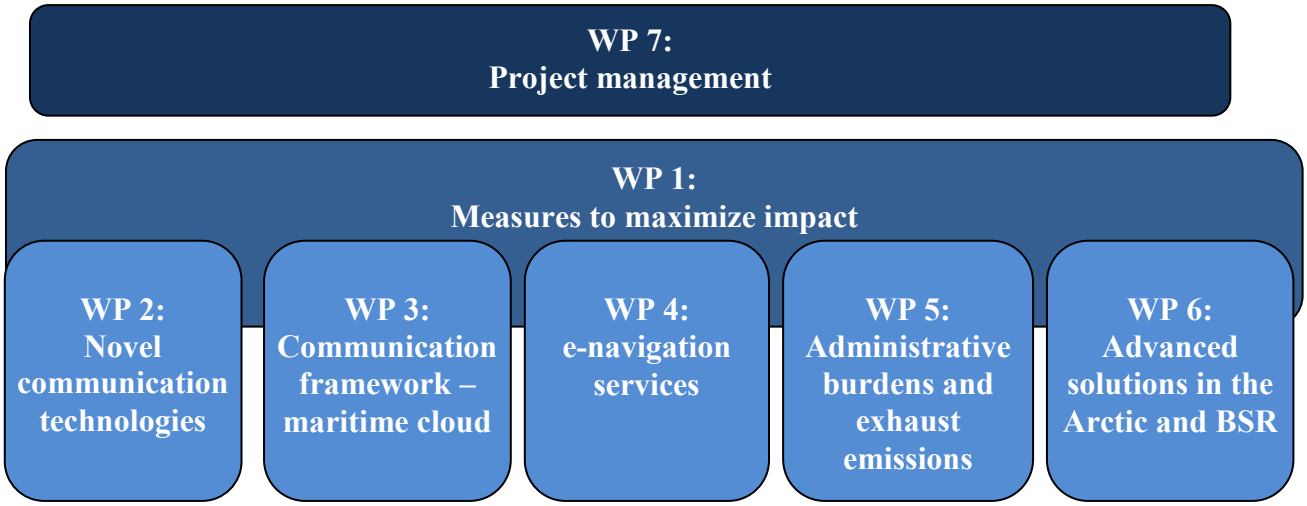
- Regulating authorities and bodies → convince them of the value of the common framework and promote regulation where relevant.
- Standard setting organisations and their members → promote the value of standardising service provision via the Maritime Cloud.
- Service and data providers primarily in BSR and the Arctic, secondarily globally → persuade them to deliver their services in the standards developed by the project.
- Equipment manufacturers → get them to adopt the new standards in their products.
- Other related projects → promote harmonization and standardization.
- Use the conceptual model and prototypes to demonstrate the concepts and value.

The WP1 task on communication will act as the marketing and sales function in the project. Main focus will be on ensuring that measures intended to maximise impact are effective in disseminating the project results and paving the way for the innovations to reach the market. This task will ensure that innovation activities are known to all targeted audiences.

3. Implementation

3.1 Work plan – Work packages, deliverables and milestones

The work efforts in EfficienSea 2 will be organized into 7 work packages:



Most project partners will focus their resources within one or two work packages, thus keeping the work of each partner focused, and each work package and task manageable. The management structure described in section 3.2 ensures overall governance by the General Assembly, which is comprised of all project partners. A smaller Executive Board is designed to monitor project risks and execute strategic decision making, while a project management team will execute and support the tactical tasks of the project through the WP leaders.

Work Package 7, led by the DMA, will address general project and financial management tasks and risk monitoring as well as provide project support, including the organization of cross-project events.

Work Package 1, led by the DMA, will ensure coordination and cross project activities, ensuring innovations remain user-focused while facilitating a coordinated approach to standardization. Issues of governance, legal issues and human factor issues will be coordinated across the project, and via appropriate liaison and harmonization with external projects, WP 1 will secure links to key international and regional organisations and stakeholders, promoting a significant and lasting impact.

Work Package 2, led by the communication manufacturer T&T, will gather key academic and commercial partners in addressing the need for robust and low cost communication systems to support efficient traffic management and safety of the maritime transport sector, taking into account the ongoing review of the GMDSS (Global Maritime Distress and Safety System) and the challenges specific to ships' communication in the Arctic. This work package will address how novel information services can be integrated into relevant systems on board ships, addressing cyber security issues.

Work Package 3, led by the DMA, will bring together key authorities with strong academic and commercial partners to develop the ground breaking communication and service provision framework that will enhance information sharing in and around the maritime sector, enabling a comprehensive and coherent e-maritime and e-navigation environment based on a service oriented architecture.

Work Package 4, led by the DMA, will address the provision of services for harmonized, modern information services supported by the communication framework developed in WP 3. This will be secured through collaboration among highly competent domain experts, authorities, data modelling experts as well as system- and service providers, aiming to achieve reference implementation of several of the Maritime Service Portfolios (MSP) defined by the IMO e-navigation Strategy Implementation Plan.

Work Package 5, led by BIMCO, will gather key shipping interests with academic and commercial stakeholders to ensure that administrative e-maritime solutions can be made available to ships in an automated manner. This will

reduce the administrative burdens that are known to distract navigators. Further, solutions for automated emission monitoring supported by the information service framework will be explored.

Work Package 6, led by the SMA, will gather authorities, academia and industry in addressing advanced information solutions for decision support services. This will reinforce efficient and safe navigation through a special focus on services that address the challenges to shipping and emergency response in Arctic waters and the Baltic Sea Region.

The work packages are highly interrelated. The specification of the communication framework – the Maritime Cloud – developed in WP 3 will be based on requirements collected from other work packages and external users. The reference implementation will be used by WP 2 in defining onboard integration of services, and by WPs 4, 5 and 6 in defining service provision. At project midterm, an 'alpha release' of the Maritime Cloud will be made available for provision of services in simulated or sea trial environments, enabling larger scale iterative prototype testing of services, in the second half of the project.

In an iterative process, services developed in WPs 4, 5 and 6 will describe technical requirements for communication links to support these services that will be compared with the capabilities of communication systems by WP 2. In return WP 2 will provide feedback to WPs 4, 5 and 6 on recommendations on how service variants can be designed that fit realistic capabilities of the most commonly available communication systems, in particular in remote regions.

Each work package, its deliverables and associated milestones are described in the following tables, and summarized in the GANTT chart on the next page.

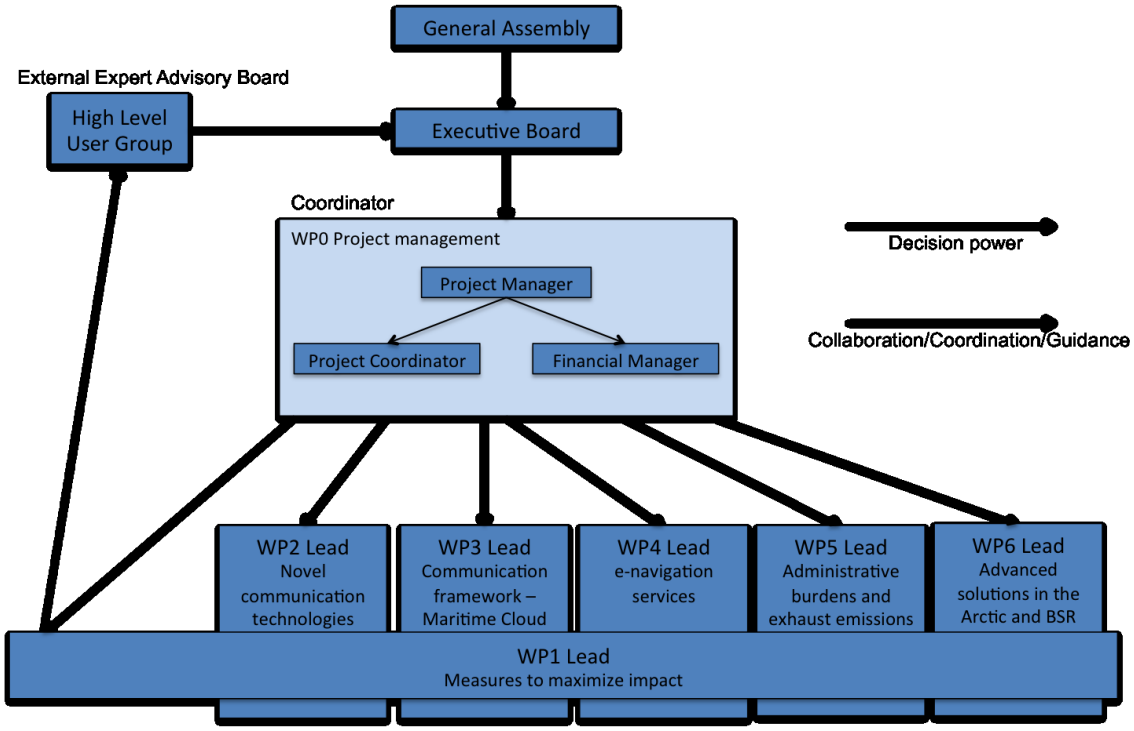
Id	Opgavenavn
1	**Milestones**
2	M3 - Signed Consortium agreement
3	M9 - Conceptual model for Maritime Cloud
4	M18 - Mid term evaluation - alpha release Maritime Cloud
5	M24 - First services
6	M30 - Major project demonstations
7	
8	**WP 0 - Project management**
9	Progress & Financial mangement
10	Project support, periodic reporting
11	Consortium agreement
12	Kickoff Event
13	Mid term major event
14	final major event
15	final report
16	
17	**WP 1 - Measures to maximize impact**
18	Task 1.1 Communication
19	Task 1.2 Liaison and coordination w. other projects and testbeds
20	Task 1.3 Coordination of standardization
21	Task. 1.4 Governance and future perspectives
22	Task 1.5 Ensuring input from High Level User Group
23	Task 1.6 Ensuring proper methodology is used for identifying and solving user needs
24	Task 1.7 Ensuring relevant innovation methodology is used throughout the project
25	
26	**WP 2 - Novel communication Technologies**
27	Task 2.1 - VDES (VHF Data Exchange System)
28	Task 2.2 - Evaluation of communication technologies
29	Task 2.3 - Robust & seamless roaming
30	Task 2.4 - Shipboard system integration, on board networks
31	
32	**WP 3 - Communication Framework - Maritime Cloud**
33	Task 3.1 - Requirement, analysis and Conceptual Model
34	Task 3.2 - Service Specification
35	Task 3.3 - Technical specification
36	Task 3.4 - Implementation
37	Task 3.5 - Deployment and testing
38	
39	**WP 4 - e-navigation services**
40	Task 4.1 - Operational service framework
41	Task 4.2 - MSI and NM (T&P) service
42	Task 4.3 - METOC Service
43	Task 4.4 - Sea charts in the enavigation era
44	Task 4.5 - Smart buoy service
45	Task 4.6 - Route optimisation service incl. Arctic challenge
46	Task 4.7 - Ice chart service
47	
48	**WP 5 - Administrative burdens and exhaust emissions**
49	Task 5.1 - Automated Port Reporting
50	Task 5.2 - Efficient Port Information
51	Task 5.3 - Emission monitoring solution
52	
53	**WP 6 - Advanced e-navigation solutions in the Arctic and Baltic Sea Region**
54	Task 6.1 - Route exchange, reporting and negotiation
55	Task 6.2 - VTS and SRS reporting
56	Task 6.3 - Self organising emergency response and decision support for ice navigation
57	Task 6.4 - Human factors in integration of e-navigation services
58	Task 6.5 - Advanced METOC data for improving maritime safety

3.2 Management structure and procedures

A solid and well structured project organisation enables effective, dynamic and agile project execution. The chosen project organisation will ensure that EfficienSea 2 will be capable of swift adaptation to change, careful progress monitoring and timely intervention to ensure that all deliverables are delivered on time and in sufficient quality. It will keep its stakeholders well informed on progress, possible risks and milestones achieved.

The structure chosen builds on extensive project experience and is in part derived from the proposed DESCA governance structure for medium and large projects as well as PRINCE 2 project management methodology. Since the project encompasses a significant number of partners and numerous activities, special attention has been paid to the following:

- A four-layer management structure with clear role descriptions and defined responsibilities to ensure suitable governance capability;
- Carefully designed separation of the roles of the High Level User Group, the Executive Board and the project management)
- A dynamic and agile Executive Board, with members able to meet as often as the project requires and thus capable of following the project's progress closely;



General Assembly	*Role in decision-making*: The ultimate decision-making body of the consortium. *Function*: Will establish the Executive Board. Will follow project progress. Make decisions for the project as it seems fit. Voting principles: Simple majority with Chairman having the casting vote. *Members with voting rights*: One representative from each project partner (high-end management level with decision-making capabilities).

	Members without voting rights: Members of the Executive Board and the Project Manager. The Chairman of the Executive Board and the Project Manager can invite other relevant individuals who may be needed in order to inform the meeting (for instance the Financial Manager and/or Project Coordinator). Meeting frequency: Will meet annually and additionally if any of the project partners requests an additional meeting. At the first meeting the General Assembly will establish the Executive Board. Chairman: Director level, from coordinator organisation (DMA).
Executive Board	*Role in decision-making*: The Executive Board will make decisions for the project within limits and tolerances decided by the General Assembly. *Function*: The supervisory body for the execution of the project. Reports to the General Assembly. Supports the coordinator in preparing meetings and deliverables to the Funding Authority. *Members with voting rights*: Those appointed by the General Assembly. These should be members of the project partner organisations without any other managerial role in the project. Chairman at Director level from DMA. Liaison officer with High Level User Group (from MDCE) Voting principle: Consensus. *Members without voting rights*: Project manager WP1 lead (innovation; IPR and dissemination) Project coordinator Financial manager The Executive Board may, when required, invite persons (from inside and outside the project) to participate on an ad-hoc basis in meetings when relevant to the decision-making process.
High Level User Group (External Expert Advisory Board)	*Role in decision-making*: Has no formal decision-making authority. Provides consultancy and advice to the Executive Board. *Function*: Will be an important contributor to project relevance as well as dissemination and impact. The communication and cooperation with the High Level User Group will be maintained by MDCE, which is also a member of the Executive Board, to ensure an active and close communication channel with the project decision makers. *Members*: Consists of a variety of end users to primarily shipping companies).
Project Manager	*Role in decision-making:* Has decision-making authority for the project within limits and tolerances set by the Executive Board. Performs the daily management of the project. *Function:* Responsible for the timely completion of deliverables. The Project Manager supervises and controls the work packages and will have regular communication and meetings with all WP leads to ensure that they are on track. *The Project Manager:* Will be provided by the Coordinator/Lead Partner (DMA).
Work Package Leaders	*Role in decision-making:* Have no decision-making authority for the project. Refer to the Project Manager. *Function:* To manage and deliver the agreed products, in the agreed time and quality, to the Project Manager. Coordinate the execution of the work package with the task leaders. *Members:* Work Package Leaders are appointed by the partner leading the respective work package.

3.3 Consortium as a whole

Given the high level of ambition in the project, it is crucial that the partner composition is of a calibre capable of realizing the objectives. The project brings together leading authorities, academia, European companies and international organisations, providing leading expert knowledge in all tasks covered by the project. The fact that organisations such as IALA, CIRM and BIMCO are partners in the project provides an excellent path to achieving short- and long-term impact on maritime safety and efficiency in Europe, while ensuring that the results are compatible with the global maritime transport business as a whole, by turning project results into international rec-

ommendations, guidelines, standards and good practices. This ensures that the input for relevant standards and legal regimes is prepared and promoted together with the authorities involved.

The partner team is composed of:

- 8 governmental institutions, covering maritime, transport, meteorological and telecom authorities
- 5 academic institutions, covering human factors in maritime applications, computer science and IT, communication and space technology
- 3 international associations, covering aids to navigation & the provision of shore based services, maritime equipment manufacturers, ship-owners and ports, etc.
- 13 commercial enterprises, covering highly competent maritime equipment manufacturers for on-board and onshore systems, system integrators, hydrographic services, and innovative IT application designers
- 3 non-profit organisations, covering European innovation networks, and applied scientific expertise on human factors, simulations and optimization

The lead partner DMA has extensive experience in international harmonization and cooperation, as well as conducting EU projects. DMA was lead partner in the previous EfficienSea project 2009-2012 under the BSR Interreg programme, and several key management roles carry experience from this project. DMA has participated in the TEN-T projects MONALISA and MONALISA 2.0 and currently lead two work packages in the ACCSEAS project (NSR Interreg). Based on experience from these projects, unique knowledge of the Maritime Cloud concept has been compiled into a core part of EfficienSea 2. For this reason the insights and expert domain and technical knowledge of several DMA employees are distributed across several parts of the project, ensuring cross project knowledge sharing.

The large partner group will generate a strong network, strengthening the innovation capacity and knowledge sharing amongst the partners. The commercial partners express an expectation to gain knowledge and bring their products close to an emerging new market for sophisticated maritime systems and services, promoting 'blue growth' in Europe; and nevertheless, since most project partners will focus their resources within only one or a few work packages, the project will remain manageable.

Great care has been exercised in selecting the right partner composition of each work package and individual task, ensuring that the right academic, scientific or industrial competences and resources are available for technical design, development and testing, while relevant human factor and IT expertise is involved in service design, testing and validation, and relevant service providers are involved in preparing mature services, etc. This way, EfficienSea 2 represents a consortium with multidisciplinary and complimentary competencies creating a collective capability to achieve the impact objectives of the project. In addition to the work done by the partners, a dynamic **High Level User Group** will be established. This group will challenge and qualify the concepts proposed and have the role of co-creators and evaluators in the innovation process, also through providing competent resources for testing and validation.

At present, the following organisations and companies have confirmed participation in the High Level User Group:

- The Nautical Institute
- The International Chamber of Shipping (ICS)
- Arctic Expeditions Cruise Operators (AECO)
- Oceanwide Marine Services
- Lindblad Expeditions/National Geographic
- Maersk Maritime Technology
- Elbe Pilots
- DanPilot
- DFDS Seaways A/S
- Scandlines A/S
- Royal Artic Line A/S
- SIMAC Svendborg International Maritime Academy

- Anthony Veder Rederijzaken B.V.

While the High Level User Group's role is to keep the partners focused on creating solutions for user needs, special attention will be paid to the human factor, including any gender or cultural differences. Leading maritime human factor university researchers will participate throughout the project.

4. Appendix A Major products of the project

The major products of the project are:

New communication framework (The Maritime Cloud)
Web user interface platform for delivering services in the Arctic (ArcticWeb)
Web user interface platform for delivering services in the Baltic (BalticWeb)
New communication technology (VDES)

4.1 Status at M18

The Maritime Cloud

A prototype instance of the Maritime Cloud will be running and suitable for developing and testing services. Report(s) with detailed specifications on all levels from conceptual / governance to technical / source code will exist at this stage. An administrative web portal will be available.

ArcticWeb

ArcticWeb already exists at the beginning of EfficienSea 2. At this stage the platform will be extended with the following services:

Arctic SAR tool (new service)

MSI&NM (existing service will be updated to reflect changes in proposed standard)

METOC (updated to reflect changes in proposed standard)updated to reflect changes in proposed standard)

Ice charts (updated to reflect changes in proposed standard)updated to reflect changes in proposed standard)

BalticWeb

The BalticWeb protal will be created based on the existing ArcticWeb technology.
The following services from ArcticWeb will be expanded to the Baltic sea region:

MSI&NM

METOC

Ice charts

VDES

A detailed report on the status of development will exist. Description of interface to the Maritime Cloud will also be in place.

4.2 Status at M36

The Maritime Cloud

A regional operational instance of the Maritime Cloud will exist, supporting services for both ArcticWeb and BalticWeb. Full documentation on all levels will be available and submitted to the appropriate standardization bodies. The administrative web portal will be implemented.

ArcticWeb

ArcticWeb will be fully operational with all relevant services available (those with TRL target 7-8). Services for the platform will be delivered using the Maritime Cloud.

BalticWeb

BalticWeb will be fully operational with all relevant services avilable (those with TRL target 7-8). In addition to what is available at M18, this will also include:

Route exchange

Automated VTS/SRS reporting

Reliable port information

Emission monitoring solutions

VDES

Prove of concept and working prototype equipment will exist. Technical specification will have been submitted to relevant standardization bodies.

5. Appendix B Ethics

5.1 Human use in the project

Expert users will be invited to test the developed services as part of the project. This will typically be done in simulators with no risk for the involved personnel. If testing are done on actual ships, then the tests will be designed in a way that they will not be interfering with the normal operation of the vessel, and will thus be without any out risk.

5.2 Non-EU contries

There is a single partner from a non-EU country (Norway), participating in the project. This should not cause any concerns. The partner will apply to the relevant EU and H2020 rules.

5.3 Dual use

The project will accelerate the development of new general purpose communication technology. This technology has the potential to be used in all kind of communication, but we do not foresee that they can be used as weapons.

For all developed solutions state of the art measures of cyber security will be applied in order to secure them from misuse and cyber terrorism.

Data gathered by crowd sourcing will be of a nature that is unproblematic to share openly.

Positions of vessels will be registered and kept in the Maritime Cloud as is already the case with other existing systems. In the Maritime Cloud however, all participating vessels will be notified that their position will be kept by the system and the system will be a voluntary.

6. Appendix C Subcontracting

All subcontract will be done according to EU rules on procurement and best value for money.

Partner	Subcontracting	Explanation
KMS (DGA)	15.000	DGA will be hiring consultants to assist with conversion of exciting data in old format to data in the new S101 and S102 formats. Assistance will be acquired from competent companies such as ESRI and/or CARIS in order to develop the needed systems.
Veeteede Amet (EMA)	71.200	Subcontracting will be divided into 3 different contracts. The reason being, that the providers will need very different competences to meet the requirement of the contracts. The 3 contracts are (with estimated costs): 1. Improvement of the wave height evaluation algorithm based on shore-side analysis of the acceleration data collected from navigational buoys and validation of the results = 25k€ 2. Enhancement of GIS functionalities of the METOC web portal with 48 hour forecasts, satellite imagery products and improved accessibility for users of mobile devices = 26,2k€ 3. Development of the concept and a demonstrator for automated adjustment of luminous intensity of AtoN lights in accordance with network acquired real time atmospheric visibility data = 20k€ Detailed descriptions follow: Improvement of the wave height evaluation algorithm based on shore-side analysis of the acceleration data collected from navigational buoys and validation of the results • Improvement of dependability of the initial wave height calculation algorithm based on analysis of the acquired data. • Implementation of an operator-assisted system for semi-automated generation of configuration parameters for wave height calculation algorithm of buoy hull types currently in use. • Utilization of wave height measurement information from the existing marine weather stations in the vicinity for checking of the quality of wave height calculation algorithm output and buoy hull calibration. • Validation of the wave data obtained from navigation buoys using in situ wave measurements with other, more precise methods like wave buoys and pressure sensors. • Implementation trials of a parallel algorithm for detection and recording of the single wave events exceeding the average significant wave height. • Comparison of wave field peculiarities obtained from navigation buoys with the data from radar satellites and marine radars. • Improvement of the initial server side algorithm for quality control of the wave height calculation results prior to publishing as e-Navigation service. Subcontract explanation: As the subcontractor has developed and implemented previous wave height calculation algorithm during last EfficienSea project, it is the quickest and most cost-effective way to use persons who already have

		knowledge and have suitable soft- and hardware to work with. EMA has a leading role in the planning of trials and in specifying criterias for description of hydrodynamics of navigational buoys. Additionally EMA owns navigational buoys, buoyships and other equipment needed to carry out surveys required for algorithm improvement. Enhancement of GIS functionalities of the METOC web portal with 48 hour forecasts, satellite imagery products and improved accessibility for users of mobile devices • Adding 48 hour forecast for the basic parameters like wind properties, water levels and waves, using of HIRLAM, HIROMB and SWAN models. • Trial for integration of the satellite imagery and METOC data from moving platforms (e.g. TUT MSI Ferrybox) into METOC web portal and realization of corresponding test products by means of this portal. • Adapting of METOC web portal for mobile devices use alternatively. • Linking selected part of METOC web portal data to BSR web page. Subcontract explanation: The subcontractor already has access to the HIRLAM, HIROMB and SWAN models. This enables us to develop further METOC portal as prognosing tool. Wave data in the Metoc portal is essential for mariners. Obtaining wave data by means of EMA's navigational buoys is the most cost-effective way Development of the concept and a demonstrator for automated adjustment of luminous intensity of Aids to Navigation (AtoN) lights in accordance with network acquired real time atmospheric visibility data • Development of an initial concept for network-centric online control of luminous intensity of AtoN lights based on actual atmospheric visibility at a specific location, utilizing existing AtoN telematics infrastructure. • Establishing of pilot interfaces with dependable atmospheric visibility data sources. • Creation of initial algorithms for atmospheric visibility dependent control of the luminous intensity of AtoN light. • Creation of a Visibility-Adaptive AtoN Light (VAAL) demonstrator and dry-testing of the network-centric operation on the shore. • Selection of a target AtoN site for feasibility testing and deployment of the VAAL • demonstrator at the selected AtoN site (leading lights) for operation throughout a test period providing variations of environmental situations typically encountered during the navigational season. • Reporting and dissemination at relevant events (EfficienSea, IALA). Subcontract explanation: The subcontractor is the manufacturer of overwhelming part of Aids to Navigation lights EMA is using being also member of IALA. This enables us to develop demonstrator most cost-effectively. As Estonian Maritime Administration is responsible for correct information concerning light characteristics, we will define rules for required light intensities and provide target AtoN site for demonstrator.
Maritime Office in Gdynia (MOG)	28.000	Our task is to build the working model of Smart Buoy , including equipment and electronic parts (PCBs) and programmed dedicated microcontroller as well as sensors, displays etc. MOG will develop the Smart Buoy

		concept and make design and specifications, however MOG does not possess the electronic engineering and programming skills, and therefore there will be a need for public tender procedure to find a company capable to execute such a work.
Swedish Maritime Administration (SMA)	35.000	Subcontracting costs concern system development at Sound VTS: • IT systems (e.g. existing VTS systems including the purpose-built VTS Database on Sound VTS and ENSI web portal) are adapted to meet the needs of both GOFREP and SOUNDREP. Existing systems are further developed to support machine-machine exchange of information which has reduced manual data management to a minimum. • Ship reporting is routed to both GOFREP and SOUNDREP systems. Furthermore, the organizations have evaluated the possible benefits of sharing more information between their respective systems and identified further work needed to achieve enhanced information flow. • Experiences and gained knowledge about information sharing between SOUNDREP and GOFREP, as well as enhanced reporting and communications procedures with ships, are fed into the procurement process for new VTS systems in Sweden and Denmark (and Finland?).
CLS	120.000	The justification of subcontracting costs is twofolds : 1. CLS proposes an equipment dedicated to the storage of raw AIS and GNSS data onboard ships over polar maritime roads. This type of equipment will be specified by CLS but the manufacturing will require a subcontractor especially considering the extremely harsh experimental conditions, 2. CLS will develop a space weather forecast service, first step will consist in realizing a demonstrator based on the records of observed geo-positionning and telecommunications systems anomalies, second step will consist in implementing an operational SW tool. This last task will be done under a subcontract.
LiteHauz (LH)	30.000	The allocated money will be utilized in order to cover expenses for: • Chemical analysis: e.g. confirmatory analysis of sulphur compounds, particles and black carbon • Software development – limited help with programming side of the application that will collect, analyse and send monitoring data to a cloud server. • Installation of monitoring devices in test facilities and ship units

7. Appendix D Other direct costs explained

Some partners have relatively high costs per travel. This is generally due to two reasons:

Some partners will participate in international committee meetings that usually have a considerably longer duration that ordinary project meetings

Some partners will conduct field tests at sea, which also induces significantly larger travel costs.

Individual justification is also given for each partner.

Other direct costs explained All EfficienSea 2 partners		
Partner no. 1: DMA	**Cost €**	**Justification**

Travel	119.494	119 travels / € 1.000 per travel
Equipment	0	
Other goods and services	145.000	**WP1: 95.000:** 15,000 Euro project webpage 15,000 Euro tools or services for innovation management e.g. system for ideation 20,000 Euro promotion material e.g. brochures, rollups, flyers, layouts, presentation etc. 45,000 Euro relevant medias for dissemination e.g. movie, interactive webpage etc. **WP7: 50.000:** 10.000 Project management IT tool 5.000 Financial audit 35.000 Three major events
Total	**264.494**	
Partner no. 2: DGA	**Cost €**	**Justification**
Travel	10.000	10 travels / € 1.000 per travel
Equipment	14.000	Purchase of software og possibly also hardware for the production of S-101 og S102 dataset. The intention is to use and test software from ESRI og CARIS, partly in connection with transformation of current dataset for the new S-100 formats, and partly for production of new S-100 dataset. This is also planned for future ECDIS systems.
Other goods and services	2.500	Licenses for databases
Total	**26.500**	
Partner no. 3: DMI	**Cost €**	**Justification**
Travel	13.000	13 travels / € 1.000 per travel
Equipment	-	-
Other goods and services	-	-
Total	**13.000**	
Partner no. 4: EMA	**Cost €**	**Justification**
Travel	2.100	3 travels / € 700 per travel
Equipment	-	-
Other goods and services	-	-
Total	**2.100**	
Partner no. 5: FTA	**Cost €**	**Justification**
Travel	6.560	8 travels / € 820 per travel
Equipment	-	-
Other goods and services	-	-
Total	**6.560**	
Partner no. 6: MOG	**Cost €**	**Justification**
Travel	24.000	16 travels / € 1.500 per travel 16 travels planned for the entire project: 3 major conferences

		(x 2 persons); 4 partner meetings (1 person); 3 workshops (x 2 persons). Due to a comparatively low labour rate, travel expenses add up to 36% of allocated personnel costs. MOG will attend international committee meetings (work-shops) with durations considerably longer than project meet-ings.
Equipment	42.200	Task 4.5 Smart buoy – requires to equip the maritime buoy with ruggedized equipment (AIS transceiver, communication modem, data logger with SSD disk, dedicated sensors). The technological model of SM buoy requires materials to build and set up a technical model of electronic special PCB boards, including microcontroller and buoy adaptation for maritime testbed.
Other goods and services	1.400	SIM cards for modems and telecommunication services (data).
Total	**67.600**	
Partner no. 7: NIT	**Cost €**	**Justification**
Travel	36.000	18 travels / € 2.000 per travel Costs of travelling (and accommodation) to project meetings and to conferences (symposiums) where the EfficienSea 2 project results will be presented. The reason for the high cost is that NIT will be conducting field tests on vessels. This will be in relation with testing of communication equipment, not human factors experiment. Conducting field tests and bringing equipment on board tests vessels induces more costs that just traveling to a meeting., including expenses for actually using the vessel. This will be done in WP2 Activity 2.1 and 2.3. This situation is similar to that of CLS and T&T.
Equipment	58.600	Costs of the necessary equipment to carry out the range and quality measurements at sea in the WP2 activitis 2.1 and 2.3, most notably a vector network analyzer, microwave elements, cables, connectors, measurement antennas and amplifiers, wireless data transmission modems, software development tools (SDK), data transmission services, etc. Detailed cost breakdown (estimates): Vector Network Analyzer (needed for measurements at sea): 20.000€ Antennas and amplifiers: 15.600€ Additional microwave parts (attenuators, cables, adapters, power dividers and limiters, combiners, etc): 7.000€ Specialised extension options for portable spectrum analyzer: 5.000€ Electronic components: 4.000€ Software Development Tool (SDK): 3.000€ Mobile data modems and terminals: 4.000€ Depreciation is explained at the end of this table.
Other goods and services	-	
Total	**94.600**	
Partner no. 8: SMA	**Cost**	**Justification**

	€	
Travel	26.000	40 travels / € 650 per travel
Equipment	53.000	SMA simulator cost, two test campaigns including preparations and retrofitting. 37 000 EUR is costs for using our simulator, two test campaigns of one full week each. The simulator cost is calculated by adding all known costs for the simulator center, i.e. software licenses, rent of premises, annual depreciations, technical support from manufacturer, maintenance costs and spare parts. All of which are actual costs, no profit applied . This number is then divided with expected total annual utilization in hours and a price per hour arise. Cost for instructor is calculated from actual cost of employed as an instructor without overhead costs. 16000 EUR are onetime costs for retrofitting of the simulator for the project-specific purposes, that is hard- and software supporting the new e-navigation functionality of information exchange between ship and shore that is going to be tested in WP4 of EfficienSea 2, such as automated SRS reporting. This concerns additional computers and screens on the simulator bridges, emulating functionality that in a future real implementation will be integrated with the regular navigation equipment but is at a prototype stage for the duration of the project.
Other goods and services	5.000	Development of existing VTS system / VTS database for information sharing in BSR.
Total	**84.000**	
Partner no. 9: CHALMERS	**Cost €**	**Justification**
Travel	27.000	18 travels / € 1.500 per travel The cost figure for traveling in Chalmers budget is based on earlier experience from three year projects. Further, Chalmers is highly involved in WP 1.6 regarding User and Human Factors aspects, so in addition to the normal project meetings, extra travels are accounted for visiting ships and shore based organizations during planned field tests
Equipment	-	-
Other goods and services	66.550	Conduction of workshop in WP1: 5000 EUR Consumables in connection with workshop: 3750 EUR Simulation lab fee in WP6: 52.800 EUR Audit costs: 5000 EUR The workshop in WP1 is to have an internal project course in human factors aspects in design, early in the project. The simulator tests will be organised in WP6 and conducted during 2016 and 2017.
Total	**93.550**	
Partner no. 10: DIKU	**Cost €**	**Justification**
Travel	15.000	10 travels / € 1.500 per travel
Equipment	2.000	Laptop for use in project (software development)
Other goods and services	933	Software licenses, publication cost etc
Total	**22.933**	

Partner no. 11: DTU	**Cost €**	**Justification**
Travel	4.000	4 travels / € 1.000 per travel
Equipment	-	-
Other goods and services	-	-
Total	**3.000**	
Partner no. 12: LMA	**Cost €**	**Justification**
Travel	12.000	12 travels / € 1.000 per travel The Latvian Maritime Academy has planned 12 trips (at a trip rate of € 1.000). These trips are estimated as necessary for the LMA to conduct the planned activities in the WPs.
Equipment	50.000	The Latvian Maritime Academy has had a modern training facility installed four years ago. This facility consists of ship bridge simulators connected in one network, so that all emulated vessels can be used in an assignment as one fleet, or separately, as individual vessels. At the moment, the facility uses software from Transas International. In the framework of the project, we want to procure 6 ECDIS simulators and connect them to the existing bridge network. This equipment will be used for the newly produced prototypes testing purposes, especially taking into consideration the new requirements (for S-100 and S-101 standards) that will allow us to conduct comparisons between old and new systems as well as to evaluate the "user friendliness" and operational effectiveness of the newly developed prototype. The increasing number of ECDIS on ships' bridges for the project planning testing and evaluation will also provide a possibility of simulating the activities of two or more fleets for cross-network data transmission testing.
Other goods and services	-	-
Total	**62.000**	
Partner no. 13: OFFIS	**Cost €**	**Justification**
Travel	27.000	18 travels / € 1.500 per travel
Equipment	10.000	Computing equipment to make the Maritime Cloud infrastructure available to the EMIR platform.
Other goods and services	-	-
Total	**37.000**	
Partner no. 14: BIMCO	**Cost €**	**Justification**
Travel	12.500	9 travels / € 1.389 per travel
Equipment	-	
Other goods and services	-	
Total	**12.500**	
Partner no. 15: CIRM	**Cost €**	**Justification**
Travel	35.000	20 travels / € 1.750 per travel CIRM is to play a major role in coordinating the work of all

		partners and ensuring standardisation. This requires an estimated 20 travels. 20 trips over three years at a cost of € 1,750 per trip is estimated as sufficient. CIRM is to play a major role in coordinating the standardisation work of all participants, and this will involve direct participation in various meetings and events alongside other IGOs, NGOs, and other project participants. The individual who will perform the work for CIRM will be based in UK and will need to travel to some of these meetings, which will include standards development and regulatory sessions (IMO, ITU Working Party 5B, IEC Technical Committee 80, IALA, IHO) in London, Geneva, Paris and Monaco; relevant industry conferences across Europe; and project meetings in Denmark. Many of these meetings have a duration that are significantly longer than a single day, thus the relatively high cost per travel.
Equipment	-	
Other goods and services	-	
Total	**35.000**	
Partner no. 16: IALA	**Cost €**	**Justification**
Travel	34.000	20 travels / € 1.700 per travel IALA's role in the project is very similar to CIRM, thus the same argument applies. Harmonisation of technical standards and services is vital and will require coordination of the national authorities of the EU participants as well as non-participants in the project. Part of the harmonisation activity will involve the location of NGOs and IGOs in different cities, namely IALA in Paris, CIRM in London, IHO in Monaco. Dr Ward, who will supervise the IALA work and perform some of it, is resident in the UK, but will need to participate in project activities in Denmark and to attend IALA meetings in Paris.
Equipment	-	-
Other goods and services	7.000	This will cover upgrading work on IALA's website to provide access to the Maritime Cloud technical standards that will be held by IALA and links to specific related tech standards websites (IEC, IHO, etc) so that the Maritime Cloud technical and standards information is made available globally in a single coordinated website.
Total	**41.000**	
Partner no. 17: MDCE	**Cost €**	**Justification**
Travel	7.500	12 travels / € 625 per travel
Equipment	-	
Other goods and services	-	
Total	**7.500**	
Partner no. 18: SSPA	**Cost €**	**Justification**
Travel	14.200	9 travels for WP4 / € 600 4 travels for WP6 / € 2.200

Equipment	-	
Other goods and services	2.240	Rental of bridge simulator
Total	**16.440**	
Partner no. 19: FORCE	**Cost €**	**Justification**
Travel	4.374	17 travels / € 257 per travel; low cost per travel since most travels will be within national boarders without hotel
Equipment	15.000	Simulator rental - Use of one full mission simulator for 10 days (usability tests and final demonstrations)
Other goods and services	-	
Total	**18.374**	
Partner no. 20: CLS	**Cost €**	**Justification**
Travel	32.500	13 travels / € 2.500 per travel; relatively high due to planned physical test on board arctic vessels. This is very similar to NIT and T&T. However, CLS's cost are higher due to testing in the arctic.
Equipment	30.000	AIS receiver/transmitter, Argos transmitter, Iridium terminal, Modified AIS receiver/transmitter for raw AIS & GNSS record-ing
Other goods and services	8.000	Iridium Telecommunication Service, Argos Telecommunica-tion Service, Terrestrial and Satellite AIS data, GNSS private network data, Iridium, Argos, AIS/GPS equipments shipment & installation onboard the polar ship
Total	**70.500**	
Partner no. 21: DANELEC	**Cost €**	**Justification**
Travel	25.215	17 travels / € 1.483 per travel
Equipment	-	-
Other goods and services	-	-
Total	**25.215**	
Partner no. 22: FRQ	**Cost €**	**Justification**
Travel	25.990	23 travels / € 1.130 per travel
Equipment	7.600	These are costs associated with the infrastructure necessary to carry out certain project tasks, these comprise costs for the server infrastructure required to perform the develop-ment tasks as well as to support the operation of the demon-stration testbed environment.
Other goods and services	-	-
Total	**33.590**	
Partner no. 23: FURUNO	**Cost €**	**Justification**
Travel	30.000	30 travels / € 1.000 per travel
Equipment	12.000	In case of each work package, Furuno will develop prototype equipment to be used in tests. This is the estimated cost of the equipment that we plan to use in the testing. This in-cludes navigation and communication equipment, cables,

		connectors and such.
Other goods and services	10.000	External audit
Total	**52.000**	
Partner no. 24: GH	**Cost €**	**Justification**
Travel	5.000	5 travels / € 1.000 per travel
Equipment	-	-
Other goods and services	-	-
Total	**3.000**	
Partner no. 25: LH	**Cost €**	**Justification**
Travel	18.000	9 travels / € 2.000 per travel • Traveling to group meetings • Traveling to land-based lab/full-scale facilities where the monitoring device are going to be/has been installed • Traveling to the ships where the monitoring device are going to be/has been installed LH will also be involved in field tests in order to demonstrate/test emmission gas sensor technologi. As with NIT and other, this will result in higher travel costs.
Equipment	40.000	The money allocated will be utilized in order to cover expenses for: - Purchase/lease of sulphur measuring devices Estimate: 16.000€ - Purchase of auxiliary devices (i.e. monitors for temperature, salinity, geoposition, etc.) Estimate: 2.000€ - Electronic equipment for data storage, test and analyses Estimate: 2.000€ - Materials and installations for field and ship testing Estimate: 12.000€ - Laboratory/Field test materials and chemicals Estimate: 8.000€
Other goods and services	-	-
Total	**58.000**	
Partner no. 26: LM	**Cost €**	**Justification**
Travel	24.000	24 travels / € 1.000 per travel
Equipment	18.000	Networking hardware for concept studies/validation. Purchasing of International Standards (IEC) and related material.
Other goods and services	-	
Total	**42.000**	
Partner no. 27: MARSEC	**Cost €**	**Justification**
Travel	15.000	10 travels / € 1.500 per travel
Equipment	1.786	This will be a number of COTS (Commercial Off-The-Shelf)

		Linux computers that we use to implement our solutions for demonstration and validation purposes.
Other goods and services		
Total	**16.786**	
Partner no. 28: RB	**Cost €**	**Justification**
Travel	4.600	10 travels / € 460 per travel. Low cost per travel, because mainly local travels are expected.
Equipment	1.830	Tablets for testing and prototyping
Other goods and services	-	
Total	**5.430**	
Partner no. 29: T & T	**Cost €**	**Justification**
Travel	42.000	21 travels / € 2.000 per travel T&T has a relatively high cost per travel due to: They will be conducting field tests (communication technology), which increases costs They will participate in international committee meetings, which also increases costs Furthermore they have a rather low total travel cost compared to personell costs (5%)
Equipment	58.000	What we foresee is that we need the following dedicated instruments to the project: High speed oscilloscope – 15000€ Signal generator for complex waveforms – 20000€ Advanced waveform analyser I/Q – 23000€
Other goods and services	22.000	Costs related to field testing (that are not direct travel costs) such as seminar fees, training of staff and purchase of background materials. Training courses for R&D staff in new technologies: liniar PA design, and QAM modulation € 14.000 Participation in technology seminars, € 5000 Special literature 1000 Related cost to field testing 1000 Other unspecified 1000
Total	**122.000**	
Partner no. 30: TRANSAS	**Cost €**	**Justification**
Travel	30.800	12 travels for WP 2/ € 800 per travel 4 travels for WP 3/ € 800 per travel 12 travels for WP4/ € 800 per travel 14 travels for WP6/ € 600 per travel
Equipment	16.500	Transas HW equipment and installation materials to be used in laboratory or onboard tests.
Other goods and services	-	-
Total	**47.300**	
Partner no. 31: VISSIM	**Cost €**	**Justification**
Travel	10.714	9 travels / € 1.190,5 per travel

Equipment	-	-
Other goods and services	-	-
Total	**10.714**	
Partner no. 32: UKHO	**Cost €**	**Justification**
Travel	26.000	26 travels / € 1.000 per travel
Equipment	-	-
Other goods and services	-	-
Total	**26.000**	

Depriciation, NIT

Other direct cost description	Total price (excl. VAT) (€)	Amortisation duration (months)	Use duration in project (months)	Percentage of usage for the EfficienSea 2	Cost in project (amortisation accounted for project) (€)
Vector Network Analyzer	33.3333,33	60	36	100%	20.000,00
Antennas and amplifiers	26.000,00	60	36	100%	15.600,00
Additional microwave parts (attenuators, cables, adapters, power dividers and limiters, combiners, etc)	11.666.,67	60	36	100%	7.000,00
Specialised extension options for portable spectrum analyzer	8.333,33	60	36	100%	5.000,00
Electronic components	4.000,00	1	36	100%	4.000,00
Software Development Tool (SDK)	5.000,00	60	36	100%	3.000,00
Mobile data modems and terminals	4.000,00	1	36	100%	4.000,00
Total	97.666,67				58.600,00

8. Appendix E: Members of the consortium

1. Danish Maritime Authority:

Our mission is to promote health and safety on clean seas and to effectively strengthen the competitiveness of and employment in the maritime industries.
Our vision is that Denmark is to be a leading maritime nation, setting the direction for future quality shipping.
Main responsibilities
- Safe ships, health and the environment
- Safe waters, buoyage and navigation
- Social conditions, seafarers and fishermen
- Framework conditions, competition and growth

Directly involved departments:
- Technology and business development

o Responsible for Project management and the technical development efforts related to EfficienSea 2, as well as Danish input to IMO, IALA and HELCOM on e-navigation
- Regulation, Manning and Certification

o Involved in environmental monitoring matters and e-maritime, as well as Danish input to IMO, IALA and HELCOM on matters related to Regulation, Manning and Certification

Profiles:

Omar Frits Eriksson:
Director of Maritime Technology at the Danish Maritime Authority (DMA). Previously head of the Innovation division of the Danish Maritime Safety Administration. Prior to this Omar was head of the Aids to Navigation division of the Royal Danish Administration of Navigation and Hydrography, and he was for ten years the Technical Director of the same organization.
Responsible for e-Navigation in DMA and is on the DMA delegation to the International Maritime Organization (IMO). Currently chairs the HELCOM AIS Expert Working Group, and the ENAV committee in the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). Also manages the IALA Risk Management Toolbox as well as the further development of IALA-NET, the IALA Global Maritime Data Sharing concept. Serves on the governing board of the IALA World Wide Academy where he is dedicated to training and education in developing countries.
Has been involved in numerous international projects. Chaired the first EfficienSea project, was on the management board of the Mona Lisa project and is actively involved in the management of both the MonaLisa 2.0 and ACCSEAS projects.
Omar has a degree in telecommunications as well as an Executive MBA degree, and is Master in Management of Technology and Innovation from the Technical University of Denmark.

Thomas Christensen:
M.Sc. in computer science and mathematics
Certified PRINCE2 Practitioner in project management
Currently Project manager / team leader in the area of e-Navigation at DMA
Thomas has had a variety of managing roles in different areas such as head of department, technical director and QA manager. The fields have been ranging from Biotechnology to software development and medical equipment. In 2007 Thomas entered the maritime world as a project manager at the Danish Maritime Safety Administration, which later was merged with the Danish Maritime Authority.
From 2008, Thomas's main involvement has been with e-Navigation, and since 2011 he has been leading DMA's e-navigation team. He also led the e-Navigation work package in the EU project EfficienSea (2009-2012), and is presently leading two work packages in the EU e-navigation project ACCSEAS (2012-2015). In IMO, Thomas is representing Denmark in e-navigation matters.
Furthermore Thomas is heavily involved in the organisation of the international conference on e-navigation, "e-Navigation underway" under the auspice of DMA and IALA.

Karoline Lundholt:
MsC, European and International Studies, University of Edinburgh
Ba, Politics and International Relations, University of Kent
Project Manager at DMA
Certified PRINCE2 Practitioner in project management
Experience as financial manager EfficienSea project (2009-2012)

Bjørn Borbye Pedersen:
Cand. Merc., Management of Innovation and Business Development, Copenhagen Business School
International MBA, National Cheng Chi University
Currently Business Developer and Special Advisor at Danish Maritime Authority

Jens K. Jensen:
M.Sc. Eng, Technical University of Denmark
Currently Project manager / business developer at DMA, previously Project manager at Danish Maritime Safety Administration / Royal Danish Administration of Navigation and Hydrography
Certified PRINCE2 Practitioner in project management
10 years of experience with standardization and harmonization efforts related to AIS, radio navigation and communication, via the HELCOM AIS Expert Working Group (EWG), the IALA AIS and e-navigation committees, IMO NAV, COMSAR and NCSR subcommittees and IEC TC80, and IMO-ITU EWG
Previously task lead in the EfficienSea project (BSR 2009-2012), (EAVDAM application, see below)

Currently Task lead in the MonaLisa 2.0 project

Relevant publications / products and services:

- EAVDAM application for coordination of FATDMA timeslot allocation for AIS, related to the European masterplan for AIS (Open Source Software package delivered by EfficienSea project - BSR 2009-2012) http://efficiensea.org/default.asp?Action=Details&Item=497
- The international 'E-navigation Underway' conference in 2011, 2012, 2013 and 2014 http://www.e-navigation.net/index.php?page=e-nav-underway-2014

Relevant projects:

- Safety@Sea http://www.northsearegion.eu/iiib/projectpresentation/details/&tid=34&theme=2
- EfficienSea - http://efficiensea.org/ appointed flagship project within the EU Strategy for the Baltic Sea Region.
- MonaLisa - http://www.sjofartsverket.se/en/MonaLisa/
- ACCSEAS - http://www.accseas.eu/
-

2. Danish Geodata Agency:

The Danish Geodata Agency (Geodatastyrelsen) ensures that geographical information about land and sea is collected, quality checked and made accessible on the internet. Information such as the location of roads, houses, lakes and streams or what the landscape looks like and where boundaries are located. This information is used by public authorities in connection with climate protection, the provision of mobile access to data, information services to citizens and by the Police and emergency services when carrying out their tasks. Geodatastyrelsen's largest customer is the Ministry of Defence.
Geodatastyrelsen houses the Centre of Expertise for Spatial Information for the Ministry of the Environment and thus plays a central role in the organising of the use of shared public data which forms the foundation for a more efficient and modern public sector.
Geodatastyrelsen is responsible for the planning of and production of nautical charts of the waters surrounding Denmark, the Faroe Islands and Greenland, just as Geodatastyrelsen also represents Denmark internationally within the field of geographical information.
Geodatastyrelsen employs approximately 300 people and has its headquarters in Copenhagen.

Databases and Standardisation
The Division Databases and Standardisation main task:
- the standards for spatial data is identified and disseminated
- the workflow and data content - current and historical – harmonized
- data processes and data management quality controlled
- optimizing of database technologies
- ensure that spatial data are provided in a way that makes them suitable for use

Profiles:
Hans Christoph Schreyer:
Male.
Dipl. Ing. Danish Geodata Agency (Geodatastyrelsen)
Founder at Noverra. Former Head of Maritime Data Branch at the Danish Maritime Administration (Farvandsvæsenet). IT Consultant at University Vienna

Jens Peter Weiss Hartmann:
Male.
Senior Advisor Danish Geodata Agency witch also contains the Danish Hydrographic Office. Involved in the implementation of a Danish Marine Spatial Data Infrastructure and Marin Spatial Planning. The Chairman of the IHO Marine Spatial Data Infrastructure Working Group (MSDIWG) and Chairman of the Baltic Sea Marine Spatial Data Infrastructure Working Group (BSMSDIWG) under the Baltic Sea Hydrographic Commission.
Associate professor at Copenhagen Business School

Has been the Head of the Danish Hydrographic Offices at Kort & Matrikelstyrelsen, Head of the Maritime Inspectorate at the Danish Maritime Administration

Relevant projects:

- BLAST 2009-2012
- Safety at Sea 2004-2007
  The project aims at harmonising risk management strategies for the North Sea Region and at transforming these strategies into practical methodologies for spatial planners, decision makers and operational entities dealing with safety at sea. The strategies will be put into practice in six demonstration projects, including classification and risk assessment of oil transport in the North Sea, practical tools on risk management for offshore wind farms, coastal zone management, places of refuge and preparedness and decision making for a maritime rescue coordination centre.
- Baltic Sea ENC Harmonisation
  In 2007, the Baltic Sea Hydrographic Commission (BSHC) formally recognized the need for harmonisation of the ENCs covering the Baltic Sea. It established an ENC Harmonisation Working Group (BSEHWG) to review the inconsistencies between Baltic Sea ENCs and to propose actions to resolve them. The work resulted in 17 recommendations for improving the member states' ENC consistency, and most were aimed at the ENC producers.

3. Danish Meteorological Institute:

The Danish Meteorological Institute (DMI) was established in 1872. More than 130 years later in 2013, the institute employs 350 people. DMI is an institution under the Danish Ministry of Climate, Energy and Building and has an annual turnover of approx. 285 million Danish Kroners.

DMI provides meteorological, oceanographic and climate services in the Commonwealth of the Realm of Denmark, the Faroe Islands, Greenland, and surrounding waters and airspace. The services include forecasting and warnings and monitoring of weather, climate and related environmental conditions in the atmosphere, on land and at sea. Purpose of all activities is to safeguard human life and property. DMI's many activities also act as background knowledge in terms of planning and decision-making in economic and environment sectors - especially within transport and industry businesses. DMI collects and processes meteorological, climatological and oceanographic measurements/observations, and measures, collects and compiles related geophysical parameters throughout the Realm. Conducting research and development within its area of expertise, DMI ensures efficient operations and state-of-the-art quality in all productions while monitoring and conducting research on global warming and the stratospheric ozone balance.

Profiles:
Jun She, Male, Ph.D. in 1991 on climate dynamics. Science Manager of DMI Centre for Ocean and Ice, expertise on ocean-wave forecasting technology, data assimilation, seasonal forecasting, ensemble forecasting and statistical analysis, optimal design of observational networks. Coordinators of FP projects YEOS and ODON. Board member of MyOcean and Chair of EuroGOOS Scientific Advisory Working Group.

Jens Murawski, Ph.D. in 2006 on physical oceanography, expertise on ocean-wave-ice forecasting skills. Participation in EU project BalticWay, MyOcean2, ECOOP and MONALISA 2.0 etc.

Nicolai Kliem, Male, Ph.D. in 1999 on physical oceanography, Head of Section for Ice Service and Remote Sensing. Expertise on ice modeling.

Mads Hvid Ribergaard, Male, Ph.D. in 2004 in physical oceanography. Senior scientist, Expertise on Arctic operational modelinng by using HYCOM-CICE and oceanography processes in Greenland waters.

Jacob Woge Nielsen, Male, MSc in 1988 in physical oceanography, senior scientist, expertise on Baltic-North Sea operational modelling and data processing.

Till A. S. Rasmussen, Male, Ph.D. in 2009 in physical oceanography. Expertise on Arctic ocean-ice modelling and HYCOM/CICE model.

Keld Quistgaard, Male, senior advisor on ice service, expertise on ice mapping, service and user training.

Relevant publications:

- DMI forecast service on ocean-ice-waves for the Baltic-North Sea and Arctic region;

http://ocean.dmi.dk/anim/index.php;
http://ocean.dmi.dk/models/index.php;
http://ocean.dmi.dk/validations;

- DMI Ice chart service:

http://www.dmi.dk/hav/groenland-og-arktis/iskort/

- Fu W., J. She, and M. Dobrynin, 2012. A 20-yr reanalysis Experiment in the Baltic Sea Using three Dimensional Variational (3DVAR) method. doi:10.5194/osd-9-1933-2012
- Rasmussen, T.A.S, N. Kliem, and E. Kaas, 2011; The effect of climate change on the sea ice and hydrography in Nares Strait. Atmos. Ocean, doi:10.1080/07055900.2011.604404
- She J., P. Berg and J. Berg, 2007. Bathymetry impacts on water exchange modelling through the Danish Straits. J. Mar. Sys. 65, 450-459
- She J. and J.W. Nielsen, 1999: Operational wave forecasts in Baltic and North Sea. Danish Meteorological Institute, Science Rep. 99-07, pp27

Relevant projects:

- BalticWay (BONUS)
- MyOcean (EU FP7)
- MONALISA2
- PolarIce (EUCISE2020)

Significant infrastructure/technical equipment:

DMI is the only METOC data provider, including both testbed and operational data production and provision. The products need to be high resolution, high quality and with uncertainty estimates which will be estimated from forecast ensembles. This can only be fulfilled by using high performance computing. DMI's in-house supercomputer will be used in EfficienSea 2 project. In 2015, current Cray XT5 will be upgraded with a faster super computer.

Supporting documentation:

Navigation in ice-covered waters faces significant challenges in maritime safety. DMI's ocean-ice-wave forecasting systems for Baltic and Arctic regions have served areas for more than a decade. In EfficienSea 2, this capacity will be further developed aiming at securing e-navigation. This includes, e.g., better horizontal resolution in ice-covered waters, better quality of ice prediction, new integrated service products with icebergs, visibility and waves, and provision of ensemble forecasts.

4. Estonian Maritime Authority:

The Estonian Maritime Administration (EMA) is a governmental authority that operates within the area of government of the Ministry of Economic Affairs and Communications. Our principal aims are to ensure safe navigation in Estonian territorial and inland waters, perform Flag State Implementation and Port State Control activities. One of the methods to ensure safe navigation is to provide mariners with Maritime Safety (MSI) and hydrographic information about Estonian territorial an inland waters. EMA is responsible for the majority of Estonian aids to navigation.

Profiles:

Alar Siht – the Head of the Development Department who will be behind resources and IT development:

Family name	SIHT
First name	ALAR
Gender	Male
Birth	31st of July 1951
Education	
1969 – 1974	Tallinn Technical University, diploma obtained: electrical engineer
1958 – 1969	Pärnu Koidula Gymnasium
Career	
1993 – 2014	Estonian Maritime Administration, head of development dept.
1992 - 1993	Private company, commercial director
1991 - 1992	Institute of Cybernetics, leading constructor
1990 - 1991	Estonian Ecology and Marine Research Institute, leading scientist on research vessel
1983 - 1990	Academy of Science, senior engineer, leading scientist on research vessel
1974 – 1983	Computing Centre of Planning Committee, senior engineer, head of group
Experiences	
2002 – 2014	HELCOM expert working group for mutual exchange and deliveries of AIS data (AIS EWG);
2010 – 2012	EfficienSea
2002 – 2004	VTS for Tallinn and Muuga Bay, project manager
Languages	Estonian (native) English (speaking and writing) Russian (speaking and writing) Finnish (speaking)

Leo Käärmann – who will be responsible for information systems:

Name	Leo Käärmann
Gender	Male
Birth	10-th of September 1950, Estonia
Education	Tartu University, physicist - teacher of physics, 1969 - 1975 Sindi Gymnasium, 1958 - 1969
Career	Estonian Maritime Administration, 1993 - Development dept, specialist, 1993 - 2004 Hydrography and Aids to Navigation Division, deputy head on technical matters, 2004 - Responsibility: deveopment of technology and equipment supply for hydrography, marine cartography, waterways and aids to navigation with focusing to development of information systems, data bases and software applications for the above-mentioned domain Estonian Marine Institute, 1985 - 1993 Sector of marine optics, sen engineer Laser Diagnostics Instruments, engineer, 1991 - 1993 Specialist Design Office Desintegraator, sen engineer, 1979 - 1985 Institute of Experimental Biology, sen engineer, 1976 - 1979 Harju Distance Learning High School, teacher of physics, 1976 Tartu University, Laboratory for Research of Electric Aerosol, engineer, 1975
Experiences	IALABATT / IALALITE, 2000, 2004, 2008 EfficienSea, 2008 - 2011
Award	White Cross Order of Merit, fourth class, 2005
Language	Estonian, native Russian, speaking and writing English, speaking and writing

Tiit Palgi – who has experiences on Aids to Navigation:

Name	Tiit Palgi
Gender	Male
Birth	19th of December 1975
Education	2000-2001 Tallinn University BSc. on Hydrography
	1994 – 1998 Estonian Maritime Academy (nowadays a part of Tallinn University of Technology), specialty: Hydrography
Career	1998 – 2014 Estonian Maritime Administration, Aids to navigation Department as a specialist, engineer, senior engineer, head specialist
Experiences	2002 – 2003 HELCOM expert working group for mutual exchange and deliveries of AIS data (AIS EWG);
	2008 IALA FloatAid workinggroup;
	2008 IALABATT / IALALITE;
	2010 – 2012 EfficienSea
	2012 IALA WORKSHOP on SHORT RANGE ATON
Languages	Estonian (native)
	Russian (speaking)
	English (speaking and writing)
	Finnish (speaking)

Relevant publications:

- Synthetic AIS AtoN service (30 navigational buoys since 2011)
- AIS ASM service, hydro-meteorologic AIS M8 message, RTK GNSS corrections over AIS channels
- Web portal of Estonian marine weather stations, incl. wave data acquired by means of navigational buoys

Relevant projects:

- EfficienSea
- SafeSeaNet
- Maritime Single Window
- Reference Vessel Data Base

Significant infrastructure/technical equipment:

EMA's system for AtoN remote control, monitoring and operations containing 350 outstations (incl. 5 buoy tenders) with built-in synthetic AIS AtoN capability and with enhanced telematic features

5. Finnish Transport Agency

The Finnish Transport Agency (Liikennevirasto) is a government agency operating under the Ministry of Transport and Communications, and it is responsible for maintaining and developing the standard of service

in the transport system's traffic lanes overseen by the government. Agency's responsibilities include:

- to maintain and develop the traffic system jointly with the other actors in the field;
- to maintain the government's road and rail networks as well as the waterways under our control and to consolidate measures directed at them and directing and supervising waterways maintenance all over the country;
- to implement vital road projects and to plan, design, maintain and construct railroads and waterways;
- to direct the road maintenance operations of the regional centres for economic development, transport and the environment ;
- to participate in reconciling traffic and land use;
- to control and develop traffic management in the government's traffic lanes and in the waterways;
- to ensure winter navigation;
- to develop and promote transport services and the functioning of the markets for them;
- to improve the performance of transport infrastructure management;
- to develop the operational preconditions for public transport and to grant maritime subsidies and subsidies for the other transport modes;
- to update and develop hydrography;
- to safeguard that the transport system is working also under abnormal conditions and in exceptional situations under normal conditions.

The Finnish Transport Agency is in Finland responsible for the development and provision of VTS-services, MSI and other information services to vessels, vessel reporting systems (including NSW) and AtoN services. We also maintain the national AIS network and related infrastructure.

Profiles:

Ms Kaisu Heikonen (1966), project coordinator, has M.Sc. degree in Electronic Engineering from the Helsinki University of Technology (1991). She has been employed by the FTA and the former Finnish Maritime Administration since 1991. Her main duties have been connected to maritime radio navigation, information and communication systems. She has been actively involved in international standardisation of maritime information systems since 1999.

Mr Mikko Klang (1972), ENSI service expert, is a Master Mariner. He has been working as a Navigation Officer at Neste Shipping tankers 2007-2011 and as Safety Management System developer at Neste Shipping HQ 2010-2012 (UKC updates, Route Planning software dev., Navigational CSA, ECDIS manual dev., etc.). He has been the Tanker Safety/ ENSI implementation project manager at John Nurminen Foundation from 2012 and ENSI Project manager at FTA from 2013.

Relevant publications:

ENSI service in the Gulf of Finland area (http://www.puhdasitameri.fi/en/ensi-service).

Relevant projects:

EU projects:

- EfficienSea (http://www.efficiensea.org)
- Monalisa 2.0 Sea Traffic Management (http://monalisaproject.eu),
- MARSUNO (http://www.marsuno.eu),
- Co-operation Project (http://www.coopp.eu)

Significant infrastructure/technical equipment:

ENSI Service server for route checks and route exchange.

6. Maritime Office of Gdynia

Maritime Office Gdynia (MOG) is representing Polish Maritime Administration. It governs and supervises national maritime networks of DGPS-PL, AIS-PL, Safe Sea Net, VTS Gdansk Bay and Center of Marititme Safety in Gdynia.
MOG was a stakeholder of many EU Projects like: EfficenSea1, Suny, Baltic Master , MARSUNO, BRISK.

The main task of MOG is mainly focus on general maritime safety. Detailed tasks are: Spatial planning, control of maritime traffic, to maintain Aids to Navigation systems (DGPS, AIS, Lighthouses, Buoys), Enviroment supervision, Port State Control and other duties like:.

- maritime safety , VTS operation,
- the designation of sea routes, anchorages and testing conditions of navigation
- protection of ports and shipping non-military tasks, particularly the prevention of acts of terror and the consequences of an such events;
- safety-related research, coordination of exploration of mineral resources of the seabed;
- protection of the marine environment
- maintenance of marine aids to navigation
- organization of marine pilotage
- monitoring and reporting on marine traffic;
- recording of cargo and passengers
- There are few ships, several crafts and two air-planes at MOG disposal.

Profiles:

Jan Mlotkowski:
MSc. Eng.; Director for Aids to Navigation Affairs.
Professional profile: An Engineer with over 20 years of experience in hydrography and construction of maritime monitoring systems. Possesses analytical and management skills that allow for planning, integration and implementation of various systems and applications.
Profession: Engineer of fishery and environment protection.
Education:

- Technical Academy in Olsztyn, MSc Eng
- Gdansk Foundation for Management Development
- Gdynia Maritime University

Work experience:

- Polish Hydrographic Office RP – specialist and senior specialist in Department of Marine Hydrography,
- Maritime Office in Gdynia (MOG) - manager in Marine Safety Information Exchange Center,
- MOG, Maritime Traffic Department – chief specialist responsible for marine projects,
- MOG, Director for Aids to Navigation Affairs.

Over the past 15 years experienced in relation to maritime safety monitoring systems. Involved to the project of construction first VTS system in Bay of Gdansk (2000 – 2003). Since 2009 responsible for Aids to Navigation Affairs, including the technical maintenance and development of IT, radionavigation and maritime monitoring systems in Maritime Office in Gdynia.
Member of international organisations:

- IALA – delegate, coordinator of Polish membership,

Marek Ledochowski:
MSc. Eng., Head of Navigation Department – Navigation Manager
Professional profile: An Electronic Engineer with over 40 years of experience in managing aids to navigation since gas operated equipment on buoys through solar power supply systems to AIS and DGNSS. Possesses analytical skills and practice that allow for planning, integration and implementation of various equipment and applications.
Profession: Engineer of Electronics,Telecommunication.
Education:

- Technical University of Gdansk, Dept. of Electronics, MSc Eng.

Work experience:

- Maritime Office Gdynia – managing, designing, applying aids to navigation systems,
- Nigerian Ports Authority – Communications Engineer,
- Polish Hydrographic Office RP – managing Polish aids to navigation systems,
- Author of many technical innovation projects and expertises related to safety of maritime navigation.

Member of international organisations:

- IALA - since 1974, currently member of Aids To Navigation Management Committee,
- HELCOM – since 2002, national contact person of AIS Expert Working Group,
- European Maritime Radionavigation Forum – member, former v-ce Chairman

Marek Dziewicki:
MSC. Eng, Head of AtoN Technique and Radionavigation Systems Division
Employment history:

- Since 1997 Head of AtoN Technique and Radionavigation Systems Div. , Maritime Office Gdynia , Poland, Aids to Navigation Department.
- 1996-2006 Specialist - Electronic Eng. , Navigation Dept., Maritime Academy of Gdynia
- 1994-1997 Senior Specialist, Navigation Dept., Polish Hydrographic Office
- 1978-1994 R&D Eng. , Institute of Hydrotechnique, Polish Academy of Sciences
- 1972-1977 Senior Assistant, Institute of Telecommunication, Gdansk University of Technology

Education history:

- 1972 Master of Science degree in Applied Digital Telemetry Gdansk University of Technology

Scientific and technical qualifications:
Publications: Author or co-author of more than 10 scientific articles and publications in the field of applied electronic instruments and radionavigation (GPS, DGNSS, AIS)
Author or co-author of more than 35 R&D technical documents and studies related to radionavigation systems deployment, field measurements, radio propagation, and AIS networks.
International organisations:

- 1995- 2014 representative of MOG and Polish Maritime Administration to IALA, (R-NAV, e-NAV)
- since 2001 representative of MOG and Polish Maritime Administration HELCOM AIS Expert Working Group (since 2014 vice-chairman).

Technical Qualifications and Experience:

- National radio-navigation and AIS systems and networks planning , design and implementation,
- Signal monitoring, coverage and propagation measurements, accuracy verification, field measurements and test-bed organisation,
- Signal and System availability and integrity,
- AtoN monitoring systems, telemetry, hydro-meteo sensors.

Participation in European projects:

- 2009-2010 Baltic Master I, II
- 2009-2012 Efficient, Safe and Sustainable Traffic at Sea – EfficienSea

Grzegorz Zacharczuk:
Senior Specialist (HELCOM, AIS-PL Administrator)
Employment history:

- Since March 2010 Senior specialist, AIS-PL Administrator, Aids to Navigation Technique and Radionavigations Systems Division, Maritime Office Gdynia
- December 2008 – October 2009, Engineer at IT construction site, Elektromar Sp. z o.o. Gdynia
- June 2007 – October 2008, Asseco Systems S.A. Warszawa, Technical Service Eng.

Education history:

- December 2006: Master of Science degree; Electronics and Telecommunication; Specialization in Optoelectronics;
- MSc. Eng dissertation: Spectroscopic methods in plasma diagnostics. Gdansk University of Technology

Scientific and technical qualifications: IT systems and networks, planning design and implementation. Member of the national AIS-PL network implementation team, Administrates and monitors the functioning of the IT infrastructure of AIS system in Poland. Controls the operation of the national radionavigation networks (AIS, DGPS) and its interaction with the networks of other Baltic countries. Supervises servers: database, proxy, regional, national and international in order to maintain data transmission flow, security and business continuity.

Member of the CEPiK (Central Register of vehicles and drivers in Poland) implementation team – coordinator of 16 technical field teams,
Member of the team that implemented 75 field bank facilities
Member of the team that supervise electrical works associated with the preparation, execution and launching of electrical installations, internet, telephone, television and intercom in-built blocks of flats, monitoring the implementation of the above work due to compliance with investor documentation, preparation of as-built documentation.

Developing documentation and alarm procedures. Gives opinions in the context of project documentation and rating of operational security of computerized data to monitor the movement of vessels in order to ensure the required availability of systems, in accordance with national and international recommendations.

Participation in European projects:

- EfficienSea (Efficient, Safe and Sustainable Traffic at Sea), European Baltic Sea Region Project

Relevant publications:

- "Operational and Technical Features of Polish AIS Network",Trans-Nav , XVI-th International Scientific and Technical Conference the Role of Navigation In Support of Human Activity on the Sea, Akademia Morska Gdynia 2008, (M. Dziewicki, M.Ledochowski)
- Modernization of Maritime DGPS in Poland" , Marine Navigation and Safety of Sea Transportation Gdynia Maritime University , 2009 (M.Dziewicki)
- "Position accuracy evaluation of the modernized Polish DGPS", Polish Maritime Research No4(62) 2009, Gdansk University of Technology,(M.Dziewicki, C.Specht)
- "Polish Endorsement of e-Navigation in ongoing Maritime Projects, EUGIN European Group of Institutes of Navigation" (J.Mlotkowski, M.Dziewicki, W.Palka), Gdansk, Poland 2013.
- Integrated Aids to Navigation Management, Monitoring and Information System – Possible Component of e-Navigation-IALA Coference,2010,Capetown-South Africa (M.Ledóchowski,M.Dziewicki,A.Baranowski)

Relevant projects:

- EfficienSea Project Report, WP4 e-Navigation, "Software Tool to Create Synthetic Hydro-Meteo AIS AtoN", Dec. 2011,
- NSMS-KSBM. Maritime Office in Gdynia in cooperation with Polish Maritime Administration and services is leading a project "National System of Maritime Safety" NSMS (Polish acronym: KSBM) which covers a wide range of undertakings to modernize and update systems being applied by Polish Maritime Administration to ensure safety at sea and protection of environment. The system, which complies with relevant international legislation, will be used for permanent monitoring of important marine area as well as for navigation surveillance and supporting decision making process in case of a sea accident or environmental disaster. The KSBM will encompass e-navigation rules covering entire Polish EEZ area . The Project will cover modernization of 3 VTS systems, new national radar system, IT network, radionavigation services like establishing permanent RTK Long Range for hydrography and precise navigation, far field monitoring of DGPS-PL .

Significant infrastructure/technical equipment:

Maritime Office in Gdynia is governmental, national provider of navigation and hydrographic information in international formats like AIS data or/and DGPS as well as owner of the infrastructure of aids to navigation systems.

Having such attributes as EfficienSea1 participation, Maritime Safety Information Exchange System (MARSIS), National Maritime Safety System, AIS and Differential GPS infrastructure, modern spar buoys and dedicated monitoring systems, makes this institution capable of comprehensive approach to maritime cloud as part of e-Navigation infrastructure.

Supporting documentation:

MOG is coordinator of MarSSIES "Maritime Safety and Security Information Exchange System" communication and data exchange platform of several maritime stakeholders. MARSSIES gathers safety related information from maritime systems and presents on common platform. The data available in MARSSIES includes: AIS and radar picture, vessel tracks, static data, hydro-meteo data, aids to navigation (AtoN) status, weather and navigational warnings.

In the future, MARSSIES can deliver information to "maritme cloud"

7. National Institute of Telecommunications:

The National Institute of Telecommunications (NIT) is a modern research & development institution operating in the area of telecommunications and information technology. It conducts development works in the

scope of telecommunication networks and standardization of telecommunication systems and devices. The general mission of the NIT is to serve to the purposes of the development of information society and knowledge-based economy, to provide a scientific, research and technical support to any institutions of the state, and to perform works used in practice by entities operating in the market. In 2005, NIT obtained the status of the National Research Institute, granted to research units, which have the capacity for performing duties, especially important for planning and executing of the State policy. Since the end of the 2011, the Institute is supervised by the Ministry of Administration and Digitization. The main activities of the NIT are:

- Wired and wireless telecommunication infrastructure (access and core);
- Future networks and architectures, internet services;
- Pilot and research networks;
- Network management and data bases;
- Cognitive radio;
- Optical and photonic transmission systems;
- Information, knowledge and decision support systems;
- Spectrum management and electromagnetic compatibility;
- Radio and TV transmission;
- Regulation and economic aspects in telecommunications, postal services and market;
- Metrology.

The key purposes of the NIT are:

- research activities focused on the development of science and practical application of research results;
- autonomy in the research strategy. That strategy is consistent with assumptions of the national and European economic and research policy;
- perfection in scientific activities and application of good practices, as an independent organization holding a neutral position in relation to any stakeholders;
- customer satisfaction - any information obtained from customers and results of any works performed for them are treated as strictly confidential;
- cooperation with research organizations and institutions, thus contribution to the integration of the scientific environment;
- active participation in creation of the European Research Area;
- taking care of scientific, professional and personal development.

Research problems are adjusted to the world and European trends; in particular, it is connected with the participation of the NIT in the EU Frame Programs and other European undertakings.

Among the most important activities of the NIT are: (a) scientific research and development, which cover all areas of telecommunications and (b) statutory works, for instance: surrounding intelligence network, optoelectronics, software engineering, knowledge management, decision support and structural, functional and development aspects of the telecommunication infrastructure. Additionally, works of interdisciplinary nature are carried out, related to such issues as telecommunication law and telecommunication economics. Apart from that, other subjects related to social and economic, legal and technical aspects of information society are undertaken.

Research works are carried out effectively by experienced scientific employees of the Institute (many of whom have scientific degrees and titles) and young people who have open paths for scientific promotion. Institute is equipped with modern research equipment. The National Institute of Telecommunications now employs about 220 persons, among them the team of scientists and experts with high competences in the field of telecommunications and information technology, in its three centers: in Warsaw, Wroclaw and Gdansk.

Publications are a significant result of conducted works. About 200 publications are issued in the Institute every year as articles in journals and papers in conference proceedings, including many published abroad and in respected journals. An important area of the Institute activity are implementations which are often a natural continuation of research work and which bring profits to the Institute.

The National Institute of Telecommunications cooperates with numerous enterprises, organizations, state services and renowned scientific institutions in Poland and abroad. Those contacts are of a various nature, from commercial to scientific ones, based on mutual support, serving purposes of exchange of knowledge and skills and development of innovative solutions.

The Institute is divided into research departments, laboratories, centres and sections. The major entitiy of the NIT involved in this project will be the Wireless Systems and Networks Department in Gdansk. The main tasks of this Department include all the activities regarding:

- Radiocommunication systems;

- Satellite systems;
- Wireless sensor networks;
- Modern transmission techniques;
- Security of wireless transmission;
- Propagation aspects of terrestrial and maritime radiocommunications.

Additionally, among the Wireless Systems and Networks Department's competences are:

- Designing and software simulations of radio networks;
- Utilization of wireless transmission techniques in order to ensure safety on land and at sea, including the eCall system and e-Navigation;
- Measurements of transmission and quality parameters in radio networks;
- Preparation of the analyses and technical documentations;
- Consultation and leadership in technical projects.

The Wireless Systems and Networks Department in Gdansk takes active part in the meetings of COMSAR – the section of the International Maritime Organization (IMO). Recently, the Department has also established a close cooperation with the European Space Agency ESA (the contract for prefeasibility study concerning Satellite AIS was signed in 2013) and the European GNSS Agency.
Considering the topics of the Efficiensea 2 which include the communication infrastructure and technologies for e-navigation / e-maritime, it can be stated that National Institute of Telecommunications (including its Wireless Systems and Networks Department in Gdansk) has the expertise and qualifications required to take active part in this project.

Profiles:

Krzysztof Bronk, PhD
EMPLOYMENT HISTORY:
Since July 2010, Associate Professor

- Wireless Systems and Networks Department
- National Institute of Telecommunications (NIT)

May 2008 – June 2012:

- Software Developer and Radiocommunication Scientific Consultant
- Radiocommunication Systems and Networks Department
- Gdansk University of Technology

May 2006 – July 2010:

- Radiocommunication Engineer
- Maritime Radiocommunication Department
- National Institute of Telecommunications (NIT)

EDUCATION HISTORY
June 2010 Doctor of Philosophy degree:

- Specialization in Radiocommunication
- Doctoral dissertation:
- Study and analysis of the secure HF data transmission
- National Institute of Telecommunications (NIT)

September 2006Master of Science degree:

- Specialization in Radiocommunication Systems and Networks
- MSc dissertation:
- Positioning effectiveness study of the mobile terminals in the radiocommunication networks
- Gdansk University of Technology

SCIENTIFIC AND TECHNICAL QUALIFICATIONS
Publications
Author or co-author of more than 30 scientific articles and publications
Author or co-author of more than 20 R&D technical documents and studies
Technical Qualifications and Experience
Programming languages familiarity: C, C++, JAVA, Pascal, PHP, Python, Matlab
Software developer experience in: multithread and object oriented applications; graphics programming; scientific simulations; measurement and device controlling applications
R&D experience in: radiocommunication systems and networks designing and planning;
Software Defined Radio systems development; multi-antenna technology (MIMO); cryptography; propaga-

tion analysis; transmission and coding techniques; positioning systems and techniques
Technical experience in: radiocommunication systems deployment, measurement and testing procedures; measurement and testing equipment; radiocommunication standards, recommendations and equipment.
Main team member or leader in the following R&D projects:

- Automatic positioning system for specialized usage, R&D grant no. O R00 0150 11
- Prototype laboratory stand for detecting DSSS signals, R&D grant no. O R00 0006 04
- Wideband spread spectrum wireless link demonstrator for the ad-hoc networks, R&D grant no. O R00 0049 06
- Spread spectrum transmission interference demonstrator, R&D grant no. O R00 0008 08
- Cellular and satellite systems signal analysis demonstrator, R&D grant no. O R00 0028 09
- Evaluation methodology for the eCall system, grant no. NR10-0016-06/2009
- Fast HF data transmission (SDR platform development), NIT's statutory work
- The concept of the secure HF data transmission system, NIT's statutory work
- Maritime radio propagation analysis tool implementation, NIT's statutory work
- The demonstrator of the self-organizing, wireless sensor network, NIT's statutory work
- Wireless networks management system design, NIT's statutory work
- Maritime VHF radio propagation conditions analysis based on the real measurement data, NIT's statutory work
- EfficienSea (Efficient, Safe and Sustainable Traffic at Sea), European Baltic Sea Region

Adam Lipka, PhD
EMPLOYMENT HISTORY
Since November 2013 Associate Professor
Wireless Systems and Networks Department
National Institute of Telecommunications (NIT)
November 2007 – November 2013 Assistant
Maritime Radiocommunication Department / Wireless Systems and Networks Department
National Institute of Telecommunications (NIT)
January 2006 – November 2007 Radiocommunication Engineer
Maritime Radiocommunication Department
National Institute of Telecommunications (NIT)
EDUCATION HISTORY
2013 Doctor of Philosophy degree
Specialization in Radiocommunication
Gdansk University of Technology
2005 Master of Science degree
Specialization in Radiocommunication Systems and Networks
Gdansk University of Technology
SCIENTIFIC AND TECHNICAL QUALIFICATIONS
Publications
Author or co-author of over 40 scientific publications (articles, reports, etc.)
Technical Experience
• Participation in European projects:
o 2009-2012 Efficient, Safe and Sustainable Traffic at Sea – EfficienSea
• Participation in projects granted by Ministry of Science and Higher Education
o 2009-2011 Evaluation methodology for the eCall system - The aim of this project was to develop a simulator of eCall device, and to test the correctness of eCall messages (MSD/FSD) transmission via cellular networks to alarm the number 112 centers, with respect to conformity with proper standards and specifications.
• Participation in projects financed by the statutory funds of the Ministry of Science and Higher Education:
o 2006 – "The concept of a universal GALILEO signal receiver for the purpose of a maritime navigation"
o 2007 – "GALILEO-based applications and services for the purpose of maritime radiocommunications"
o 2007 – "Fast data transmission in the HF band"
o 2008-2010 – "The transmission methods analysis in the multiple input multiple output (MIMO) systems"

o 2011 – "Development of the self-organizing wireless sensor networks for monitoring hydro-meteorological conditions at sea"
o 2012 – "The Internet of Things technology – architecture, protocols, applications"
o 2013-2014 – "The management of wireless networks"
Technical Qualifications:
• Software development in C/C++, Matlab;
• R&D experience in: radiocommunication systems and networks designing, MIMO systems, modern transmission and coding techniques, satellite systems, propagation analysis;
• Familiarity of wide range of radiocommunication standards (GSM, UMTS, LTE, WiFi 802.11.X, WiMAX);
• Foreign language – English (fluent and spoken, including technical vocabulary

Rafał Niski, PhD
EMPLOYMENT HISTORY
Since 2001 Maritime Radiocommunication Department / Wireless Systems and Networks Department
National Institute of Telecommunications (NIT)
• Since 2006 – Associate Professor
• 2005 – 2013 – The Manager of the Department
EDUCATION HISTORY
2006 Doctor of Philosophy degree
National Institute of Telecommunications
Specialization in Radiocommunication
2001 Master of Science degree
Specialization: Mobile Radiocommunications Systems, Gdansk University of Technology
R&D QUALIFICATIONS
• Author or co-author of over 90 scientific publications (articles, reports, papers)
• Member of the Scientific Council of the National Institute of Telecommunications since 2007.
• R&D projects in the field of radiocommunication systems, digital signal processing in radiocommunications, conducted in the National Institute of Telecommunications as statutory work:
o Development of the self-organizing wireless sensor networks for monitoring hydro-meteorological conditions at sea, work no. 08300011,
o Development of the hardware communication module for the self-organizing wireless sensor network, work no. 08300050,
o Possibilities analysis of the satellite communications usage as a satellite hyper cells for the 2G/2G/4G systems, work no. 08300039
• Other R&D projects:
o Cellular and satellite systems signal analysis demonstrator, R&D grant no. O R00 0028 09
o Evaluation methodology for the eCall system, grant no. NR10-0016-06/2009
o EfficienSea (Efficient, Safe and Sustainable Traffic at Sea), Baltic Sea Region Programme 2007-2013
• R&D and technical experience:
o software development in C/C++.
o radiocommunication systems and networks design and planning, Software Defined Radio systems development; radio propagation analysis; transmission and coding techniques,
o measurement and testing equipment and procedures; radiocommunication standards.
• Foreign language - fluent written and spoken, technical vocabulary.

Jerzy Żurek, PhD
CURRENT EMPLOYMENT
Since 2005 Associate Professor
Maritime Radiocommunication Department / Wireless Systems and Networks Department
National Institute of Telecommunications (NIT)
• Since 2013 – The Manager of the Department
Since 2005 Associate Professor
Faculty of Electrical Engineering of the Gdynia Maritime University
EDUCATION HISTORY
2005 Doctor of Philosophy degree
Specialization in Radiocommunication

Gdansk University of Technology
Dissertation: "Analysis and investigations of Frequency Hopping performance in the GSM system"
1990 Master of Science degree
Specialization in Maritime Radioelectronics System
Gdynia Maritime University
Dissertation: "Simulation of digital radiocommunication channel with slow Nakagami fadings"
PROFESSIONAL EXPERIENCE
Since 1992 employed at the Faculty of Electrical Engineering of the Gdynia Maritime University
1992-1997 Radioofficer, Radioelectronics Officer, Scientific Officer and Masters Assistant at the Polish tall ship "Dar Mlodziezy"
1994-1997 member of Polish National Examination Commission for Radiocommunication Certificates, also for GMDSS
1995-1998 participation in the work on IMO (International Maritime Organization) Model Course for Radioelectronics in GMDSS
Since 1998 member of Polish Government delegation to IMO Comsar Sub-committee in London
Since 2000 coordinator of Erasmus/Socrates European programme at the Faculty of EE of Gdynia Maritime University
2000-2005 chairman of Polish IMO COMSAR team
2002 organized and chaired 12th session of Baltic Barents Sea regional Conference on the GMDSS
Since 2005 cooperates with Space Research Centre of the Polish Academy of Sciences, involved in Galileo project monitoring
• Member of many IMO Working and Correspondence Groups: for Satellite Communication and LRIT, GMDSS, e-Navigation, etc.
• Involved in cooperation with the Ministry of Administration and Digitization and Office of Electronic Communications in the fields of spectrum management and ITU and CEPT cooperation.
In the recent years he was involved in the R&D projects in the field of radiocommunication systems, digital signal processing in radiocommunication – financed and conducted in the National Institute of Telecommunications:
• Development of the self-organizing wireless sensor networks for monitoring hydro-meteorological conditions at sea, project no. 08300011,
• Development of the hardware communication module for the self-organizing wireless sensor network, project no. 08300050,
• Analysis of the satellite communications utilisation as a satellite hyper cells for the 2G/3G/4G systems, project no. 08300039.
Other R&D projects financed from the European Programmes and national grants:
• European project EfficienSea (Efficient, Safe and Sustainable Traffic at Sea), Baltic Sea Region Programme (2009-2012)
• Cellular and satellite systems signal analysis demonstrator, national R&D grant no. O R00 0028 09 (2010-2012)
• Evaluation methodology for the eCall system, grant no. NR10-0016-06/2009 Programme 2007-2013 (2009-2011)
Involved in cooperation with the Ministry of Administration and Digitization and Office of Electronic Communications in the fields of spectrum management and ITU and CEPT cooperation.
Author or co-author of over 110 scientific publications (papers, reports, etc.) and reports for Polish Administration.

Relevant publications / products and services:
Selected publications:

- Bronk K., Grzybkowski M., Niski R., Żurek J., Validation of the ITU 1546 land-sea propagation model for the 900 MHz band, Military Communications and Information Technology: A Trusted Cooperation Enabler Volume 2, Wydawnictwo Wojskowej Akademii Technicznej, 2012, s. 215-226
- Bronk K., Katulski R. J., Lipka A., Propagation Analysis of the Point-to-Point Radio Links Operating in the EHF Band, Polish Journal of Environmental Studies, Vol. 18, No. 4B, HARD, Olsztyn 2009, str. 12-16.
- Bronk K., The Concept of the Secure HF Data Transmission, Polish Journal of Environmental Studies, Vol. 18, No. 4B, HARD, Olsztyn 2009, str. 7-11.
- Bronk K., Katulski R., Lipka A., Radio Wave Propagation Conditions for Terrestrial Radiocommunications in the EHF Band, Electronics and Telecommunications Quarterly, Polish Academy of Sci-

ences, Vol. 54, No 1, pp. 81-96, 2008.

- Bronk K., Katulski R., Lipka A., Stefański J., An overview of Multiple-Input Multiple-Output (MIMO) systems, Electronics and Telecommunications Quarterly, Polish Academy of Sciences, Vol. 53, No 3, pp. 273-289, 2007.

Products and services:

1. Software tool for radio networks planning. This professional tool was created and developed by a team of highly competent engineers working for the NIT. Its main purpose is to facilitate radio networks planning, including the calculations of useful coverage and interference range – for any possible configurations of the base stations, terminals and propagation environments (outdoor, indoor, deep indoor, etc.).

The planning process in this tool can be carried out for the following digital and analog radio solutions: (a) cellular (2G, 3G and LTE); (b) trunking, broadcast, WLAN and WMAN networks; (c) VHF, UHF, SHF point-to-multipoint systems as well as (d) SHF and EHF point-to-point systems.

The tool utilizes digital elevation models (DEM): (a) SRTM-3 maps – resolution for Poland approximately 60x90 m, (b) ASTER maps – resolution approximately 20x30 m, (c) external DEMs. The calculations can be performed for a resolution higher than the native map's resolution – through oversampling. The tool also enables to use a 3D layer of buildings and landuse classes. Besides the coverage analysis, it is also possible to carry out the terrain profile's visualizations (including the buildings and landuse). It is also possible to conduct the planning on the basis of fantom-type equipment model or for any specific equipment.

2. Mobile platform for the measurement of the radiocommunication systems' quality parameters. This hardware platform was developed by the NIT (in the Wireless Systems and Networks Department in Gdansk) to enable the measurements and analysis of the wide range of systems, including the GSM, UMTS, HSPA, WiMAX and LTE. The platform is fully mobile so it is particularly suitable for any kind of measurements conducted in the field and in hard conditions. Generally, the platform is comprised of: (a) laptop with a control software, (b) GSM/UMTS/LTE module, (c) GPS module and (d) programmable spectrum analyzer with a measurement antenna.

The main purpose of the platform is to obtain and store several quality and identification parameters of the networks mentioned above. The most important of those parameters are: maximum, minimum and mean throughput in the uplink/downlink, average latency, average jitter, packet loss ratio, BSIC, Cell ID, RSSI, Ec/Io, etc. The measurement methodology of those parameters is fully compliant with appropriate standards, norms and recommendations.

3. Additionally the staff of the Wireless Systems and Networks Department in Gdansk has created a big number of technical reports, expert opinions, studies and other documents covering a wide range of subjects relevant to the contemporary radiocommunication techniques. The most important recent study performed in the Gdansk branch of the NIT was dedicated to the problem of the wind farms influence on the radiocommunication and radar systems performance.

Relevant projects:

International projects:

- EfficienSea – Efficient, Safe and Sustainable Traffic at Sea (2009-2012). The project financed by European Regional Development Fund was realized in a consortium gathering 16 partners from six countries around the Baltic Sea. EfficienSea was an Interreg project aiming at improving the Baltic Sea with focus on the environment and the safety of navigation.
- Collaborative Project ALICANTE– Enlarge MediA Ecosystem Deployment through Ubiquitous Content-Aware Network Environments – Enlarged EU (FP 7) (2011-2013). The aim of the project was to provide content-awareness to the network environment, network and user context – awareness to the service environment, and adapted services/content to the end user for one's best service experience possible.

Projects supported with the European Regional Development Fund: Innovative Economy Operational Program 2007-2013:

- Computer platform for propagation analysis, electromagnetic compatibility and optimization of wireless networks in telecommunication and data communication systems – PIAST (2010-2014) - the sole project executor. The aim of the project is to develop and establish the full computerized software system (including hardware clients - server architecture) which can be used by NIT experts for research and business activities, academic institution for educational purposes, and other companies or individuals accessing to the project Web page for tutorial and other commercial reasons. In 2011, the project received Award of the Ministry of Science and Higher Education

National projects funded by Ministry of Science and Higher Education:

- Next generation data communication services and networks – technical, application and market aspects (2008-2010) - project coordinator. The goal of this project was to prepare tools and procedures enabling the implementation of solutions which are necessary for the state and self-government development and being competitive on the market. NIT has played an important role in several subjects: decision support systems, electromagnetic compatibility, traffic management in IP nets, metrology and monitoring, digital radio networks, design tools and methods.
- Mobile laboratory for functions and quality testing of electronic communication services to be used by command and communication teams (2010-2012) - project coordinator. The general aim of the project realized with Military Communications Works was the improvement of telecommunication networks efficiency, especially the networks that are important for public security. Final product of the project is a prototype of mobile laboratory designed for operation in real environment in which the services are utilized.

Significant infrastructure/technical equipment:
Wireless Systems and Networks Department in Gdansk is very active in the field of satellite communication and navigation systems. In the year 2013, a close cooperation with the European Space Agency (ESA) and European GNSS Agency was established. In the second half of the year, a first contract for prefeasibility study concerning Satellite AIS was signed. Since 2013, the Department has been representing Poland in the EU Satellite – AIS Collaborative Forum and cooperating closely with the European Maritime Safety Agency concerning the European Satellite AIS. Additionally, the Wireless Systems and Networks Department owns an infrastructure and equipment relevant to the topic of the EfficienSea 2 project, including the mobile platform for the measurement of the radiocommunications systems' parameters (described above) and the calibrated, professional measurement equipment (spectrum analyzer, signal generators, cables, antennas, etc.).
The Internet Architectures and Applications Department leads the work package which is responsible for the development of experimental environment (called PL-LAB), which is a nationwide distributed laboratory (open access), built by eight leading Polish research and academic centers. Partners associated in PL – LAB can apply for a virtual laboratory, which is created with particular devices located in different sites and VLANs established between them. PL – LAB equipment enables performing tests in various scopes (network protocols, applications, etc).
Electromagnetic Compatibility Department is mainly focused on development and standardization of new digital radio technology: LTE, Cognitive Radio, White Space Radio Systems, etc.

Supporting documentation:
The representatives of NIT take part in international cooperation and standardization work within CEPT, ITU, ETSI, ECC, IEEE, IEC, CISPR. NIT is a member of ETSI and has a close cooperation with this organization.
NIT collaborates with International Telecommunication Union in the area of radio communications items (technologies, services) and with International Centre for Theoretical Physics in the area of cognitive radio.

8. Swedish Maritime Administration

About the Swedish Maritime Administration
The Swedish Maritime Administration (SMA) offers modern and safe shipping routes with a 24-hour service. We take responsibility for the future of shipping. SMA is a government agency and enterprise in the transport sector and is responsible for maritime safety and availability.
Our services include, for example:

- Pilotage
- Fairway Service
- Maritime Traffic Information
- Icebreaking
- Hydrograpy
- Maritime and Aeronautical Search and Rescue
- Seamen's Service

Our activities focus primarily on merchant shipping, but also take the interests of pleasure boating and fishing into account.
SMA has been lead partner in the MONALISA and MONALISA 2.0 projects, as well as initiating the MICE project together with Chalmers University of Technology.

SMA is responsible for the Swedish Maritime Safety Information (MSI) and coordinator for Navigational Warnings in the Baltic Sea.
Swedish Vessel Traffic Service (VTS) is one of SMA's tasks as well as managing Soundrep SRS in a joint venture between Sweden and Denmark.

Profiles:
SMA's activities in EfficienSea 2 will be the responsibility of the unit for Research and Development at SMA. Per Setterberg is responsible for SMA's part in the application phase (CV attached). Other experts will be involved in the project but names are yet to be decided.

Per Setterberg:

CV Per Setterberg

Master Mariner
Innovation Coordinator
Swedish Maritime Administration

Employment

Innovation Coordinator, Swedish Maritime Administration	2012-
Business Area Manager, Swedish Maritime Administration	2011-2012
Process manager / project manager, Swedish Maritime Administration	2009-2010
Public development projects official , Swedish Maritime Administration	2006-2009
System manager, Swedish Maritime Administration	2004-2006
Deck officer oil and chemical tankers, DP officer offshore	1998-2004

Education

BSc Nautical Science, Merchant Marine Academy, Kalmar, Sweden	1994-1998
Computer Science program, Linköping University, Sweden	1991-1993

Age: 43

Gender: Male

Relevant publications / products and services:

- Swedish Vessel Traffic Service (VTS)

- Soundrep SRS (Sound VTS)
- Hydrography (including Swedish Maritime Safety Information, MSI)

Relevant projects:
- MONALISA and MONALISA 2.0 projects
- MICE project

Significant infrastructure/technical equipment:
- Sound VTS and other Swedish VTS centres.

9. Chalmers University of Technology:

The Department of shipping and marine technology, Chalmers University of Technology AB, Gothenburg Sweden.
The department combines operational research and technical research in the field of maritime operation, ship design, maritime Human Factors and maritime environment. The department is also a maritime academy training ship officers.
The task given to Chalmers is to contribute with competences within maritime Human Factors, maritime operation and navigation, e-navigation concepts, and evaluation of concepts using simulator testing.

Profiles:
Mikael Hägg, Chalmers contribution manager, responsible for Chalmers simulator center and lecturer and expert in the field of e-navigation and navigation systems, long experience in project management and systems engineering, seagoing experience. Education: MSc in Electrical Engineering and BSc in Nautical Science (Master Mariner).

Dr Scott McKinnon, Human Factors expert, Professor (2010-Present), School of Human Kinetics and Recreation, Memorial University of Newfoundland, St. John's, NL, Canada. Visiting Professor at the maritime Human Factors group at the department. His research is about keeping people safe in the workplace. That means health and safety for people who work in marine and coastal jobs, trying to better understand the relationship between physical work exposure and health risk and the impact of participatory ergonomics in the establishment of safe and healthy work environments.

Dr Thomas Porathe, Human Factors expert, Professor (2014- present), Doctor in information design, has been worked as a researcher in several EU maritime projects (Blast, Impact, EfficiencySea, Accseas, MonaLisa). Vice chair in IALA, test bed group.

Linda de Vries, deck officer and oceanographer (Plymouth, 2002) with first degree in Law (Maritime law and international trade) (Oxford, 1998), Linda has worked mainly within hydrographic and oceanographic survey in the North Sea offshore and renewable energy sectors. She joined the Maritime Human Factors group at Chalmers as project coordinator in June 2013.

Reto Weber, simulator instructor, professional experience as captain in command and maritime pilot prior to being employed at Chalmers as lecturer and nautical expert in projects involving simulator research.Education: BSc in Nautical Studies (Master Mariner), MSc in Maritime Affairs specializing in Maritime Safety and Environmental Affairs

Relevant publications:
- de Vries, L. & Praetorius, G. (2014, accepted) Success factors in navigation assistance: a complementary ship-shore perspective. De Waard, D., Brookhuis, K., Wiczorek, R., Di Nocera, F., Barham, P., Weikert, C., Kluge, A., Gerbino, W., and Toffetti, A., (Eds.) (2014), Proceedings of the Human Factors and Ergonomics Society Europe Chapter 2014 Annual Conference
- Lützhöft, M., Lundh, M. & Porathe, T. (2013) Onboard ship management overview system - an information sharing system on board. Transactions of the Royal Institute of Naval Architects 155, nr. C1, s. 11-14.
- Mallam, S. & Lundh, M. (2013) Ship engine control room design: Analysis of current human factors & ergonomics regulations & future directions. Proceedings of the Human Factors and Ergonomics

Society DOI: 10.1177/1541931213571112.
- Porathe, T., Lützhöft, M. & Praetorius, G. (2012) What is your intention? Communicating routes in electronic nautical charts. Procedia - Social and Behavioral Sciences DOI: 10.1016/j.sbspro.2012.06.1292.
- Porathe, T. & Shaw, G. (2012) Working with the human element: Human Factors and technical innovation from EfficienSea and on to ACCSEAS. Proceedings of the International Symposium. Information on Ships, ISIS 2012

Relevant projects:
- EU project Efficiensea
- EU project MonaLisa
- National MonaLisa ICE project
- EU project MonaLisa 2.0
- EU project ACCSEAS
- National project GOTRIS (River Information Service)

Significant infrastructure/technical equipment:
Chalmers Simulator Center contains advanced Full Mission Bridge simulators, Engine simulator, Navigation simulator, GMDSS, DP and Cargo handling simulators. Chalmers Full mission bridge simulators can be fully integrated with SMA:s full mission simulators. Chalmers has a long heritage in conducting usability analysis and concept evaluation using simulation tests.

10. Department of Computer Science, University of Copenhagen:

The Department of Computer Science at the University of Copenhagen (DIKU) hosts undergraduate and graduate studies centered in the fields of Algorithms and Programming Languages, Image Processing and Machine Learning, and Human-Centered Computing, with local inter-disciplinary collaboration with the departments of Physics, Mathematics, Economics, and the Department of Media, Cognition and Communication, as well as a number of international research collaborations. The Department was founded by Turing Award winner Peter Naur, still affiliated as professor emeritus.

The department has approximately 25 permanent scientific staff members, 45 PhD students and 20 post-doctoral researchers. The sustained academic excellence of the department is evident by the consistent high profile of its scientific alumni, amongst others the vice chancellor of the Danish IT University and the director of the Fraunhofer Institute for Software and Systems Engineering in Dortmund. More details are available at http://www.diku.dk.
DIKU will be contributing to WP 3, development of Maritime Cloud, in areas witch are core expertise research areas for the Department: Security, Distributed Systems, and Software Quality.

Profiles:
DIKU will participate with two persons, a senior researcher (Ken Friis Larsen) and a post-doctoral researcher who will be employed for the project.

Ken Friis Larsen (male) is an associate professor in Computer Science with good scientific qualifications, administrative experience, and extensive experience with industrial and cross-disciplinary projects with industrial partners (projects 3gERP, WallViz, and HIPERFIT). He holds a PhD degree from the Technical University of Denmark, and has been the supervisor of more than 25 masters students, co-supervising five doctoral students (including three cross-disciplinary). Friis Larsen has ample management experience, from both academia (serving as the Department of Computer Science's Head of Education) and industry (serving as Manager of Microsoft Innovation Centre). Friis Larsen was invited as an external expert in Property-based testing for the EU project PROWESS's mid-term workshop.

The post-doctoral researcher is not yet employed. But we do not foresee any problems in filling the position with a highly qualified candidate. Usually, when the department has an open post-doctoral position, we get around 70 applications where at least one third are qualified.

Relevant publications:

- M. Magnani, I. Assent, K. Hornbæk, M.R. Jakobsen, and K.F. Larsen. SkyView: a user evaluation of the skyline operator. In Proceedings of the 22nd ACM international conference on Conference on information & knowledge management, CIKM '13, pages 2249–2254, New York, NY, USA, 2013. ACM.
- Michael Flænø Werk, Joakim Ahnfelt-Rønne, and Ken Friis Larsen. An embedded DSL for stochastic processes: research article. In Proceedings of the 1st ACM SIGPLAN workshop on Functional high-performance computing, FHPC '12, pages 93–102, New York, NY, USA, 2012. ACM.
- F. Henglein and K.F. Larsen. Generic Multiset Programming with Discrimination-based Joins and Symbolic Cartesian Products. In Journal of Higher-Order and Symbolic Computation, 2011.
- K.F. Larsen. A MuDDy Experience–ML Bindings to a BDD Library. In Proceedings for Domain-Specific Languages, pages 45–57, volume 5658 of Lecture Notes in Computer Science. Springer, 2009.
- M.I. Nielsen, F. Sudzina, J.G. Simonsen, and K.F. Larsen. Classifying VAT Legislation for Automation. In Proceeding for Das Internationales Rechtsinformatik Symposion (IRIS), February 2009.

Relevant projects:

Friis Larsen has or are participating in the following research projects:

• HIPERFIT: An open research centre in Functional High-Performance Computing for Financial Information Technology. A cross-disciplinary center with industrial partners from the financial industry and the Math department at University of Copenhagen.

• WallViz: esearch project is to use visualization on wall-sized, interactive displays for improving decision making from massive collections of data. The academic project participants address this objective in collaboration with case partners working in healthcare, finance, and sustainability.

• 3gERP: a collaborative strategic research project with partners CBS, DIKU and Microsoft Development Center Copenhagen about establishing the academic and market foundation for developing a standardized, yet highly flexible and configurable global ERP-system for small- and medium-sized enterprises.

11. National Space Institute at the Technical University of Denmark:

The Technical University of Denmark (DTU) is the largest technical university in Denmark with a scientific staff of about 1000, 6000 students preparing for Bachelor or Masters degrees, and 700 Ph.D. students. The research done at the DTU forms the basis for a variety of services and products which are offered to Danish industry, authorities and educational institutions - e.g. technology transfer, advice on space-related matters and supervision of PhD students.

The National Space Institute (DTU Space) is the national institute for space-related activities in Denmark. The Technical University of Denmark The DTU Space conducts research in astrophysics, solar system physics, geodesy, remote sensing and space technology. DTU Space has significant activities within the areas of Earth Observation and polar research. Main application areas are sea level, sea ice, land ice, geodesy, and oceanography. DTU Space has participated in several EU projects and ESA projects on the developments of services for Copernicus. In additipon, DTU Space carries out research in navigation with a focus on utilizing the upcominbg European GNSS GALILEO. DTU Space operates permanent GPS-stations and tide gauges in Greenland, as well as is responsible for overall geodetic infrastructure. In connection with recent EU and ESA projects, DTU Space has participated and led major Arctic field data campaigns.

Profiles:

Professor dr. Per Knudsen (M), Head of the Department of Geodesy at DTU Space. He has participated in several projects on sea level from space for various purposes, such as marine gravity field, mean sea surface, sea level changes, and ocean tides and on combination of space and in-situ data. He has co-authored over 35 papers in peer-reviewed journals. He is coordinator in EU projects GOCINA, GOCINO and LOTUS as well as in ESA projects GUTS and ABSRATE.

Professor dr. Per Høeg (M) has in his scientific career focused on ionosphere research and applications related to satellite navigation systems. Early on he took part in the modelling of the ionosphere for the GPS system together with Dr. Klobuchar at US Air Force Research Laboratory in Boston, USA. Later his modelling activities addressed high-latitude ionosphere conditions in the auroral region and the polar cap, combining models and observations from radars and GNSS receivers on the ground and in space (GPS radio occultations). Since 2004 he has been a professor in Space Physics, Aeronomy, and Satellite Navigation.

Dr. Ole Andersen (M) is a Senior Scientist at DTU Space. He has participated in several projects on sea level from space for various purposes, such as marine gravity field, mean sea surface, sea level changes, and ocean tides and on combination of space and in-situ data. He has co-authored over 75 papers in peer-reviewed journals. He is workpackage leader in several EU projects and recently headed a major Danish project called Hydrograv.

Relevant publications:

1. Cheng, Yongcun, Andersen, Ole Baltazar, and Knudsen, Per. Integrating Non-Tidal Sea Level data from altimetry and tide gauges for coastal sea level prediction. Advances in Space Research (ISSN: 0273-1177) (DOI: http://dx.doi.org/10.1016/j.asr.2011.11.016), vol: 50, issue: 8, pages: 1099-1106, 2012.

2. Høeg, Per, and Carlstrom, Anders. Information content in reflected global navigation satellite system signals. 2nd International Conference on Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems Technology. IEEE, p. 1-5. 2011.

3. Høeg, Per, Prasad, Ramjee, and Borre, Kai. Impact of Atmosphere Turbulence on Satellite Navigation Signals. Satellite Communications and Navigation Systems, p. 231-239, 2008.

4. Johannessen, J. A., Raj, R. P., Nilsen, J. E. Ø., Pripp, T., Knudsen, Per, Counillon, F., Stammer, D., Bertino, L., Andersen, Ole Baltazar, Serra, N., and Koldunov, N. Toward Improved Estimation of the Dynamic Topography and Ocean Circulation in the High Latitude and Arctic Ocean: The Importance of GOCE. Surveys in Geophysics (ISSN: 01693298) (DOI: http://dx.doi.org/10.1007/s10712-013-9270-y), vol: 35, issue: 3, pages: 661-679, 2014.

5. Wickert, Jens; Andersen, Ole Baltazar; Beyerle, George; Cardellach, Estel; Chapron, Bernard; Gommenginger, Christine; Hatton, Jason; Høeg, Per; Jäggi, Adrian; Jakowski, Norbert; Kern, Michael; Lee, Tong; Martin-Neira, Manuel; Montenbruck, Oliver; Pierdicca, Nazzareno; Rius, Antonio; Shum, C. K.; Zuffada, Cinzia. "Innovative Remote Sensing Using the International Space Station: GNSS Reflectometry with GEROS". Proceedings of IGARSS-2014. 2014.

Relevant projects:

- MyOcean 1+2 (EU FP6+7)
- Monarch-A (EU FP7)
- LOTUS (EU FP7)
- C-band Ionospheric modeling (ESA European GNSS Evolution Program)
- Galileo Arctic Testbed (ESA European GNSS Evolution Program)

Significant infrastructure/technical equipment:

- Permanent GNSS stations in Greenland

12. Latvian Maritime Academy:

Latvian Maritime Academy (LMA) is a public higher education institution that provides high quality maritime education and professional training for students studying in the following undergraduate study programmes: Maritime Transport – Navigation, Port and Shipping Management, Marine Engineering and Marine Electrical Automation. LMA also provides a Professional Master's degree in Maritime Transport. LMA is experienced in preparing study programmes, as well as organising and implementing of the study process. LMA has a considerable experience in project management activities, particularly in coordination and financial management of international EU-financed projects, such as LLP Erasmus Mobility, Leonardo da Vinci, Socrates, Baltic Sea Region Programme, et.al

The aim of the Academy is to provide students with a balance of academic education, professional training and practical skills in order to respond to a wide spectrum of needs in the maritime industry. LMA graduates well-qualified mariners in the technical areas of navigation, marine engineering, marine electrical automation, and port management. LMA trains officers for the Latvian Navy.

Maritime Research Institute

The Research Institute is a unit of Latvian Maritime Academy. It complies with the Law on Science and the Law on Higher Education Institutions, resolutions passed by the Academic Senate, Statutes of the Research Institute and other regulations. The general meeting of scientists which gathers all the staff with doctoral

degree employed by the Institute is its highest decision-making body. The competence of the Scientific council elected at the general meeting includes the following:

1. the elaboration of the guidelines for Institute's activities;
2. the election of Institute's director and research fellows;
3. the adoption of regulations dealing with internal activities of the Institute;
4. other aspects mentioned in the legislation.

The director is the highest officer who represents the Institute and whose area of responsibility includes as follows:

1. providing the resources for the activities of the Institute;
2. the implementation of decisions made by the Scientific council;
3. the approval of Institute's development strategy.

At present the following officials are members of the executive institutions:
Director of the Research Institute – professor Dr. sc. Ing. Jānis Bērziņš
The Research Institute aims to provide favourable and supportive environment to academics and students involved in scientific research and consulting in order to acquire the knowledge and elaborate the new technology in the field of water transport and infrastructure. In addition the Institute promotes the development of research as an integral part of educational process. The activities of the Research Institute are arranged in several groups, which consist of both the research fellows employed by the Institute and highly qualified academic staff of Latvian Maritime Academy.
Field of research:

- Operation, dynamics, diagnostics and control of ship electrical power equipment
- Safety of ship electrical power equipment and management systems
- Efficiency, quality and safety of navigation
- Development of maritime education
- History of navigation and personal management at sea
- Recycling of industrial waste
- Electrochemical analysis of nanostructured materials. Chemistry of water

Profiles:

Mr.Andrejs Zvaigzne, Vice rector of LMA.

CURRICULUM VITAE

Name	Andrejs Zvaigzne
Contact details	Vilandes st. 12-9, Riga, Latvia ph. +371-29478533
Birthday	18.06.63. Liepāja, Latvia
Family	Wife Svetlana Zvaigzne, 1963. Son Arkadijs Zvaigzne, 1994.
Education	2004 USA, Naval Command College 1997 USA, Naval Staff College 1993 Swedish coast guard school 1985 USSR, Leningrad Naval academy, navigator. 1980 USSR, Leningrad Naval high school 1978 Liepaja, Latvia elementary school
Languages	Latvian, Russian, English
Business experience	2013 Vice Rector, Latvian Maritime Academy 2008- 2013 "AZK Komercfirma" director, 2008-2013 Thales business adviser for Latvia. 2008-2011 "Reids Ltd." commercial director 2007-2008 "TRIPARTITE BALTIC Ltd." Executive director
Military rank	Commander s.g. (Retied)
Navy experience	30.12.2004- 30.08.2007 Special responsibility officer for the CinC Latvian Navy, new SWATH patrol boats building project leader. 11.07.2001. Chief of staff of the Latvian Navy 13.07.2000. BALTRON (Baltic States navies squadron) commander 15.12.1999 Warships flotilla, commander 16.07.1999 Warships flotilla, chief of staff 17.05.1996 Warship squadron commander 09.12.1993 FPB commander, Latvian Navy 28.12.1988 Frigate commanding officer (CO) 24.09.1987 Frigate executive officer (XO) 22.06.1985 Navigator

Mr.Dmitry Gorelikov, Head of LMA practice department:CV

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Personal information

Surname(s) / First name(s)	**Gorelikov Dmitry**
Address(es)	Latvia, Riga, Tinuzhu 6 - 20
Date of birth	05 October 1975
Gender	Male

Desired employment / Occupational field

Higher education teaching professional

Work experience

Dates	21 January 2014 →
Occupation or position held	visiting lecturer
Main activities and responsibilities	reading lectures "Aircraft digital electronic and computer systems"; management of practical training; examination of student;
Name and address of employer	Riga Technical University, Latvia, Riga, Kaļķu 1
Type of business or sector	Education

Dates	15 August 2013 →
Occupation or position held	Head of practice department
Main activities and responsibilities	cooperation with National Maritime Administration and crewing companies; creation of training practice programs; conclusion practice agreements with crewing companies; supervision of students practical training;
Name and address of employer	Latvian Maritime Academy Latvia, Riga, Flotes 5b
Type of business or sector	Education

Dates	01 September 2012 →
Occupation or position held	visiting docent
Main activities and responsibilities	reading lectures GMDSS, ECDIS; management of practical training; creation of training programs; examination of student;
Name and address of employer	Latvian Maritime Academy Latvia, Riga, Flotes 5b
Type of business or sector	Education

Dates	01 September 2012 → 1 January 2013
Occupation or position held	visiting lecturer
Main activities and responsibilities	reading lectures "Aircraft communications and navigation systems"; management of practical training; examination of student;
Name and address of employer	Riga Technical University, Latvia, Riga, Kaļķu 1
Type of business or sector	Education

Dates	01 March 2000 → 15 July 2013
Occupation or position held	GMDSS chief instructor
Main activities and responsibilities	cooperation with National Maritime Administration and Rescue Centre; creation of training programs; training and examination of student;
Name and address of employer	Latvian Shipping Company, Marine Training Centre Latvia, Riga, Andrejostas 6
Type of business or sector	Maritime Safety

Dates	04 September 1997 - 01 March 2000
Occupation or position held	GMDSS instructor
Main activities and responsibilities	training of students; work with hardware radio installations;
Name and address of employer	Latvian Shipping Company, Marine Training Latvia, Riga, Andrejostas 6
Type of business or sector	Maritime Safety, Marine Training

Mrs.Inese Barbare, Project manager of LMA, researcher CV

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Personal information

First name(s) / Surname(s)	**Inese Barbare**
Address(es)	6-45, Berzu aleja, LV5001, Ogre, Latvia
Telephone(s)	+371 650 447 45 Mobile: +371 220 037 58
E-mail	Inese.barbare@gmail.com
Nationality	Latvian
Date of birth	18.06.1960
Gender	female

Desired employment / Occupational field **Independent expert with a socio-economic research background**

Work experience

Dates	Since September 2011
Occupation or position held	European Regional Development Funds Project Manager
Main activities and responsibilities	Implementation of public e-services in welfare institutions of Latvia
Name and address of employer	Welfare Ministry of Latvia. Website: www.lm.gov.lv
Type of business or sector	Government authority
Dates	Since March 2013
Occupation or position held	Project Manager
Main activities and responsibilities	Project management for EU research projects in Latvian Maritime Academy
Name and address of employer	Latvian Maritime Academy. Website: www.latja.lv
Type of business or sector	Government higher education institution
Dates	1997-2010
Occupation or position held	Business development manager
Main activities and responsibilities	Product development strategy and financial planning. New product introduction, standards and offer composition. Sales strategy and pricing of new products. Marketing activity initiation for new products and businesses. My responsibility scope – Inbound/Outbound contact center services (Customer care by phone, Telemarketing, Telesales, Back-Office Workflow), Document digitalization, Mobil entertainment services, SMS gateway support, IT Helpdesk, Consultation business
Name and address of employer	Lattelecom BPO. Website: http://www.lattelecom.lv
Type of business or sector	Telecommunications & IT

Education and training

Dates	2011-2014
Title of qualification awarded	PhD candidate
Principal subjects/occupational skills covered	Education Management (Labour market research in Maritime cluster)
Name and type of organisation providing education and training	University of Latvia, Faculty of Education and Psychology
Level in national or international classification	Sc.Dr.Ed.M.
Dates	2006-2008
Title of qualification awarded	M.P.M.
Principal subjects/occupational skills covered	International Project Management (EU Structural Funds specialisation)
Name and type of organisation providing education and training	Latvian University of Agriculture, Social Science Faculty
Level in national or international classification	Master degree in Professional Project Management
Dates	2004-2008
Title of qualification awarded	M. Ed. & DaF Teacher Qualification
Principal subjects/occupational skills covered	eLearning, ICT for foreign language
Name and type of organisation providing education and training	University of Latvia, Faculty of Education and Psychology
Level in national or international classification	Master degree in Education Management

Relevant publications:

- Dmitrijs Kopilovs „Automātisko un pusautomātisko karšu un karšu katalogu atjaunošanas struktūra un analīze" [„Analysis of automatic and semi-automatic procedures for ECDIS

charts and chart's catalogues updates"], LMA, 2013

- Maksims Bizjuks „Elektroniskās karšu un informācijas sistēmas datorprogrammas Transas NaviSailor 3000 un 4000 salīdzinoša analīze" [„Electronic chart and display information system Transas NaviSailor 3000 and 4000 comparative analysis"], LMA, 2013
- Ruslans Timerbulatovs „Pēdējās paaudzes Inmarsat platjoslu sistēmas un to iespējama izmantošana elektroniskās datu apstrādes sistēmas uz kuģa" [„Last generation of Inmarsat broadband satellite systems and possible usage in ship's electronic data processing systems"], LMA, 2013
- Viktors Belkovskis „Datu pārraides uzlabošanās iespējas izmantojot „Inmarsat Fleet 77" un „Inmarsat Fleet Broad Band" satelītsakaru sistēmas" [„Analysis of data transmission improvements possibilities in Inmarsat Fleet 77" and "Inmarsat Fleet Broad Band" satellite system"], LMA, 2012

Relevant projects:

Research projects:

- At present the Research Institute takes part in international project Baltic Sea Region Programme 2007-2013 'BSR InnoShip – Baltic Sea Co-operation for reducing ship and port emissions through knowledge and innovation based competitiveness'. The project is promoting new and innovative transnational approach to mitigate the different needs and interests of the maritime sector and to ensure basis for more sustainable and economically viable management of the Baltic Sea resources. The overall objective of the project is to minimize adverse effects of pollution from maritime traffic and optimize the competitiveness of the Baltic shipping. The project has been realized by 19 partner organizations from nine Baltic Sea region countries (Denmark, Estonia, Finland, Germany, Lithuania, Norway, Poland, Russia and Sweden) representing universities and research institutes, maritime business development agencies and associations, Pan-Baltic organizations and cities. Project budget is 240 000 EUR in 2007 – 2013 and it is part-financed by European Regional Development Fund). Under the supervision of experienced researchers a number of tasks (for example, literature studies, opinion surveys, primary statistical processing of data) have been carried out by Master degree students as well. It provides them with an opportunity to improve their research skills and to get extensive experience in scientific work, which is vitally important for writing Master theses, to visit seminars abroad and to communicate with foreign cooperation partners.
- „Smart competitiveness for the Central Baltic region", Financial support by Central Baltic INTERREG IV A Programme 2007-2013, realized in 2012-2013;The changing operating environment is creating challenges for the Central Baltic Sea region maritime clusters. Besides common challenges, the countries also share opportunities, of which the most important is national cluster competitiveness amongst other maritime clusters in region.The aim of the consultation day is to strengthen the collaboration among triple helix actors and stimulate discussion regarding co-operation prospects, developments and business opportunities between the Latvian based maritime cluster actors and share experience on national maritime cluster strengthening in the region
- „YOUTH 4 Job", Research about employment in maritime Cluster, Financial support by EC program PROGRESS, realized in 2013;
- „INTERMAR: a plurilingual approach to maritime communication", funded with the support from the European Commission Lifelong Learning Programme for Transversal Programmes – Languages (Key Activity 2), realized in 2011-2013.
- „European Union's Common Fisheries Policy (CFP)", Research about The fishing vessel's engine power certification and verification, realized in 2013-2014

Significant infrastructure/technical equipment:

ECDIS training facility with Navi-Sailor 4000 (Instructor and 7 workplaces as vessels with ECDIS in Local Area Network), which can be used for imitation of entire fleet group with satellite data transmission between vessels.

13. Offis e.V.:

OFFIS is a research institute for information technology co-located with the University of Oldenburg founded in 1991. Besides two other domain energy and health OFFIS mainly focuses on the development of safety critical systems in the transportation domain. Here, via intensive cooperation with maritime, automotive and

aerospace industy partners OFFIS gathered large competences in the design and development of dependable, cooperative assisting systems. OFFIS brings long-term experience with risk assessment, simulation and architecture development for and assessment of complex transportation systems. OFFIS is involved in several FP 7 and national projects and together with main German maritime industry partners initiated the e-Maritime Integrated Reference Platform (eMIR). This platform is used for early testing and demonstration of new e-maritime technologies. Within EfficienSea 2 OFFIS will align the eMIR testbed with the development of the maritime cloud and will provide access to eMIR-testbed for demonstration.

Profiles:
Prof. Dr. Axel Hahn will contribute his special experience in the domain of simulation, maritime transportation systems and field level control in manufacturing. After his PhD in mechanical engineering, Prof. Hahn worked five years as head of development for a SME software company dealing with technical product information management. Since 2006 he is full professor for system analysis and optimization at the University of Oldenburg and he is member of the board for the division transportation at OFFIS.

Dr. André Bolles received his diploma degree in Computer Science in 2008 and achieved a PhD in 2011. Since 2011 he works at OFFIS where he is leading the group "Cooperative Mobile Systems" with 12 researchers. He has extensive experience in sensor fusion concepts for (semi-)automated vehicles and vessels, system architectures and simulation concepts for automotive and maritime transportation systems. André Bolles coordinated several national funded maritime projects and together with Axel Hahn and Michael Siegel is leading the OFFIS-eMIR-testbed activities. He holds a Professional Scrum Master I certificate and will contribute to the architecture development within EfficienSea 2.

Dr. Michael Siegel studied Computer Science and received his PhD from University of Kiel, Germany.
From 1999 to 2010 Dr. Siegel held various research, development and managerial positions at Siemens Corporate Resaerch, Infineon and One Spin Solutions. Since 2011 Dr. Siegel is director of the R&D Division Transportation at OFFIS, is the responsible director for OFFIS' maritime activities including eMIR and leads the competence center on Dependable System Design. His current research interests cover design and verification for safety-critical HW/SW systems and intelligent transportation systems with a focus on advanced driver assistance systems, (semi-) automatic vehicles and vessels, as well as smart traffic infrastructures.

Relevant publications / products and services:
Odysseus is a complex event processing engine developed by the University of Oldenburg and OFFIS. It allows flexible processing of arbitrary sensor data for several applications. It has been used for object tracking in road vehicles as well as for data exchange between vessels and VTS centers.

eMIR is a platform for testing and demonstration of new e-navigation technologies and is initiated the German maritime industry and OFFIS.

HAGGIS is co-simulation environment for risk and efficiency assessment of maritime transportation systems. Within eMIR HAGGIS is the virtual environment of the physical testbed and is the starting point for the assessment of new e-navigation technologies.

LABSKAUS is the real world testbed within eMIR. It consists of an experimental VTS, a mobile bridge, NaviBoxes and sensor boxes for a research port. These components provide physical infrastructure for the early assessment of new e-Navigation technologies.

Publications:
Bolles, Hahn; COSINUS – Cooperative Navigation for nautical Safety; International Symposium Information on Ships; 2014 (to be published)

Denker, Sobiech, Mextorf, Randall, Allen, Mikkelsen, Dami, Javaux; Modelling Human-Machin Cooperation For Human-Centered Ship Bridge System; Proceedings of the 5th Transport Research Arena Conference 2014

Sobiech, Eilers, Denker, Lüdtke, Allen, Randall, Javaux; Simulation of Socio-Technical Systems for Human-Centered Ship Bridge Design; Proceedings of the International Conference on Human Factors in Ship Design & Operation 2014

Läsche, Pinkowski,Gerwinn, Droste, Hahn; MODEL-BASED RISK ASSESSMENT OF OFFSHORE OPERATIONS, Proceedings of the 33rd International Conference on Ocean, Offshore and Arctic Engineering, OMAE 2014, San Francisco, USA

Läsche Golluecke, Hahn; Using a HLA Simulation Environment for safety concept verification of offshore operations; Proceeding of 27th conference on modeling and simulation; 2013

Hoerstebrock, Denker, Buss, Hahn; A toolbased approach to assess technology introduction in transporation systems demonstrated by the LNG introduction for ship propulsion; International conference on logistics and maritime systems; 2012

Relevant projects:

- D3COS – FP7 project for ambient information representation
- CASCADE – Human centered design of bridge systems
- COSINUS – Cooperative Navigation for nautical safety – Data exchange between bridge and VTS-systems
- eMIR – Testbed for e-maritime technologies
- SOOP – Safe offshore operations

Significant infrastructure/technical equipment:
OFFIS brings in the eMIR testbed that is initiated by the German maritime industry together with OFFIS. eMIR provides infrastructure for the demonstration and testing of new e-maritime technologies including sensor boxes for data recording and situational awareness, a bridge system as well as a VTS-system.

14: BIMCO:

BIMCO (founded in year 1905) is the largest of the international shipping associations representing shipowners; its membership controls around 70 percent of the world's tonnage and it has members in more than 120 countries, including managers, brokers and agents.
The association's main objective is to facilitate the commercial operations of its membership by means of developing standard contracts and clauses, and providing quality information, advice, and education. BIMCO also conducts various training programmes around the world for the Maritime Community.
BIMCO promotes fair business practices, free trade and open access to markets. Through the BIMCO membership quality information and advice are provided, while promoting harmonisation and standardization of commercial shipping practices and contracts.
In support of its commitment to promote the development and application of global regulatory instruments, BIMCO is accredited as a Non-Governmental Organisation (NGO) with all relevant United Nations organs. BIMCO actively promotes the application of international agreed regulatory instruments. In an effort to promote its agenda and objectives, the association maintains a close dialogue with governments and diplomatic representations around the world, including maritime administrations, regulatory institutions, and other stakeholders within the areas of EU, the United States, and Asia.

Profiles:

Aron Sorensen holds the position as Chief Marine Technical Officer (since 2008) being responsible for BIMCO's technical affairs. He manages BIMCO's role relating to marine, operational and related matters at a number of international organizations such as ILO, IMO, ISO, IACS and IHO. This work includes negotiating, monitoring and disseminating relevant Conventions and regional/national requirements, and assessing their impact on BIMCO members.
Following a career at sea as a deck officer, Aron Sorensen, has taught apprentice deck officers at Nautical Institutes in Denmark and has been a member of the Danish Examination Board for Maritime education. He further has been in charge of developing regulation of the safety of navigation at the Danish Maritime Authority.

Jeppe Skovbakke Juhl is educated as naval architect and holds a position (since 2012) as Senior Marine Technical Officer at BIMCO with responsibility for co-ordinating BIMCO's initiative on a large variety of technical related matters and project management. His core competencies cover maritime Flag state administration (Flag state implementation, Goal- and functional-based regulation, Risk-based approval process), Risk assessment (Formal Safety Assessment methodology), Ship stability (intact and damage) as well as in-depth technical knowledge on Green House Gases and Air Emissions. Jeppe Skovbakke Juhl has previously been working at FORCE Technology (Danish Maritime Institute) for 8 years and at the Danish Maritime Authority for another 8 years.

Significant infrastructure/technical equipment:

- Shipowners representing two thirds of the world's commercial fleet
- Advisory services dealing with 3,500 enquiries per year
- Over 3 million web searches per year in our vast online database of vital shipping information

15. CIRM:

Comité International Radio-Maritime (CIRM) is a non-profit international association representing companies involved in the manufacture, supply and service of electronic navigation and communication equipment for the maritime industry.

CIRM's main task is to represent the interests of the marine electronics industry on an international basis. In order to accomplish this the organization co-ordinates the views and actions of its members in resolving regulatory issues, and provides technical and industrial advice to the international regulatory organizations.

CIRM is a key contributor to the regulation and standardization of the marine industry. CIRM is accredited as a non-governmental organization in consultative status to the International Maritime Organization (IMO). CIRM is a Sector Member of the International Telecommunication Union (ITU-R and ITU-T), and is a Liaison Member both of the International Organization for Standardization (ISO) and of the International Electrotechnical Commission (IEC).

CIRM funds the Secretary role for IEC Technical Committee 80 (TC 80), a body that develops international standards for maritime navigation and radiocommunication equipment and systems, and many CIRM members are active in the Committee's technical Working Groups. As such CIRM and IEC TC 80 work closely in the development of new and revised navigation and communication technical standards.

The tasks in the proposal include the coordination of standardization work across the project, and the development of technical standards for shipboard integration of new communication technologies. Through its close links to the international maritime standards setting organizations and active participation in their work, CIRM's experience and expertise is well matched to these tasks.

Profiles:

Richard Doherty (CIRM)
(CIRM's actual committed resource for the EfficienSea 2 project may be subject to change)

ACADEMIC QUALIFICATIONS:

- Postgraduate Certificate in Web Design & Development. Sep 2012 – July 2013, Birkbeck University, London. Web Development (HTML5, CSS3, PHP, JavaScript)
- Postgraduate Certificate in International Business Practice. Sep 2007 – Sep 2008, Mountbatten Internship Programme, New York, USA
  - International Diploma in Management
  - Managing Information & Managing Markets
- Bachelor's Degree in Politics & Philosophy. Sep 2002 – Jun 2005, Queen's University, Belfast

- Political Research Methods, International Politics, American Politics (2:1)

CAREER HISTORY:

- Chief Technical Officer (CIRM), December 2013 – present:

Comité International Radio-Maritime (CIRM) is a non-profit technical association of companies engaged in the marine electronics industry. CIRM's scope of technical interest includes navigational equipment and systems, electronic charts and systems, radiocommunications and GMDSS, LRIT and satellite-enabled tracking, Automatic Identification System, Voyage Data Recorders and Vessel Traffic Systems

- Responsible for implementing CIRM's technical programme as defined by the CIRM Technical Steering Committee;
- Participate in the development of international regulations and standards on behalf of the CIRM membership; provide technical and industrial advice via presentations and meeting input papers;
- Represent the membership internationally in UN agencies such as ITU, IEC, IMO, and other non-governmental organizations such as IEC, IHO and IALA;
- Coordinator and chair of CIRM's internal Working Groups and the CIRM/BIMCO Joint Working Group.

- Business Development Executive (Pole Star Space Applications), July 2012 – Dec 2013

Pole Star is a leading provider of satellite-enabled tracking, security and risk management solutions to the maritime industry

- Researched markets and technologies new to Pole Star to analyse the commercial opportunity;
- Product Owner of PurpleTRAC, a web-based risk management application for financial markets;
- Authored business documents (market research reports, business cases, business requirements documents) on identified opportunities;
- B2B development - identified opportunities, built relationships, and secured commercial agreements;
- Participated in numerous international technology seminars and trade shows to generate new business leads, gathered competitor intelligence and developed product enhancements.

- R&D Business Analyst (Pole Star Space Applications), April 2010 – July 2012

Product Development and Project Management role within Pole Star's R&D team, responsible for delivering product demonstrators and technological proof-of-concepts

- Researched markets and technologies new to Pole Star to analyse the commercial opportunity;
- Worked as liaison between R&D technical team and wider company;
- Project-managed R&D projects using Waterfall & Agile methodologies - delivered several product demonstrators and proof-of-concepts in conjunction with wider R&D team;
- Maintained a comprehensive market intelligence portal on the company intranet;
- Represented Pole Star at a range of international conferences, workshops and seminars.

- LRIT Project Manager (Pole Star Space Applications), December 2008 to April 2010

Responsible for delivering web-based Long Range Identification & Tracking (LRIT) software solutions

- Joint ownership of the LRIT Programme Plan; implementation of individual project plans using Prince II-based project methodology;
- Worked with project teams and stakeholders to define scope, goals and budget;
- Point of contact for 20 client governments and international ship registries.

- Intern (AIG Consultants), Sep 2007 – Sep 2008

Located on Wall Street, New York, AIG Consultants is the consultancy arm of American International Group

- Project manager for internal Home Office projects (e.g. overhaul of staff administration system);
- Legal research into claims history for AIG law teams.

- Pensions Resource Consultant (Legal & General), September 2005 – September 2007

Legal & General is a UK-based life assurance company

- Front-line support for Legal & General's top pension brokers;
- Branded pension scheme member websites, using HTML and CSS.

Relevant publications / products and services:

1. Code of Business Practice for Maritime Accounting Authorities

The Code of Business Practice for Maritime Accounting Authorities was developed by CIRM in response to an invitation by the International Telecommunication Union (ITU). It sets standards of conduct for Accounting Authorities and the service that they provide to the Maritime community in support of radio and satellite communications.
The voluntary Code is administered and maintained by CIRM. It has been signed by 32 Maritime Accounting Authorities from 22 countries, and is open for signature by all reputable maritime Accounting Authorities who meet the basic criteria for eligibility and support its objectives.

The Scope of the Code includes minimum standards for service, billing and settlement of accounts for all Maritime Public Correspondence Terrestrial and Satellite Telecommunication Services. It provides for commercial as well as technical and operational requirements and is applicable to Accounting Authorities (A.A.s) as defined in ITU-T Recommendation D.90.

2. Manufacturer Identity Service for AIS-SART, MOB and EPIRB-AIS devices

In line with the Liaison Statement from ITU-R Working Party 5B to CIRM, September 2008, CIRM has the global responsibility for issuing Manufacturer identities to companies wishing to manufacture AIS-SART, MOB and EPIRB-AIS devices.

CIRM maintains a Manufacturer Identity database, which currently lists the identities of around 40 international companies. The service is provided free of charge to companies whether they are members of CIRM or not.

Relevant projects:

- IMO Resolution MSC.210(81) - Performance standards and functional requirements for the long-range identification and tracking of ships (2006); IMO Resolution MSC.263(84) - Revised performance standards and functional requirements for the long-range identification and tracking of ships (2008). CIRM was heavily involved in the development of these International Maritime Organization (IMO) Performance Standards, which specify minimum performance and functional requirements for the Long-Range Identification and Tracking (LRIT) international maritime tracking/communications system. Actively participating in larger IMO project teams called Working Groups, CIRM staff and members provided technical and industrial advice and expertise throughout the development of the standards.

- CIRM/BIMCO Joint Working Group on Software Maintenance (current). This active project is a collaboration between CIRM and BIMCO, a major maritime NGO representing shipowners. Modern navigation and communication systems onboard ships require software and firmware maintenance to ensure they remain in compliance with the mandatory requirements of the International Maritime Organization and the International Telecommunications Union (ITU). However there is currently no internationally recognized standard in place to regulate shipboard software and firmware maintenance. As a result, a lack of standardization is observed, leading to a number of problems for all stakeholders involved in the process. This situation may also lead to software-driven systems being unreliably maintained, and as a result they may not function correctly. In 2013, BIMCO and CIRM established the CIRM/BIMCO Joint Working Group on Software Maintenance, to develop an industry standard on shipboard software and firmware maintenance in order to address the problems inherent in the current situation to the benefit of the wider shipping industry.

16. IALA:

IALA is a non-profit, international technical association.
Established in 1957, it enables marine aids to navigation authorities, manufacturers, consultants, and, scientific and training institutes from all parts of the world to exchange and compare their experiences, achievements, and technical and operational policies via participation in IALA Technical Committees. The Committees work to create IALA Recommendations and Guidelines which are recognised worldwide as the international standards for the implementation and operation of aids to navigation. These standards help to ensure that the movements of vessels are safe, expeditious, cost effective and harmless to the environment.

IALA's scope and expertise extends to e-Navigation and Vessel Traffic Services.

Profiles:

1. IALA Deputy Secretary-General, Mr Michael Card
- Graduate and post-graduate degrees in engineering
- Experience as head of a national aids-to-navigation authority
- Commercial experience in the application of international standards to the design of maritime systems
- Experienced manager of engineering teams and commercial teams in Europe, USA, Japan

2. Technical expert, Dr Nick Ward
- Graduate engineer
- Experienced in the creating and approval of international technical standards
- Familiar with maritime technology, especially communications and data exchange systems
- Experienced with national and international application of maritime technology standards and guidance

Relevant publications:

IALA is the accepted body worldwide for the setting of technical recommendations and guidelines for:
- o Marine aids to navigation
- o Vessel Traffic Services
- o E-Navigation shore systems

Relevant projects:

- IALA e-Navigation Committee, working on communications, data-modelling, sensors, shore infrastructure, with over 100 international participants, meeting twice per annum
- IALA Vessel Traffic Services (VTS) Committee creates technical and operational standards for the design, operation, and training associated with VTS
- Creation of the VDES maritime data communications concept and current activity to finalise frequencies and modulation, including participation at International Telecommunications Union in global frequency allocation
- Maintenance of the ITU technical standard for AIS data communications
- Technical work in great detail on e-Navigation provided to the International Maritime Organisation to enable it to generate its e-Navigation Strategic Implementation Plan
- Annual e-navigation Conferences in Europe and USA, and biennial VTS Conferences (Last in Turkey, next in Malaysia)

Supporting documentation:

- IALA 2013 Annual report

17: Maritime Development Centre of Europe:

The Maritime Development Center of Europe (MDCE) is a triple-helix non-profit cluster and network organization for the maritime industry in Denmark. MDCE has 187 members from the whole value chain of the maritime industry, including ship owners, ship brokers, ports, producers and suppliers of equipment, service and information providers, maritime organizations, universities, maritime schools, government bodies as well as media. The main goal of MDCE is to create value for the members through a broad range of activities such as B2B networking, seminars and conferences as well as innovation projects and branding. The MDCE is involved in a broad range of projects and running thematic knowledge sharing networks within Maritime ICT, Short Sea Shipping, Environment, Maritime Law, HSQE Surveyors, communication, HR and Crewing, as well as Working Environment.

The main tasks in the Efficient Sea II project will be knowledge dissemination as well as involving the End-Users in the development of the different components. This will help secure that the project results gain visibility in the maritime community and that the user requirements from the end users are taken into consideration from an early stage. MDCE has a vast experience within dissemination activities as well as great knowledge in facilitating collaboration among firms, universities and authorities. Furthermore, the MDCE

has a huge and growing international network of firms within Maritime ICT.

Profiles:
Mr. Jan Boyesen is the Business Development Manager at the Maritime Development Center of Europe and Head of Secretariat at The Danish Society of Transport Economics. Jan is in charge of MDCEs international Cooperation as well as developing and managing the project portfolio. Before joining the MDCE, Jan worked five years at the cross border triple-helix cooperation Øresund Science Region/Øresund Logistics as Development Manager. Jan will be responsible for caring out the activities in the Efficient Sea II project at the MDCE.

Mr. Kim Erik Jensen is the Member & Network Coordination Services Manager at the MDCE. He is among other responsible for coordinating the Maritime ICT network, which is a knowledge sharing network which unites people from maritime firms that are interested in solving Maritime ICT challenges. Before joining the MDCE Kim was working 10 years for SeaPress ApS. SeaPress ApS publishes "Søfart", the leading maritime newspaper in Denmark, first as Sales Manager and later on as Managing Director.

Relevant publications:
The Maritime Development Center of Europe is facilitating a thematic knowledge sharing network with approximate 50 maritime companies within Maritime ICT. The network arranges periodic meetings within various topics for Danish and international companies.

Both MDCE and Øresund Logistics where involved in the FP7 project SKEMA, which established a Sustainable Knowledge Platform for the use of stakeholders in the Maritime Transport & Logistics industry

18: SSPA Sweden AB:

SSPA is fully owned by the non-profit Foundation Chalmers University of Technology which makes SSPA non-profit. SSPA is divided into the departments Ship Design, Maritime Operations and Research.
SSPA Research develops new methods, tools and applications in close cooperation with the maritime industry and initiates, lead and participates in national and EU financed research projects. About 20 % of our resources are engaged in competitive research programs financed by industry, Europe and Sweden. SSPA has participated in about 60 European research projects since -97 and more than 20 of them are related to e-navigation topics.
SSPA has a thorough experience in maritime risk, safety, efficiency and cost/benefit analysis at different levels including FSA.

Profiles:
CV – Linus Aldebjer, male
Linus has worked with the control and regulation technology for unmanned underwater vehicles; including the behaviour based robotics. Since 2010, he has worked at SSPA Sweden AB with optimization of routes within the EU project MonaLisa, fuel optimization in SSPA product RoutePred. Besides this, he has also worked with simulations for ships. Linus has M. Sc. in Engineering Physics.

CV - Lars Markström, male:
Lars is sub activity leader in the EU project MonaLisa 2.0, where SSPA's part is to make fuel efficient, safe and traffic coordinated routes and analyses of how the traffic pattern changes using historical and simulated AIS data. He is also leader for a sub activity regarding risk assessment in coastal- and harbour areas. He works at SSPA with different research projects within the concept of e-navigation. Lars has a M. Sc. in Mech. Eng. and a B. Sc. in Nautical Sci.

CV- Jessica Johansson, female:
Jessica has worked at SSPA since 2002 with projects within the marine environmental- and risk area, research projects as well as commercial assignments. She has also worked with navigational risks in archipelago and harbour areas concerning, e.g. traffic with fast passenger ferries, LNG transports, or emergency anchoring. In some large research projects, she has studied effects on navigational risks for sea traffic due to large-scale traffic rescheduling in the Kattegat. Jessica holds a Lic. Eng. in Env. Sci. and a M. Sci. in Mech. Eng.

CV - Henrik Holm, male:
Henrik is former product manager from the gaming industry and internet commerce. Henrik has more than 10 years' experience in the commercialization and development of self-learning software, where the major focus has been performance and measurability. He is developing the optimization software in MonaLisa and has experience with the RoutePred software used at the Stena ferries. He studied Engineering Physics at Chalmers and read the Masters Program Complex Adaptive Systems.

CV - Peter Grundevik, male
Peter is Head of SSPA Research department, at SSPA since 1997 and has a doctoral degree in Physics. He has worked with different navigational and safety fields and has international experience as Co-ordinator of international projects; relevant ones – TOHPIC, Tools to Optimise High speed craft Port Interface Concepts, Efficient terminals for Intermodal Transport, Dynamic Decision Support System, BaSSy - Baltic Sea Safety and Engine Control Rooms - Human Factors. He has been SSPA project manager for WINGS-FOR-SHIPS, eTEN WINGS, MarNIS, EfficienSea, ADOPTMAN, ACCSEAS and GOTRIS.

Relevant publications / products and services:
- Maritime operations Investigations, both in full mission bridge simulations and desktop environment.
- The speed/energy management software RoutePred.
- The precision manoeuvring assistance tool Dynamic Predictor.
- The river traffic flow management software from the GOTRIS project.
- Different AIS data analysis software´s incl. further development of IWRAP

Relevant projects:
- EfficienSea: SSPA contributions - e-navigation, AIS data quality and Dynamic risks
- ACCSEAS: e-navigation platform in North Sea Region incl. SSPA Dynamic Predictor information exchanged between two nearby vessels and SSPA dynamic risk tool
- MonaLisa & MonaLisa 2.0: SSPA contributions - Route optimization, Traffic Coordination & Risk Analysis
- CyClaDes: SSPA contributions - Human centred design of a Conning Display, Human factors influence in safety culture & Limitations in near-field simulator views
- ADOPTMAN: SSPA contribution - emergency ship manoeuvring in man over board situations
- ESABALT: Real-time maritime traffic and environment monitoring, including crowd sourcing information gathering

Significant infrastructure/technical equipment:
SSPAs' facilities include a modern and highly flexible full mission bridge simulator, the towing tank, the large cavitation tunnel, the seakeeping and manoeuvring basin and computational capacity.

Supporting documentation:
SSPA has also been working within Arctic navigation in the following projects:
- Performance index for icebreaking vessels
- Manoeuvring in pack ice under extreme operational conditions – modelling, predicting, full scale
- Development of ice load in managed ice condition model for simulations
- IceMaster – a decision support tool for planning of operations in ice-covered waters
- EEDIce-Op: EEDI and Finnish-Swedish ice class rules – Impact study and operational aspects
- ChanIceRes: Interaction between engine output regulation and actual resistance in a brash ice channel

19: FORCE Technology:

FORCE Technology is an independent, non-profit, knowledge and technology-based R&D organisation and service provider, which offers development, consultancy and other services in the following areas: Optimization of production and processes; Materials utilization, protection and analysis; Maritime technology; Inspection, testing, calibration, verification and certification; Sensor technology development and application; Management systems optimization and development.
FORCE Technology has departments located all over Denmark, has 100% owned daughter companies in Sweden and Norway, and has representations in Russia, China, USA and Singapore.
FORCE Technology employs a total of about 1250 people. The Division for Maritime Industry is based in Lyngby just outside Copenhagen, Denmark. The division has three departments, which all have an interest in

the EfficienSea2 project, viz:

- The Hydro- and Aerodynamics Department, which among other things develops the onboard system voyage planning system SeaPlanner (part of the SeaSuite family)
- Department of Applied Psychology which among other things manages Human Centred Design processes and conducts Usability testing of new equipment
- Department for Simulation, Training & Ports, which is developing part task and full mission simulators and performs training of navigators and engineering studies using the simulators.

The tools, facilities, skills and competences of FORCE Technology relevant for EfficienSea2 will be attributed to the following main tasks:

- Cross Project Activities: FORCE contribution: Competences on Human Factors and Human Centred Design
- Maritime cloud: FORCE contribution: Stakeholder analysis, Human Centred Design and usability tests
- Route optimization: FORCE contribution: Provision of route optimization system (SeaPlanner) as demonstrator platform for new formats/standards for route communication with external stakeholders.
- Port Information: FORCE contribution: Simulator based verification and validation of new communication concepts
- Emission Monitoring: Development of new monitoring concepts (based on ships route plans)

Profiles:

Søren Asbjørn Hattel, received his PhD in physics from the Danish Technical University in 1992. Søren Hattel conducted Post Doc. research at Cambridge University in a Carlsberg scholarship from 1992 to 1996, After that he has had chief software development positions at Danish Space Research Institute, Hovedkvarteret ApS and Visma Sirius IT until 2011 where he joined FORCE Technology as software engineer and team leader responsible for in-house software and onboard systems (SeaSuite).

Thomas Koester, Psychologist, MA, Human Factors Specialist, received his BA in Psychology and Computer Science in 1994 and his MA in Psychology in 1998 both from University of Copenhagen.
His experience can be summarized as:

2012-present	FORCE Technology, Department of Applied Psychology, Teamleader
2002-present	FORCE Technology, Psychologist, MA, Human Factors Specialist
2000-2002	Danish Maritime Institute, Psychologist, MA, Human Factors Specialist
1998-2000	IT-consultant and project supervisor, Undervisnings- og Kulturforvaltningen, Roskilde Amt
1998-2001	External lecturer, University of Copenhagen, Department of Psychology
1995-present	Editor, author and consultant, Frydenlund Publishers, Copenhagen
1994-1996	Lecturer in psychology, Køge Gymnasium & VUC i Køge

Thomas has the following key qualifications within EfficienSea2 relevant topics:

- Experimental and cognitive psychology
- Human factors, HCI and cognitive ergonomics
- Psychology in design and innovation, interaction design, service design and usability
- Field studies, ethnographic observations and development of methods
- Accident investigation and analysis from psychological and organisational perspective

And also with special relevance to EfficienSea2 Thomas Koester has developed course concepts, course syllabus and teached at courses:

- Maritime human factors courses, several occasions
- Human factors based accident investigation courses for maritime personnel, several occasions
- Course for industrial designers, system developers and marketing, Harrit & Sørensen A/S, EuroCom Industries A/S 2003
- Course for product development department at Saab Danmark A/S, Sønderborg 2009

Relevant publications:

Koester, T. (2001). Human Error in the Maritime Work Domain. In: Proceedings of the 20 th European Annual Conference on Human Decision Making and Manual Control (EAM 2001), 25-27 June, 2001, Kongens Lyngby, Denmark, pp. 149-158.

Koester, T. & Sørensen, P.K. (2004). Measurement of stress and mental activity among maritime crew members. Submitted to: Human Perfomance, Situation Awareness, & Automation (HPSAA) - 2004 Conference,

22-25 March 2004, Daytona Beach, Florida.

Koester, T. (2005). Human Factors in the Design Process - A New approach to the Design of Maritime Communications Equipment. Paper presented at Royal Institution of Naval Architects (RINA), HUMAN FACTORS IN SHIP DESIGN, SAFETY AND OPERATION 2005, London, UK.

Pyne, R. & Koester, T. (2006). Methods and Means for Analysis of Crew Communication in the Maritime Domain. The Archives of Transport. Vol. XVII, No 3-4, pp. 193-208.

Koester, T., Hyll, N. & Stage, J. (2009). Distributed Cognition in Ship Navigation and Prevention of Collision. In: Norros, L., Koskinen, H., Salo L. & Savioja, P. (eds.). Designing beyond the Product – Understanding Activity and User Experience in Ubiquitous Environments. Proceedings of the European Conference on Cognitive Ergonomics 2009, Helsinki, pp. 202-209.

Relevant projects:
Human Factors based design projects

- Maritime communication equipment, for Harrit & Sørensen A/S, EuroCom Industries A/S
- Control room design and work processes, for Storebælt A/S
- Workplace design and occupational psychology, for DanPilot 2010
- Workplace design and occupational psychology, for Søværnets Operative Kommando, JRCC 2011

Other significant projects

- Decision Support for Navigation, for Sjöfartsverket, 2007
- HINTLAB, project on human factors and perception, 2007-2009
- Initial study on safety and human factors, for Banedanmark 2011
- Human factors project in relation to railway technology, for Siemens 2011-present

Significant infrastructure/technical equipment:

Full mission ship manoeuvring simulators.
FORCE Technology develops, designs, installs, operates and sells maritime simulators. The maritime simulators are sold to customers all around the world.
The ship simulator systems at FORCE Technology range from desktop to full-mission solutions. Via advanced computer models and mathematical calculations the simulator accurately renders the manoeuvering capacities, bridge environment, communication equipment and surroundings of the ship.

The cornerstone in creating an optical, realistic and professional simulation comes from the realism of the mathematical ship model DEN-Mark1 and FORCE Technology has decades of experience within hydro and aerodynamics and are known as one of the world's leading experts when it comes to generating mathematical ship models.
FORCE Technology simulation facilities at our premises in Kgs. Lyngby, Denmark include:

- Full-mission simulator, 360° (Equipped with full size bridge consoles for control and monitoring. Real NACOS Radar, Conning and Ecdis system. Full HD visual system)
- Full-mission simulator, 210° (Equipped with full size bridge consoles for control and monitoring. Real NACOS Radar, Conning and Ecdis system. Full HD visual system)
- Full-mission simulator, 210° (Equipped with full size bridge consoles for control and monitoring. Real NACOS Radar, Conning and Ecdis system. Full HD visual system)
- Part task simulator, 130° (Full HD projection theatre. Real size bridge consoles. Single NACOS Radar system. Ideal for engineering studies)
- Tug cubicles, 2 pcs (Mini Tug bridges. Mostly used in conjunction with multi bridge setups, dealing with tug operations)
- Full-mission tug simulator, 360° (Control and monitoring from a real life tug boat. 2 X Full HD visual system with 52” LCD screens. Perfect for tug operations)
- Debriefing facilities.

SeaPlanner – Voyage Planning and Route Optimization

Choosing the optimal route, adjusting the speed and avoiding hard weather reduces the fuel consumption significantly. Together with Danish Meteorological Institute, FORCE Technology has developed the onboard decision support system, SeaPlanner, which aids the navigator in choosing the optimal route.
SeaPlanner enables the navigator to plan a route with minimum fuel consumption and at the same time avoid unacceptable weather conditions and ship motions.
Key objectives are:

- Optimised route
- Optimised speed along the route
- Optimised propulsion plant operation (number of engines in operation, WHR etc. and moreover, SeaPlanner is able to predict the fuel consumption for the entire voyage)
- Safe weather routeing

SeaPlanner can be used as a standalone route planning and weather information tool. Or it may be combined with the weather routeing service provided by an experi¬enced marine meteorologist at DMI - Maritime Service (a division of the Danish Meteorological Institute). The optimized route can be presented on a map in SeaPlanner or it can be exported to other onboard systems like ECDIS or track pilots etc.

20: Collecte Localisation Satellites (CLS)

Collecte Localisation Satellites (CLS) is a French Société Anonyme created in 1986, of 250 staff. CLS' core activities are focused on satellite-based services for governmental and commercial operators. Almost all CLS activities are related to the maritime domain:

- Sustainable management of marine resources (incl. control of fisheries),
- Environmental monitoring (oceanography, wildlife tracking)
- Maritime security

CLS is a subsidiary of the French Space Agency CNES and has two main offices in France with CLS Head-quarters located near Toulouse and VIGISAT radar applications centre located near Brest. CLS has also sub-sidiaries in Spain, the USA, Peru, Indonesia, Brazil, and offices in Australia, Chile, Russia, Japan, Vietnam, Korea, and China.
To fulfill its core activities, CLS is organized in 3 main departments.

- The Geo-Positioning and Data Collection systems Department (DCL), specialized in the promotion and the operation of global data collection and tracking systems.
- The Space Oceanography Department (DOS), set-up in 1991 to process and distribute oceanography data issued from satellite observations. This division today counts over 65 engineers and oceanog-raphers involved in numerous projects and operational activities, including Copernicus Marine Core Services.
- The Radar Applications Department (DAR) recognized as a main provider of satellite radar scenes and services based on the analysis of Synthetic Aperture Radar (SAR) scenes,. CLS operates the first and only SAR ground receiving station in France (for civilian missions), called VIGISAT. The satel-lite radar based services produced by the Radar Applications Department (DAR) are, inter alia, oil spill detection, vessel detection, wind field retrieval (presently used by other EMSA CleanSeaNet service providers) and swell field retrieval.

CLS has already worked in the past closely with maritime authorities, navies, law enforcement agencies, commercial fleets, international organizations and space agencies, and developed a strong experience as In-tegrated Maritime Surveillance Application Service Provider in processing ARGOS, AIS, IRIDIUM, IN-MARSAT, Synthetic Aperture Radar(SAR), Optical Images, Weather Forecast, INTELLIGENCE sources and LRIT data. CLS has developed a comprehensive offering of LRIT solutions for government maritime agencies the world over (data-processing centre, ASP telecommunication services and location beacons). CLS developed the European SAT-AIS Data Processing Centre (EU SAT-AIS DPC) for ESA/EMSA and a key part of the IMDATE (integrated maritime data fusion platform for the EMSA).

CLS engineers have a strong experience on navigation and positioning systems but also on space weather effects that may impact their integrity, availability or accuracy.

Tasks in the proposal

/ cross project activities
The maritime Identity Registry is one of the three fundamental pillars of the proposal. As we are interested in

the future maritime services, CLS intends to contribute to the Central Business Registry for companies. As a consequence, we would like to be involved in the business models for maritime clouds, VDES/NAVDAT commercial services and generally for ideas and proposal for innovative solutions.

/ Novel communication technologies & e-navigation services

CLS is involved in AIS, SAT-AIS since many years and more recently in the VDES or NAVDAT. More details on CLS activities are given hereafter. CLS contributes to the IGS as an analysis center (accurate satellites orbitography, precise positioning). CLS is also interested in the development of Galileo services on the maritime sector.
The high latitude navigation and more specifically the Arctic case are strongly vulnerable to the ionosphere conditions. CLS experience both on the navigation and communications systems and on space weather will permit to characterize impacts, to establish mitigations solutions and to provide warnings and forecast to the mariners (for ex. via dedicated MSI).
CLS Company has a long, unique and worldwide recognized experience in the field of the sea surface wind and waves retrieval and iceberg detection from SAR imagery. CLS will then be able to provide relevant inputs for test beds in the test beds.

Hereafter is a list of potential future maritime services we have been identified for the VDE-SAT. We already made some specification analysis for part of such products. We would expect to be involved for test, demonstration or validation of such services whatever the novel communication support (specification, protocol, standards, validation…).

Nature of info	Services	Products
MSI from satellite to ship	Weather, ice	Charts, bulletins
	Hazards	Dangers identification & location (containers, offshore structures, pieces of wood, drifting buoys, cetacean…)
	Area notice	Restricted maritime area (in complement to nautical publications)
	SBAS_corrections	Long term variation corrections (satellite ephem. & clocks, ionosp)
	Space weather warnings	Warning/alert Bulletin + maps nowcast and forecast (Nav. or Communication system affected)
Report from ship to satellite	Weather report from ships	in-situ observations, WMO/VOS Program (ASM + ECDIS mangement to reduce manual operations)
	Extract of Voyage data recorder (VDR)	data report, complementary information (my last positions, vessels in vicinity)
	Position report from ship	Dangerous cargo freight, Piracy: victim or witness report
SAR	SAR Operations	distress alert, situation report (Sitrep) RCC acknowledgment

Envisaged future VDE-SAT or (VDE-TERR) products but applicable also to other novel technologies (CLS source)

Profiles:

Dr. Jean-Jacques Valette (male):
Research Engineer at Space Systems Department, Technical Division, CLS, Ramonville Saint-Agne, France
- E-navigation : AIS/GNSS integrity, Arctic case
- Innovative services (Space weather) and models
- Novel communication technologies : VDES, NAVDAT, Galileo return link

JJ. Valette will be primarily responsible for carrying out the proposed research and/or innovation activities.

Dr. Philippe Yaya (male):
Research Engineer at Geodesy and Oceanography, Oceanography Division, CLS, Ramonville Saint-Agne, France
- E-navigation : AIS/GNSS integrity, Arctic case
- Innovative services (Space weather).

Miche Vivies (male):
RF Engineer at RF Department, Technical Division, CLS, Ramonville Saint-Agne, France
- Expert on RF equipment (Argos, GPS, AIS),
- Satellite communications.

G. Fabritius (male) :
Head of Maritime security department, Geo-Positioning and Data Collection systems Department , CLS, Ramonville Saint-Agne, France

Dr. Nicolas Longépé (male):
Research Engineer at Radar Application Division, CLS, Brest, France
- Improvement and implementation of iceberg monitoring service by spaceborne radar technologies (SAR + altimetry) and drift modeling
o Assessment of SAR-based iceberg detection for yacht races around Antarctica and offshore oil rig safety in Arctic seas
o Research on advanced methods for iceberg detection and ice mapping in Arctic Seas in the frame of SIDARUS FP7 project
- Development of innovative SAR-based methodologies for ship tracking

Dr. Romain Husson (male)
Research Engineer at Radar Application Division, CLS, Brest, France
- Development of innovative SAR-based methodologies for ocean swell monitoring:
o Swell algorithms for CFOSAT SWIM future instrument
o Calibration/Validation of ENVISAT ASAR and Sentinel-1 (ESA)
- Responsible for the Marine Collaborative Ground Segment project:
o Development, production and delivery of advanced SAR-based ocean products in Near-Real time using Sentinel-1 data (Météo-France)

Dr. Jean-Pierre Malardé (male):
Research Engineer at Space Systems Department, Technical Division, CLS, Ramonville Saint-Agne, France
- E-navigation : AIS/GNSS integrity
- Novel communication technologies : VDES, NAVDAT, Galileo return link.

Relevant publications:

VDES:
- Participation to VDES documents for ITU (CEPT/ECC, "Agenda Item 1.16 VDES and its satellite component" , ESA doc.; "Justification of the channel plan for the VDES under agenda item 1.16", France, Germany, Ireland, Romania, Spain, Sweden, the Netherlands common doc.)
- Nader Alagha, Frank Zeppenfeldt, J. Lizarraga, G. Fabritius, JJ. Valette, J. Elstak, W.J. Ubbels, The role of satellite in the emerging maritime VHF Data Exchange System, Space Communications and navigation symposium (B2), 65th International Astronautical Congress 2014

GNSS:
- CLS is an analysis center for the International GNSS Service (http://igsac-cnes.cls.fr/) Loyer S., Perosanz F., Mercier F., Capdeville H., Marty J.C. Zero-difference GPS ambiguity resolution at CNES–CLS IGS Analysis Center. Journal of Geodesy. Springer Berlin / Heidelberg. Doi: 10.1007/s00190-012-0559-2, 2012

Space Weather:
CLS has specific algorithms and softwares, CLS has access to relevant real time observation datasets and provide space weather services.
- Solar energetic particles event forecast service (ESA uses it for ATV missions on the International Space Station) (http://blogs.esa.int/atv/2011/04/14/watching-the-sun-over-atv/)
- Equatorial scintillations monitoring service (polar service not yet developed)

Analysis of local ionospheric effects on GPS signals in Scandinavia, Valette J.J., N. Suard, P. Lassudrie-

Duchesne, R. Fleury, C. Hanuise, P. Yaya, G. De Franceschi, L. Alfonsi, V. Romano, C. Mitchell, B. Meggs, Third CNES Workshop on Earth-space propagation, Toulouse, Sept. 2006

Performance of Civil Aviation Receivers During Maximum Solar Activity Events, L. Deambrogio, C. Macabiau, W. Vigneau, JJ. Valette, M. Mabilleau, E. Robert, Proceedings of the ION 2013 PNT Meeting, Honolulu, Hawaï, April 2013, pp 986-994

Operational Service for the estimation of the risk of Solar Energetic Particles Events. Ph. Yaya, J.J. Valette, Sun-Earth relations and Space Weather session, SF2A, 20-23 June 2011

Iceberg prediction:

- N. Longepe, M. Sutton, F. Mercier, E. Greiner, F. Lefevre, A. Salman, "Iceberg Monitoring Service for Offshore Oil Rig Safety by Spaceborne Radar Technologies and Drift Modelling", SPE Arctic and Extreme Environments, 2013

Relevant projects:

VDES:

- ESA study on VDES future services, user needs and market, on VDE-SAT mission, system, architecture design (2013). Presentations at IALA (E-NAV16 and Brest VDES meeting, August 2013
- CLS intention to participate to the ESA ARTES-1 call for a VDE-SAT flight experiment

National Single Window solutions for SafeSeaNet:

- SWAMSI (FRANCE): Single Window for Automatic Maritime Safety Information – France (CLS is leader). In this project, the specification and implementation of the S-100 as a standard exchange format for MSI on e-navigation is a key point. The leader of the IHO S100 Navigational Warning Correspondence Groupe (S100NW CG) is a major contributor to SWAMSI. This is the reason why CLS proposes to be associated to EfficienSea2 S-100 tasks in order that a coherent approach is followed between the two projects.

(http://www.iho.int/srv1/index.php?option=com_content&view=article&id=611&Itemid=850)

High latitudes and Arctic case (Space weather impact on maritime navigation and communications):

- CLS is partner of the ESA MONITOR project that is dedicated to the analysis of ionosphere effects on GNSS systems during solar events. CLS routinely collects observations and provides technical support for the operations of permanent ionospheric scintillation monitors (Sodankyla, Kevo…)

http://monitor.estec.esa.int/Monitor/index.php?Page_id=2

- CLS is partner of a Eurocontrol project that intends to further assess the space weather impact on GNSS-based aviation operations. CLS has proposed typical space weather scenarios and analyses events via a permanent GNSS network composed of several hundreds of stations over ECAC.

http://www.stce.be/esww10/sessions/06aviation.php

Sea Ice detection (possible contribution for test beds & demo – to be discussed):

- SIDARUS: The overall objective of the FP7 SIDARUS project (2011-2013) was to develop and implement a set of sea ice downstream services in the area of climate research, marine safety and environmental monitoring.

High resolution wind fields maps (possible contribution for test beds & demo – to be discussed):

- As part of MCGS project (Marine Collaborative Ground Segment), the processing chains able to produce improved SAR wind fields in Near Real-Time (NRT) have been developed

Significant infrastructure/technical equipment:

For efficienSea2, CLS proposes to develop a specific equipment that will permit to continuously collect on route relevant data in order to a posteriori precisely characterize high latitude perturbations on navigation and communications systems. It will be composed of a modified AIS receiver coupled with an Argos transmitter. The AIS receiver will be augmented with an electronic system that will record both raw AIS data and raw GNSS data. The raw AIS data will include the messages generated by the ship itself but also all the messages

received from the other ships in the vicinity. The raw GNSS data will include basic observations (satellites constellation, pseudo ranges, C/N0). The Argos transmitter will always transmit the same message to five LEO satellites so that degradation of the data transmission may be quantified. Such equipment will be installed during for long term observations over the Baltic sea, around Greenland and along the Arctic. That way, different solar and magnetic conditions will be encountered from quiet, medium up to severe storms. For the first time, the same perturbations will be recorded on multi-bands spectrum (VHF, UHF, L-band). The impacts on the AIS and GNSS systems will then be quantified using raw data and specific algorithms (including point positioning). Correlations with space weather proxies will permit to establish forecasts of perturbation risks.
The following table summarizes the main solar events or other source of ionization of the Earth that generate perturbations in the ionosphere.

Source of Ionisation	Ionospheric Perturbations	Description	Magnetic region				
			Polar lat	Auroral lat	Mid-lat	Low-lat	Equat. Lat
Solar radiation surge (X, EUV)	Ionos. Enhancement	Rapid electron density increase by photo ionization (λ < 130 nm)	X	X	X	X	X
Coronal Mass Ejection	Ionos. Storm	solar wind energy transformation into polar currents and particle acceleration Iono wall front High velocity southward TAD	X	X	X	X	(X)
Magnetosp. Auroral and Geomagnetic storms	Termosph. Storm	Coupling with Ionos. Storm previous case					
Solar Energetic Particles	Energy input and electrojet enhancement	cf Solar radiation surge (X, EUV) + Coronal Mass Ejection effects					
Outer magnetosph. connection electrons, protons precitipation increase at solar max	Tongues of ionization auroral lights	irregularities, density enhancement large scale plasma troughs steep and instable density gradients at borders	X	X	(X)	X	X

High latitudes sources of ionisation (CLS source)

CLS will then elaborate proto-types of space weather bulletin or maps that may be experimented/validated on test beds. CLS will also contribute to the analysis of the possible communication supports at short medium and long term: VDES (terr. or sat.), Galileo return link or NAVDAT.

When considering the future GNSS services, the perturbations expected in high latitudes should be analyzed in the context of the IMO requirements (Resolution A.915(22), see also following table). Note that absolute accuracy and integrity requirements are very high even in open ocean. It is not guarantee that even the Galileo system will be robust enough to the ionospheric scintillations in order to fulfill such requirements. For the project, before the update of ships with multi-frequency receivers and Galileo compatible, a relevant question is the following. What will be the minimal requirement of position accuracy and level of availability of GNSS solutions for the polar navigation?

Table of the minimum maritime user requirements for general navigation

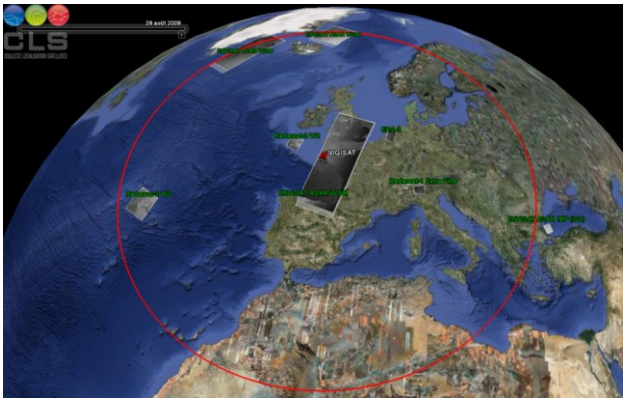
	System level parameters				Service level parameters			
	Absolute Accuracy	Integrity			Availability % per 30 days	Continuity % over 3 hours	Coverage	Fix interval[2] (seconds)
	Horizontal (metres)	Alert limit (metres)	Time to alarm[2] (seconds)	Integrity risk (per 3 hours)				
Ocean	10	25	10	10^{-5}	99.8	N/A[1]	Global	1
Coastal	10	25	10	10^{-5}	99.8	N/A[1]	Global	1
Port approach and restricted waters	10	25	10	10^{-5}	99.8	99.97	Regional	1
Port	1	2.5	10	10^{-5}	99.8	99.97	Local	1
Inland waterways	10	25	10	10^{-5}	99.8	99.97	Regional	1

Notes: 1: Continuity is not relevant to ocean and coastal navigation.
2: More stringent requirements may be necessary for ships operating above 30 knots.

CLS VIGISAT antenna footprint (possible contribution for test beds & demo – to be discussed)

The VIGISAT antenna of CLS entered allows for tasking and reception of Radarsat-2 SAR satellite as it covers all Western European areas, VIGISAT delivers near realtime services over the East Atlantic, the

North Sea and West Mediterranean sea.



Supporting documentation:
IMO Resolution A.915(22)
REVISED MARITIME POLICY AND REQUIREMENTS FOR A FUTURE GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

IHO S100NW CG (Navigational Warning Correspondence Groupe)
Regulatory process associated with the implementation of S-100 based products and services (http://www.iho.int/mtg_docs/com_wg/HSSC/HSSC5/HSSC5-05.1D_Regulatory_Process_for_S-100_Products_and_Services.pdf)

21: Danelec Marine:

Danelec Marine is a leading manufacturer of VDRs (Voyage Data Recorders) with more than 5,500 installations worldwide and is strongly positioned in ECDIS (Electronic Chart Display and Information Systems).
Our vision is to provide the most efficient product and service solutions to shipowners, resulting in lowest cost of ownership and highest customer satisfaction in the maritime industry.
We are headquarted in Birkeroed just outside Denmark, and is a 100% Danish owned company.
Please see links for more detail:
http://www.danelec-marine.com/story.aspx
http://www.danelec-marine.com/about.aspx
http://www.danelec-marine.com/management.aspx'

Profiles:

Peter Videcrantz, CTO:

Curriculum Vitae

Personal data:

Name:	Peter Videcrantz
Address:	Helleruplund Allé 9 2900 Hellerup, Denmark
Telephone no.:	+45 39 62 17 75
Birth date:	17th of March 1958

Careers data:

1977 - 1981	BSEE (graduate from Danske Ingeniør Akademi).
1981 - 1984	Chr. Rovsing A/S, R&D Engineer. Chr. Rovsing A/S designed large data networks for the airline industry.
1984 - 1985	GN Netcom A/S, Manager of the LAN R&D group. In 1984 the department for microprocessor based products and the LAN activities at Chr. Rovsing were acquired by GN.
1985 - 1990	Dataco A/S, Co-founder and Director of Engineering Development of LAN products based on the Ethernet (IEEE 802.3) standard.
1990 - 1992	Dowty Networks A/S, Director of Engineering Besides being Dataco's largest distributor, Dowty itself developed a wide range of other communication products.
1991 - 1995	Member of the Board of Directors in Scanview A/S
1992 - 1995	Cray Communications A/S, Director of Engineering for LAN products. In 1992 Cray communication acquired Dowty's data communication activities. Member of Cray Communications Worldwide Managing board. Responsible for 100 development engineers employed by Cray communication A/S in Denmark and 15 employed by Cray in the UK.
1995 - 1998	Scanview A/S, Director of R&D. Development of prepress products such as image setters, scanners and color management software. Approximately 35 development engineers were employed in Scanview A/S.
1998 – 2002	I-DATA A/S General Manager for data communication products.
1999 – 2001	ExBit A/S, Member of the board of directors. Development of 10GBits Ethernet switch chips.
2002 - 2014	Danelec Marine A/S. CTO and COO
2014 -	Danelec Marine A/S. CTO

Klaus Kuhn, Udviklingsingeniør:

KLAUS KÜHN

M. SC., E.ENG, PH.D., SENIOR HARDWARE ENGINEER

SUMMARY OF QUALIFICATIONS

8 years of experience working in maritime electronics, maritime systems & standards such as Voyage Data Recorders, ECDIS (chart plotters) and radar. Participated in IMO and IEC recommendation and standard development.
3 years of experience with optical and other system engineering aspects of unregenerated long haul systems from 500 km to 4000 km from scratch in a successful start-up environment
4½ years of experience working with 10Gb/s line interfaces
Successfully managed teams of 4 to 10 persons to meet objectives

2013-2005 **DANELEC MARINE**
Senior Hardware engineer
Designed & tested the electronics of the DM300,DM200 Voyage Data Recorder including the capsule electronics.
Designed & tested the electronics of the DM800 & DM700 ECDIS (a "Chart plotter").
Wrote recommendations on the use and user education of the DM800 ECDIS.
Participated in IMO & IEC to decide upon on future updated requirements for the VDR and ECDIS.
Designing the 2014-version VDR electronics.

2002-1999 **NORTEL NETWORKS (QTERA)**
Senior optical systems engineer
Managed the impairment budget, optical architecture and optical budget for ultra long haul systems (2000 to 4000 km) including proposals for future systems. Worked as an expert - troubleshooting installations by Qtera/Nortel and develop system commissioning procedures and reviewing documentation of the LH4000 product
Designed and led the development of the short-reach part (module) of Qtera/Nortel's system

1999-1998 **QTERA CORPORATION**
Senior optical engineer
Invented the so-called "Jägermeister" solution, a simple dispersion slope compensation arrangement, which arguably saves the concept
Joined Qtera corporation (Florida, U.S.) as one of the first 20 employees, writing Qtera's system document with a focus on the optical aspects (such as optical power budget), but also alarms, SONET intricacies, rack solutions. Qtera designs one of the first available ultra-long haul 10Gb/s/wavelength systems and was sold to Nortel Networks for 3.25 bill.$

1998-1994 **DSC COMMUNICATIONS**

INDUSTRIAL SCIENTIST
Started to design a second generation 10 Gb/s TDM optical interface alone before leaving DSC. Looked at optical networks for immediate commercial use by DSC. The work results in a patent application "An optical network" and an optical protection switch module. Later, I briefly try to incorporate my concept into the European standards in telecommunications
My first efforts on looking on optical networks are presented. Two patent applications on switching in optical networks
Compared TDM networks with WDM networks
Appointed project manager of the hardware construction team in the 10 Gb/s (TDM) Danish Field Trial, which starts in 1994. The working equipment is exhibited at TELECOM '95, Geneva

EDUCATION

1997 **Ph.D. degree "10 Gb/s and optical networks"**
1993 **M.Sc. in E.Eng. from the Technical University of Denmark (TUD).**
Master thesis was "Techniques for WDM Networks", focusing on optical non-linearity (Four-Wave-Mixing). The weighted grade average was 10.8 (A-student) I worked as a student tutor in probability theory, applied electromagnetic theory, microwave techniques and in systems science.

PUBLICATIONS

T. Numai, K. Kurihara, K. Kühn et Al., IEEE J. of Quantum Electron., vol. 31, pp. 636-642, 1995.

Klaus Kühn and Peter Møller Kjeldsen : "The Introduction of STM-64 Equipment in the Trunk Network", presented at Networks and Optical Communications, Heidelberg, 1996.

Klaus Kühn : "Comparisons between WDM and TDM network solutions", presented at Networks and Optical Communications, Heidelberg, 1996.

SKILLS, TOOLS

Worked with Cadence OrCad-Allegro (1994-2013), Pascal (1984-1997), Microsoft Office (1994-2013), Java (2004-2013).
Worked briefly with standardization groups ITU, ETSI and OIF, worked with IMO (Danish delegation, NAV) and IEC (TC80).

LANGUAGES

English, Danish, some German and a little French.

Niels Gram Jeppesen, Udviklingsingeniør:

NIELS GRAM JEPPESEN
M. SC., E.E., PH.D., SOFTWARE DEVELOPMENT ENGINEER

SUMMARY OF QUALIFICATIONS

2013-2005 **DANELEC MARINE**
Software development engineer
Development of software for audio compression (MP3 encoder on an ADI BF537 processor). Development of software for USB/Firewire NAS (capsule interface). System architecture and design of 2nd generation frame-grabber. Development of software for auto sync on the 2nd generation frame-grabber.

2005-2003 **CONSULTANT**

Participation in building a "home Server2; A small Ethernet based plug-and-play file server intended for home entertainment systems. Consultant for Sycs, a small Danish startup that tried to develop a new and different micro processor architecture especially suited for vector processing.

2002-1998 **MIPS DENMARK DEVELOPMENT CENTER (MDDC)**
Co-founder and member of management staff
Group leader and development engineer in the "Synthesizable 64-bit processor core" group. Management: Participation in general management of MDDC, Micro architecture group management, RTL coding style standard and verification of "infrastructure".
Engineering responsibilities: Coprocessor 0 (CP0, System Control Coprocessor) of the 5K processor family and participation in the further development of MIPS instruction set.

1998-1996 **LSI LOGIC**

DEVELOPMENT ENGINEER
"Tiny RISC" (MIPS) design team and technical responsibilities included RTL design and ACIC Layout.

1995-1988 **DATAO A/S**

DEVELOPMENT ENGINEER
Development of data communication software for embedded systems based on both Z80 and MIPS processors.Development of software for a X86-based PC. Development of security systems (access controls, data encryption and key management.

EDUCATION

1990 **Ph.D. degree from Technical University of Denmark**
Thesis on estimation of signal-to-noise ratio for seismic signals.

1985 **M.Sc. in E.E. from the Technical University of Denmark (TUD).**
Special areas of interest during the studies: Analog electronics (especialy audio equipment) and digtital signing processing. Masters thesis on impulse response measurement for linear systems. Work included building a TMS32010 based system and writing software for this system.

PATENTS: **US 7000095B2: "METHOD AND APPARATUS FOR CLEARING HAZARDS USING JUMP INSTRUCTIONS**

LANGUAGES
English & Danish

Relevant publications:
Besides the extensive know-how on data collection on board vessels derived from the VDR expertise, Danelec has established a project for ensuring transmission of data between ship and shore in a readable and manageable format which will allow to operate even under very low satellite band-width capacity which is the case for the majority of vessels. Please see attached:
DBS10949-10 White paper on VDR remote access

Relevant projects:
- VDR Remote Interface
- Development of entirely new product platform, DM100, for the new VDR standard entering into force in 2014
- Driving force in setting the standard: IEC61996-1_ed2.0 (new VDR standard coming into force in 2014)

22. Frequentis AG:

Frequentis AG is an international supplier of communication and information systems for control centres with safety-critical tasks. With a market share of 30%, the company is the world market leader in voice

communication systems for air traffic control; it's also world market leader in the area of Aeronautical Information Management. Frequentis can draw on enormous reserves of project know-how built through numerous international engagements and decades of experience. The company is technology-oriented with a strong focus on innovation.

Frequentis technology is helping to manage maritime traffic across 20% of the world's oceans. We first entered the maritime market with the Global Maritime Distress and Safety System (GMDSS), which allows emergency communications to use whatever technology makes the most sense for the ship's current location.

At Frequentis, our all-encompassing objective and prime orientation is summarized in the term "maritime domain awareness" (MDA). Every authority with maritime responsibility and every maritime service provider must be able to identify all and any potential hazards to life, goods, territorial integrity and the environment and they must be able to do this in a timely manner. MDA includes such topics as maritime safety (accident prevention), maritime security (crime prevention) and environmental protection (clean, sustainable and productive seas). Our products and solutions are designed with these responsibilities in mind.

Our maritime voice and information communication solutions can fulfil these MDA requirements because we understand the related infrastructural issues and the problems faced by maritime service providers. We take a holistic approach that reflects the needs of each of our customers.

The origins of the Frequentis Research unit date back to 1998, and Corporate Research has since become a cornerstone of our technology leadership. Our research team works on a range of future oriented topics that impact all business areas within the company. All these research activities are driven by either a customer need or a promising technological impulse.
Our research projects are either a joint undertaking with one of our customers (e.g. ESA, SESAR or NENA) or carried out within the framework of an international research programme that also involves our customers. This means each research project is guided by an approved business case and our goal is to set international standards in relevant fields. Research efforts always benefit from diversity, which is why we place such value on the exchange of ideas and insights with our customers and on cooperation with universities, research institutions and other industry partners.
Frequentis has a lot of experience in distributed systems as well as in migration scenarios towards IP based networks. Combined with a deep know how of land based maritime solutions our knowledge from other domains like AIM (especially SESAR/SWIM) and public safety will contribute to a a successful EfficienSea2 project.

Profiles:
Thomas Lutz (male)
Senior Lead Expert at Frequentis AG, Dipl.Ing., has a degree in Environmental Engineering & Water Management (BOKU, University of Natural Resources & Life Sciences) since 2003. He accumulated 18 years of experience in software architecture & development, especially in the area of Distributed Systems, GIS systems and Agile Development. He has been speaker on international conferences and was part of several large scale greenfield projects and research projects in various domains including financial risc management and trading systems, aeronautical information management systems (Aeronautical Information Exchange Model (AIXM)) , a Public Safety CAD platform, and Maritime GIS Products.

Wolfgang Kampichler (male)
Principal at Frequentis AG, received his PhD from the Vienna University of Technology in 2002 and has accumulated 18 years of experience in IP communications technology. He has participated in scientific roles in all recent Frequentis activities related to design and development of IP based voice communication systems. He contributes to standardisation working groups in public safety and air traffic management and is a recognised expert and speaker at public and customer events addressing topics related to VoIP in air traffic management and emergency services with Internet technology.

Silvana Caushi (female)
Project Manager at Frequentis AG, Dipl.-Ing., PMP, has accumlated 19 years of project management experience in large scale Maritime, Public Safety, Air Traffic Management and Telecommunication projects. She has been the responsible Frequentis Program Manager for the SESAR project. She holds certifications in Risk Mangement, Quality Management and degrees in International Project Management (University of

Economics and Business Administration, Vienna), Electronics & Telecommunications (Faculty of Mechanical and Electrical Engineering, Tirana and Vienna University of Technology) and a post-graduated at the Superior Institute of Specialisation in Telecommunications in Rome.

Florian Gruber (male)
Maritime Product Manager at Frequentis AG, Dipl.Ing., received his technical degree in radio communication electronics in 1993, his engineer degree in electro technique in 1996, and his diploma degree in Precision- System- and Information- technology at the University of Applied Sciences Wiener Neustadt in 2001.
He worked for the federal army as engineer on military communication sites, before entering the field of navigation in 2000 at RIPE NCC "Reséaux IP Européen" in Amsterdam working on GPS time synchronisation for Internet Test Traffic Measurement Services.
He is Maritime TnT Product Manager (TnT data solutions for Command and Control Centres) at Frequentis. He is engaged in IALA work for AIS, Aid to Navigation and is working on GMDSS and Maritime Domain Awareness for Frequentis.

Harald Milchrahm (male)
Scientist at Frequentis AG, recieved his PhD from the Technical University Graz, Institute for Software Technology in 2010. He has 12 years of experience in software architecture & development. He is Conference committee member of the Conference on Advances in Computer-Human Interactions since 2009, Editorial Board member and reviewer of the International Journal of Advances in Intelligent Systems since 2012 and has held numerous scientific talks on agile software development at conferences and in the industry. He is Chairman of Eurocae Working Group 100 (Remote and Virtual Tower) as well as chairman of SESAR 2020 Definition Phase SWIM Technical Infrastructures. Within Frequentis he is AIM & ATM Civil Strategy and engaged in all recent Frequentis activities in SESAR WP 8 & 14 System Wide Information Management.
Relevant publications:

Frequentis T&T:
The Frequentis maritime information solution, which carries the brand name “Tracking and Tracing System” (T&T), provides a solid foundation for a total, integrated maritime solution. The operator position is providing each operator with access to a common operational overview and all kinds of communication alternatives.
The Tracking & Tracing framework is the perfect environment for integrating maritime applications from multiple vendors. For EfficienSea2 T&T will be one of the platforms to be used, utilizing a proven technology to make sure high TRL’s can be realized.

Frequentis Maritime Communication Systems (MCS):
The MCS is available in various editions the so called "MCS Family" especially designed to fulfil all individual customer needs in their different surroundings. These include Coastal Radio Service (CR), Coastal Surveillance Solutions (CSS), Rescue Coordination Centres (MRCC), Vessel Traffic Services (VTS) and Port Communication Solutions (PCS).
Each part of the systems and applications (e.g. DSC, NAVTEX, radio remote control) is designed for network usage, with free and flexible interconnections between ships and land subscribers.

Frequentis smartAIM™:
smartAIM is an integrated, net-centric and SWIM-compatible solution designed to automate the management of Aeronautical Information. A modular set of applications built to fit into Air Traffic Management enviroments ensure a customized and future proofed solution based on international standards (e.g. AIXM - Aeronautical Information Exchange Model).
smartAIM is proven technology, with functionality and high scalability based on EAD, the world’s largest Aeronautical Information System (AIS), a centralised reference database of quality-assured aeronautical information and, simultaneously, a fully integrated, state-of-the-art AIS solution.
With more than 700 AIS/AIM positions (remote clients, national AIM solutions and regional AIM hubs), smartAIM offers solutions from NOTAM, METEO and AIXM data mangement to integrated charting, and electronic (as well as paper) AIP publications, always with safety as one major design goal (based on SWAL 3).

EAD ITP (EAD IT Service Provision):
Frequentis AG was entrusted with the EAD IT Service Provision, operating and maintaining a highly availa-

ble distributed IT infrastructure available all over the world including 24/7 operations and support
Frequentis acts also as service provider for aeronautical information management (partnership with AENA and DFS - GroupEAD).

Relevant projects / products and services:
GMDSS for the Australian Search and Rescue Area:
The Global Maritime Distress and Safety System (GMDSS) ensures that search and rescue authorities on-shore, as well as ships in the immediate vicinity of a ship or person in distress, are rapidly alerted to a distress incident.
The system also covers urgent, safety-related communication, including distribution of maritime safety information (such as navigational and meteorological warnings and forecasts).
Frequentis provides its MCS3020 plus VCXiP and T&T Rel 2.6 covering DSC, Voice Communication, scheduled Weather FAX transmission, scheduled Voice broadcast for weather reports and navigational warnings as well as a maritime Radio Telex Service (NBDP).
All services are implemented utilizing HF radio technology and a satellite based IP communication network.
Voice and data communication system for the Canadian Coast Guard:
The system provides integrated voice communication for radio, telephone, maritime applications, and sensor information in one unique system with unlimited conferencing capabilities. The MCS3020 provides any operator access to all communication channels, regardless of the system load at any place and at anytime.
24 Command and Control Centres with 198 Coastal Stations and 100 working positions in Canada´s five maritime regions (Newfoundland and Labrador Region, Maritimes Region, Quebec Region, Central and Arctic Region and Pacific Region) are part of that project.

SESAR and NextGen:
Frequentis is a member of SESAR Joint Undertaking and is as such an active participant in numerous research, regulatory, industry and standardisation communities and initiatives like EUROCAE.
This participation is a result of the company's intense commitment to the ATM community and to the current and future safety of the world's airspaces.
It also reflects the strong position held by Frequentis within this community, through our long-history of cooperation with ANSPs, controllers and other ATM organisations, our orientation to technological innovation, and the expertise and know-how collected in decades of successful ATM project work around the globe.
Frequentis is also working on research projects within the FAA's NextGen initiative. This initiative will transform US airspace, leading to reduced environmental impact, fewer delays, safer skies, and vastly more efficient ATM processes.

FABEC N-VCS, France:
DSNA (the French air navigation service provider) and EUROCONTROL’s Maastricht Upper Area Control Centre (UAC) have entrusted Frequentis with the development, deployment and maintenance of their future voice communication systems
Smooth transition from existing legacy systems to IP-enabled communication services, leveraging IP technology to enhance air/ground and ground/ground ATM communications for facilities of all sizes. The project will offer the technical possibility to standardise procedures and technical interface protocols between ANSPs, based on EUROCAE ED-137A and laying grounds for further development of it

Significant infrastructure/technical equipment:
Frequentis can provide highly available IT infrastructure provided by a very experienced IT department. Production sites are hosted on physical servers as well as in virtualized enviroments. For operational systems a Customer Service Devision provides 24/7 support where necessary and requested.

23. Furuno Finland Oy

Furuno Electric Co Ltd is among world’s leading manufacturers of marine electronics, including navigation and communication equipment.
Furuno Finland Oy (FFOY), a subsidiary of Furuno Electric Co, specializes in research and development, delivery and service of navigation and surveillance solutions for mariners and authorities.
FFOY has a strong R&D team and long-standing expertise in integrated navigation systems. The company is very actively involved in standardization of marine technology: currently participating in IEC, IHO, IMO,

IALA and CIRM.
Profiles:

Mr. Hannu Peiponen, M.Sc Tech, has been working in Furuno Finland Oy and its predecessors since year 1984 in different positions, although most of the time as R&D manager. Since 2011 Hannu has been working as Technical Director responsible for follow-up and participation to international rule setting with organizations such as CIRM, IALA, IEC, IHO and IMO. During his long professional career he has been involved in design, development, testing, and type approval of nearly all navigation instruments for SOLAS class vessels. He has participated in every IEC workgroup for navigation and communication instruments and acted as chairman in many. Within IHO Hannu is among the few invited experts from industry to participate in drafting of new standards including the S-100, which is selected by IMO as the baseline for e-Navigation.

Mr. Timo Kostiainen joined Furuno Finland in 2007, after receiving his D.Sc Tech. degree in computer science. He has been developing ECDIS and track control systems. His current position is head of the R&D department.

Mr. Rauno Juutila, M.Sc. Tech, joined Furuno Finland in 2003 to continue his career in electronic and software engineering. He has worked on many aspects of bridge systems, including communication, alert management and user interfaces.

Mr. Karri Kaksonen, M. Sc., joined Furuno Finland in 2004, after accumulating strong experience in software and hardware development in many companies. At FFOY, he has worked on communication and data security applications as well as chart and radar display solutions.

Mr. Antti Kukkonen has been working in Furuno Finland Oy and its predecessors since year 2000 in different positions. Antti has been developing Bridge Alarm Monitoring Systems and has been responsible for Field Operations and Research & Development departments of the company. He has worked 3 years in Products Planning and Marketing Department of Furuno Electric Co.,Ltd in Japan. Antti is now working with Hannu on International Standardization and is a member of IALA e-Navigation Committee, IEC TC80 WG15 for Automatic Identification Systems and PT62923 for Bridge Alert Management.

Relevant publications:
ECDIS
GMDSS / VHF radio equipment
VSAT satellite antenna equipment
Gate-1 online update system for navigational charts

Relevant projects:
Many projects and activities related to products and systems mentioned above.

Significant infrastructure/technical equipment:
- Cloud based infrastructure for chart distribution to vessels
- Integrated bridge system

24. GateHouse:

GateHouse A/S is a software and consultancy company located in Denmark.
GateHouse has been active in the maritime marked for 20 years.

Profiles:

Lars Mohr Jensen:

EUROPEAN CURRICULUM VITAE FORMAT

PERSONAL INFORMATION

Name	JENSEN, LARS MOHR
Address	GATEHOUSE A/S, LINDHOLM BRYGGE 31,DK- 9400 NR. SUNDBY, DENMARK
Telephone	+45 70201909
Fax	+45 70201910
E-mail	lmj@gatehouse.dk

Nationality	Danish
Date of birth	12.05.66

WORK EXPERIENCE

• Dates (from – to)	1995 – NOW
• Name and address of employer	GateHouse A/S
• Type of business or sector	Telecommunication
• Occupation or position held	Technical Programme Manager – Tracking and Surveillance
Main activities and responsibilities	Technical responsible for all activities in the GateHouse Tracking and Surveillance business area (maritime C2, ITS backend, conditional maintenance, communication).
• Dates (from – to)	1992 – 1995
• Name and address of employer	Politechnico di Milano, Italy / Aalborg University, Denmark
• Type of business or sector	University
• Occupation or position held	Research assistant
Main activities and responsibilities	Research activities (management, analysis, programming, experimentation lead, scientific paper writing, conference contributions). Human motor control and experimental pain research.

EDUCATION AND TRAINING

• Dates (from – to)	2005
• Name and type of organisation providing education and training	Rovsing, Copenhagen, Denmark
• Principal subjects/occupational skills covered	Project Management
• Title of qualification awarded	PRINCE2 (APM Group)
• Level in national classification (if appropriate)	
• Dates (from – to)	1987 – 1992
• Name and type of organisation providing education and training	Aalborg University, Aalborg, Denmark
• Principal subjects/occupational skills covered	Electronic engineering, computer science, control engineering, medical informatics
• Title of qualification awarded	MScEE Systems Engineering

• Level in national classification (if appropriate)	
PERSONAL SKILLS AND COMPETENCES *Acquired in the course of life and career but not necessarily covered by formal certificates and diplomas.*	
MOTHER TONGUE	**DANISH**
OTHER LANGUAGES	
	ENGLISH
• Reading skills	Excellent
• Writing skills	Excellent
• Verbal skills	Excellent
SOCIAL SKILLS AND COMPETENCES *Living and working with other people, in multicultural environments, in positions where communication is important and situations where teamwork is essential (for example culture and sports), etc.*	Have been working closely with different nationalities on universities in both Italy and Denmark. Used to travel around the world on business.
ORGANISATIONAL SKILLS AND COMPETENCES *Coordination and administration of people, projects and budgets; at work, in voluntary work (for example culture and sports) and at home, etc.*	Managing people and projects for 10 years: 2007- - Business Unit Management (Tracking Solutions) Business Development, Sales & Marketing 2005-2007 - Programme management (Defence Systems) 2005-2006 - Project Management of the Danish Army NBO advisory group 2003-2004 - Overall Project Management on National AIS System (DK) 2002-2005 - Programme management (Radio Communication Systems) 1997-2002 - Project management (different communication systems)
TECHNICAL SKILLS AND COMPETENCES *With computers, specific kinds of equipment, machinery, etc.*	**Architecture**: enterprise architecture (system of systems), system architecture, architectural frameworks. **Requirement development**: Scenario development, requirement specification development. **Quality Assurance and Process Improvement**: CMMI, Engineering Process Group. **Project Management, Analysis and Design**: SCRUM, UML, SA/SD, SPU. **Tools and Technologies**: MS Office, MS Project, various version control tools (CVS, PVCS…), various programming tools, support tools (Bugzilla, OnTime), distributed systems (maritime mission critical; fleet management, ITS, various tracking systems), telematics, GIS, ITS, GMDSS. **Operating systems**: Windows, OSX and Linux. **Telecommunication Protocols**: DSC and AIS related protocols (ITU/IALA/IEC), UMTS, TCP/IP.
ADDITIONAL INFORMATION	Current assignments: Strategy development for Tracking and Surveillance. Program Management for Tracking and Surveillance. GateHouse project management of the ITS Nordjylland research project in cooperation with AAU and Inntrasys. Intelligent Transport System (ITS) backend server. Supervisor on AAU Ph.D. project "Detecting DDoS Attacks in Dedicated Networks". The study is focused on security in ITS networks. Steering group Fleet Management Freja Transport & Logistics. Technical sales activities.
Page 2 - Curriculum vitae of Jensen, Lars Mohr	For more information go to www.cedefop.eu.int/transparency www.europa.eu.int/comm/education/index_en.html www.eurescv-search.com

Poul Bondo:

EUROPEAN CURRICULUM VITAE FORMAT

PERSONAL INFORMATION

Name	BONDO, POUL
Address	GATEHOUSE A/S, LINDHOLM BRYGGE 31,DK- 9400 NR. SUNDBY, DENMARK
Telephone	+45 70201909
Fax	+45 70201910
E-mail	pba@gatehouse.dk
Nationality	Danish
Date of birth	26.10.67

WORK EXPERIENCE

• Dates (from – to)	1992 - 1999 and 2000 – 2004 and 2009 – NOW
• Name and address of employer	GateHouse A/S, Strømmen 6, Nr. Sundby, DK-9400, DENMARK
• Type of business or sector	Telecommunication
• Occupation or position held	Director Maritime Department
• Main activities and responsibilities	Management Tracking and Surveillance, maritime and ITS
• Dates (from – to)	2004 – 2009
• Name and address of employer	Bondo Consult, Nordre Kystagervej 8, DK-2650 Hvidovre, Denmark
• Type of business or sector	Technical systems and software development.
• Occupation or position held	Consultancy in program and project management IT and Bank Security
• Main activities and responsibilities	Program management. Project management
• Dates (from – to)	1999-2000
• Name and address of employer	TERMA AS, Taastrup, Denmark
• Type of business or sector	Naval systems
• Occupation or position held	Systems and Software Engineer
• Main activities and responsibilities	Naval Command and Control (C2) systems. Missile launch control

EDUCATION AND TRAINING

• Dates (from – to)	2000-2000
• Name and type of organisation providing education and training	Hosted by Copenhagen Business School
• Principal subjects/occupational skills covered	Project Management as a ½ year course. Project management of software development projects.
• Title of qualification awarded	Project Manager
• Level in national classification (if appropriate)	Projektledelse på datanom uddannelsen

• Dates (from – to)	1987 – 1992
• Name and type of organisation providing education and training	Aalborg University, Aalborg, Denmark
• Principal subjects/occupational skills covered	Electronic engineering, computer science, control engineering, medical informatics
• Title of qualification awarded	MScEE Systems Engineering
• Level in national classification (if appropriate)	
• Dates (from – to)	1994 – 2001
• Name and type of organisation providing education and training	GateHouse
• Principal subjects/occupational skills covered	Making courses as teacher in various subjects particularly the C++ language. This has been for customers as part of the general consultancy work.
• Title of qualification awarded	
• Level in national classification (if appropriate)	

PERSONAL SKILLS AND COMPETENCES

Acquired in the course of life and career but not necessarily covered by formal certificates and diplomas.

MOTHER TONGUE	Danish
OTHER LANGUAGES	English
• Reading skills	Excellent
• Writing skills	Excellent
• Verbal skills	Excellent

SOCIAL SKILLS AND COMPETENCES

Living and working with other people, in multicultural environments, in positions where communication is important and situations where teamwork is essential (for example culture and sports), etc.

Have been working closely with different nationalities on many international projects
Used to travel a lot on international projects

ORGANISATIONAL SKILLS AND COMPETENCES

Coordination and administration of people, projects and budgets; at work, in voluntary work (for example culture and sports) and at home, etc.

Managing people and projects for 10+ years:
2009-now – Management of the Maritime Department at GateHoue
2004-2009 - Program Management and head of department for software development
2004-2007 – Project Management IT security projects
2002-2004 – Project Management surveillance projects
1997-1999 – Project Management Radio communication projects

TECHNICAL SKILLS AND COMPETENCES

With computers, specific kinds of equipment, machinery, etc.

Architecture of systems and software. Robust systems. Distributed systems, IT Security, safety systems development. Redundancy. Requirement specification development.
Tools and Technologies: SCRUM, UML, GIT, AIS/GMDSS, GIS (geoserver / mapserver).
Software development: C++ (expert), C, Java, C#, Assembler.
Database development: PostgreSQL.
Operating systems: Linux and Windows. Various embedded (incl. Android)

ADDITIONAL INFORMATION

Relevant publications:

GateHouse provides AIS systems for a significant number of European (and worldwide) Coast Guards and Maritime Authorities.
GateHouse provides the system for maritime exchange of AIS data in the HELCOM and North Sea agreements.
GateHouse is providing IALA members with the IWRAP mk2 risk analysis tool.
GateHouse has worked with other private companies in providing solutions for environmental monitoring and control of dissipated exhaust from ship engines.
GateHouse has delivered integrated port solutions for several ports worldwide. These systems are integrated with other IT systems, to leverage the usage of AIS throughout the port.

Relevant projects:
GateHouse has participated in the EU Mona Lisa project.
GateHouse is participating in the EU Mona Lisa 2 project.

Significant infrastructure/technical equipment:
The HELCOM and North Sea programs for exchanging AIS data is considered a foundation of the Maritime Cloud to be developed in this project. GateHouse is providing the complete AIS backend software and support and maintenance for both systems.

Supporting documentation:
GateHouse provides fleet management systems for large transport companies in North Europe. These companies runs a multi modal transport business (sea, road, air and rail), and would benefit significantly from timely maritime information in order to perform a multi modal optimization throughout their operations. As from the road part route optimization and constant ETA estimates are an integrated part of securing operational awareness both for their own usage and for the benefits of their customers. GateHouse envisions a large potential in leveraging these processes throughout the logistic chain – including sea transport.

25: LITEHAUZ ApS:

The LITEHAUZ project focus on monitoring of emissions and discharges to the marine environment and LITEHAUZ is a company dedicated to the environmental issues of shipping. The vision is to employ onboard sensors or use existing to provide operationally relevant self-monitoring data locally and to exchange with cloud based data repositories allowing for timely back up, meta-data analysis (data mining) and identification of risk/impacts. The use of central data stacking improves authorities' data access and allows for increased transparency.

Profiles:

We propose three LITEHAUZ staff members for the study:

Dr. Frank Stuer-Lauridsen:

CURRICULUM VITAE

Name	Frank Stuer-Lauridsen
Date of birth	24 September 1961
Nationality	Danish
Education	Master of Science in biology, University of Copenhagen 1988. Ph.D. in Environmental Chemistry, University of Odense 1996.
Memberships	1991-2007. Society of Environmental Chemistry and Toxicology (SETAC). 1988-2008. Danish Association of M.Sc.'s and Ph.D.'s. 1990-present. Danish Association of Engineers. Section: Environment
Appointments	2008-present. Coordinator for the Network of Environmental Managers in Danish Shipping 2008-present. Technical expert in IMO GESAMP working group on ballast water 1998-present. Technical expert to the National Environmental Appeal Board 1994-1997, 2000-2002. Board of the Danish Society of Environmental Chemistry. Chairman for three years. Reviewer for Environmental Science & Technology and Journal of Cleaner Production. GLP Study Director and Principal Investigator.
Key qualifications	Dr Frank Stuer-Lauridsen has 20 years of experience in management of cross discipline and multi stakeholder projects. He is a specialist in strategic management and assessment of hazardous materials in industry and society. In recent years he has worked intensively with the environmental challenges of the shipping sector, in particular emissions and discharges, ballast water and ship recycling. He has also worked extensively with the economic and environmental assessments in shipping. Frank was researcher at the National Environmental Research Institute (1990-1996), senior consultant and chief project manager at COWI (1996-2005). He was responsible for R&D as Head of Innovation at DHI until 2007 when he founded LITEHAUZ, a consultancy company working with environmental management in the marine sector. Frank has worked intensively with ballast water management over the last three years, both with the risk assessment issues underlying requirements and exemptions, and with the system approval in IMO as a member of the GESAMP Ballast Water Working Group. In LITEHAUZ he is managing and/or quality controlling the development and approval process for seven BWMS. Country experience: India, Bangladesh, UAE, Russia, Lithuania, China, South Africa, Namibia, Mozambique, Egypt, Jamaica, Ireland, Singapore.

Employment record

Year	***Firm***	***Position and responsibilities***
2007-present	LITEHAUZ ApS Maritime Environmental Consultants	Owner and Managing Director
2007	DHI Water Environment Health	Head of Innovation – Centre for Environment and Toxicology

Year	*Firm*	*Position and responsibilities*
2005-2006	DHI Water & Environment	Head of Innovation – Environmental Risk Assessment
2003-2005	COWI A/S	Chief Project Manager - Environment and nature
2001-2003	COWI A/S	Senior Specialist - Chemical Assessment Strategies
1996-2001	COWI A/S	Environmental chemist and ecotoxicologist. Environmental exposure, impact and risk assessment
	Universities and Danish Association of M.Sc.s and Ph.D.s	Critic at PhD thesis defences. Lecturer on courses in Risk Assessment of Chemicals, Environmental Analytical Chemistry, Ecotoxicology and Contaminants in the aquatic environment
1993, 1994	COWI A/S	Ad hoc consultant on sediment contaminants of the North Sea and of harbour sediment
1992-1996	National Environmental Research Institute, Dept. of Environmental Chemistry.	Research Scientist
1989-1992	National Environmental Research Institute, Dept. of Environmental Chemistry	Ph. D. study; Project keywords: Hydrophobic organometals, sediment, passive sampling, bioavailability
1989	The August Krogh Institute, University of Copenhagen, Denmark.	Research assistant at the Institute of Biological Chemistry A

Dr. Artur Mielczarek:

Name	Artur Tomasz Mielczarek
Date of birth	24 july 1983
Nationality	Polish
Education	PhD Environmental Biotechnology, Aalborg University, Denmark MSc. Eng. Environmental Engineering, Aalborg University, Denmark MSc. Eng. Biotechnology, Technical University of Lodz, Poland
Memberships	2010-present: Danish Association of Engineers. Section: Environment
Key qualifications	Artur holds a PhD in Environmental Biotechnology from Aalborg University. He has worked as an engineer and microbiologist on international and Danish projects, with main focus on microorganisms in water treatment. He has also been involved in projects concerning ozone treatment and bio membranes/biofilms and is experienced in database development and statistical handling of large data volumes. Recently he has been involved in the R&D project for development of an in-line monitoring device for ballast water and he assists ballast water treatment developers and is currently working on the development of a monitor for ballast water.

Employment record

Year	***Company***	***Position and activities***
2013- present	Litehauz ApS	Environmental Consultant
2012 – 2013	Aalborg University	PostDoc
2011 – 2012	Aalborg University	Research Assistant
2010 – 2010	Aalborg University and LimnoTec	Research Assistant
2007 – 2011	Aalborg University	PhD student

Experience record – Selected assignments 2008 - present

Year	***Project***	***Position and activities***
2013-ongoing	Development of an in-line monitoring device for ballast water Client In-house project, supported by: The Danish Business Innovation Fund	Technical and strategic consultant. Development of an inline monitoring prototype and appertaining software for determining ballast water quality
2013	Preparation of a G9 Basic Approval application for a Ballast Water Treatment System developer Client: Confidential	Technical expert. Development of basic application and resolution of technical and strategic choices in development of the BWTS.

Languages	**English**	**Danish**	**Polish**	**Russian**
Speaking	5	4	5	2
Reading	5	4	5	3
Writing	5	4	5	2

(Mother tongue/excellent: 5; Average: 3-4; Poor: 1-2)

Public and Peer Reviewed Publications

2012 **Mielczarek A.T.**, Nguyen H.T.T., Nielsen J.L., Nielsen P.H. Population Dynamics of Bacteria Involved in Enhanced Biological Phosphorus Removal in Danish Wastewater Treatment Plants (akcepteret)

Mielczarek A.T., Kragelund C., Eriksen P.S., Nielsen P.H. Population dynamics of filamentous bacteria in Danish wastewater treatment plants with nutrient removal. (DOI:10.1016/j.watres.2012.04.009)

2011 Muszynski A., **Mielczarek A. T.**, Nielsen P.H., (2011) Techniki FISH i PCR w badaniach bakterii akumulujących polifosforany. Gaz, Woda i Technika Sanitarna, No 5. p. 189-193

Kragelund C., Thomsen T. R., **Mielczarek A.T.**, Nielsen P.H. Eikelboom's morphotype 0803 in activated sludge belongs to genus *Caldilinea* in the phylum Chloroflexi. (DOI:10.1111/j.1574-6941.2011.01065.x)

2010 Nielsen P.H., **Mielczarek A.T.**, Kragelund C., Nielsen J.L., Saunders A.M., Kong, Y., Hansen A.A., Vollertsen J.A conceptual ecosystem model of microbial communities in enhanced biological phosphorus removal plants. (DOI:10.1016/j.watres.2010.07.036)

Nielsen P.H., **Mielczarek A.T.**, Kragelund C. Den Mikrobiologiske database over danske renseanlæg –en status. Spildevandsteknisk Tidsskrift, Vol. 38, No. 4, p. 20-22

2009 Nielsen P.H., Nguyen H.T.T., McIlroy S.J., **Mielczarek A.T.**, Seviour R. Identification of polyphosphate-accumulating and glycogen-accumulating organisms by FISH. (FISH Handbook for Biological Wastewater Treatment: Identification and quantification of microorganisms in activated sludge and biofilms by FISH. ed. / Nielsen P.H.; Daims H.; Lemmer H., IWA Publishing Company, p. 25-32)

2008 Nielsen P.H., Stevenson M., **Mielczarek A.T.**, Nielsen J.L. Den mikrobiologiske database: Hydrolyse og fermentering. Spildevandsteknisk Tidsskrift, Vol. 36, No. 4, 2008, p. 48-51.

2007 Nielsen, P.H., Stevenson M., **Mielczarek A.T** Dansk "standard" aktivt slam. Spildevandsteknisk Tidsskrift, Spildevands Teknisk Forening 35 (5): 46-47

Ms. Ditte Kristensen:

Name	Ditte Kristensen
Date of birth	11 December 1985
Nationality	Danish
Education	MSc. Eng. Environmental Engineering, Technical University of Denmark
Memberships	2007-present: Danish Association of Engineers. Section: Environment
Key qualifications	Ditte Kristensen holds a MSc in Environmental Technology from the Technical University of Denmark. She has a strong interest in air pollution, Arctic environment and climate changes. She has participated in LITEHAUZ projects on ballast water management, assessments of technologies to reduce air emissions, black carbon abatement technologies, and Arctic shipping. Over the last two years she has furthermore carried out several studies in Greenland, including projects on the effects on the physical and biological parameters of increased freshwater discharge into a Greenlandic fjord and on black carbon measurements at Station Nord.

Employment record

Year	**Firm**	**Position and responsibilities**
2012-present	LITEHAUZ ApS Maritime Environmental Consultants	Environmental consultant

Experience record

Year	**Project**	**Position and activities**
2013 - ongoing	Note on emission reduction technologies and environmental climate classifications Client: The Danish Ministry of the Environment	Technical expert. Evaluation and description of use of battery and internal engine modifications to achieve reduction in emissions for ferries.
2013 - ongoing	Ballast Water Convention transition phase for local shipping in the Baltic Sea and the North Sea Client: The Danish Partnership on Ballast water	Technical expert. Mapping of ferry routes in the North Sea and the Baltic sea and review of the option for exemptions from the BWMC. Estimation of the costs of exemptions for the routes most suitable.
2013 - ongoing	Proposal to designate the North Sea as an ECA for nitrogen oxides (NECA) from ships Client: The Danish Ministry of the Environment	Technical expert. Development of environmental part of application to IMO for a NECA in the North Sea.
2013	Environmental and climate classification of ships Client: The Danish Ministry of the Environment	Technical expert. Environmental and climate classification of ships and environmental criteria for tendering ferry services.

Year	Project	Position and activities
2012 - 2013	Emissions from shipping in the Arctic Client: OPRF, Japan	Technical expert. Density and composition of arctic traffic and development of projections for future shipping and oil & gas offshore activities.
2012	Report on black carbon abatement technologies Client: IMO Marine Environment Division	Technical expert. Investigation of appropriate abatement technologies to reduce Black carbon emissions from international shipping.
2012	Report on exemption opportunities and use of potable water as ballast. Client: Esvagt, Denmark	Technical expert. Strategic mapping of BWM opportunities for two vessels and a review of the current legal interpretation and future use of potable water as ballast.
2011-2012	Development of risk assessment for exemption of ballast water treatment system. Client: Scandlines A/S, Denmark.	Technical expert. Development of risk assessment for exemption of the BWTS.
2011 - ongoing	Assistance to developer of ballast water treatment system for final approval. Client: Confidential, Singapore.	Technical expert regarding technical and strategic choices in development of the BWTS.

Relevant publications:

Year Client	Report	Short description
2013 Danish Ministry of Environment	Environmental Classification of Ships. Report no. 1579 from Danish Environmental Agency	Development of voluntary measures to reduce environmental and climate change emissions in shipping
2012 - ongoing Danish Ministry of Business and Growth	Status reports and conference publications available.	Monitoring of ballast water quality. Phase 2 of the development of an in-line measuring instrument, which efficiently monitors the quality of ballast water.
2012 IMO Marine Environment Division	Investigation of appropriate control measures (abatement technologies) to reduce Black Carbon emissions from international shipping (www.imo.org)	Assessment of standards and monitoring data on black carbon, and on abatement technologies to reduce Black carbon emissions from international shipping and of their technical and economical feasibility
2013 - ongoing Ecoinnovation & Danish Nature Agency	AIT BALL –Monitoring of ballast water quality (status reports available)	R&D project on technical methodology and cloud analysis of data with relevance to the IMO Ballast Water Management convention

We have developed a service for ballast water monitoring and meta-analysis of data, which is currently tested. (www.bw-monitor.com)

Relevant projects:

Year Client	Report	Short description
2013 Danish Ministry of Environment	Environmental Classification of Ships. Report no. 1579 from Danish Environmental Agency	Development of voluntary measures to reduce environmental and climate change emissions in shipping
2013 Danish Ministry of Environment	Application for NECA in the Baltic Sea (DRAFT)	Draft proposal to designate the Baltic Sea as an ECA for nitrogen oxides (NECA) from ships.
2012 - ongoing Danish Ministry of Business and Growth	Status reports and conference publications available.	Monitoring of ballast water quality. Phase 2 of the development of an in-line measuring instrument, which efficiently monitors the quality of ballast water.
2012 IMO Marine Environment Division	Investigation of appropriate control measures (abatement technologies) to reduce Black Carbon emissions from international shipping (www.imo.org)	Assessment of standards and monitoring data on black carbon, and on abatement technologies to reduce Black carbon emissions from international shipping and of their technical and economical feasibility
2013 - ongoing Ecoinnovation & Danish Nature Agency	AIT BALL –Monitoring of ballast water quality (status reports available)	R&D project on technical methodology and cloud analysis of data with relevance to the IMO Ballast Water Management convention

Significant infrastructure/technical equipment:
The LITEHAUZ project is focused on the software analysis part. Our current project on environmental data analysis relates to ballast water and is presented on www.bw-monitor.com

26. Lyngsø Marine A/S:

Lyngsø Marine A/S – main tasks is the design, manufacturing, sales and service of ship automation and navigation equipment (The NACOS Platinum range, see http://www.lyngsoe.com/getdoc/d3f87a90-6c74-4411-a20b-075e3807bce0/NACOS-Platinum.aspx
and http://www.sam-electronics.com/dateien/navigation/navigation.html). NACOS Platinum is characterized by being the only fully integrated and networked navigation, automation and DP system in the market.

As part of the business development activities in the company, LM officers are active in relevant international standardization (IEC TC80 etc.) and represented in the LR Technical Committee.

The Lyngsø Marine A/S company profile thus fits 100% to the activities suggested with respect to our participation.

Profiles:

Erik Styhr Petersen
Lyngsø Marine A/S
+45 4516 6200 - +45 4516 6275 (direct)
erik.styhr.petersen@l-3com.com

Summary

- Documented experience in the domain of ship design, including basic design, structural design, electric and electronic equipment, bridge design and control room design.
- Documented experience in ship safety, navigation, ship operations, ship routing, ship energy efficiency and fuel saving technologies.
- Research and documented practical experience in User Centered Design and the institutionalization of User Centered Design.
- Documented HMI design practitioner; SAM Electronics HMI Design Authority.
- Documented experience and success in forming, acquiring and leading maritime innovation in multidisciplinary, multi-participant and multicultural research and development environments in the maritime sector.
- Documented experience and success in building and maintaining long-lasting networks.
- Experienced speaker; communicates ideas clearly and effectively; teaching experience.
- Experienced in negotiation at all organizational levels.
- Skilled at learning new concepts quickly, used to a high level of concurrence, works well under pressure.
- Widely connected in the maritime industry.
- Fluent in Danish and English, speech and writing (company working language).
- High computer literacy.
- Travels Worldwide.

Education

Technical Doctor (Ph. D.) *2012*
Chalmers Technical University, *Gothenburg, Sweden*
Dissertation on 'Engineering Usability' – on the theoretical institutionalization of usability and human-centric design in a classic design engineering organization.

Licenciate of Engineering (Lic. Eng.) *2010*
Chalmers Technical University, *Gothenburg, Sweden*
Thesis on 'User-centered Design Must Also be User Centered' – on the field experiences related to the institutionalization of usability in environments with low Usability Capability Maturity.

Naval Architect (B. Sc.) *1983*
Helsingør Teknikum, *Helsingør, Danmark*
Thesis on the design of a high-speed catamaran patrol ship.

Memberships & Affiliations

- Member, Lloyds Register Technical Committee (Ships)
- Member, Society of Naval Architects and Marine Engineers (SNAME)
- Member, The Nautical Institute (NI)
- Member, Ingeniørforeningen (IDA)

Relevant publications:
Kindly see
http://www.lyngsoe.com/getdoc/d3f87a90-6c74-4411-a20b-075e3807bce0/NACOS-Platinum.aspx
http://www.sam-electronics.com/dateien/navigation/navigation.html

Relevant projects:
ATOMOS (I – IV), DISC, DISC II, CyClaDes, Flagship, MarNIS

Significant infrastructure/technical equipment:
The NACOS Platinum range of products

27. MARSEC-XL:
MARSEC-XL sets out to shape the digital future of the maritime industry. An innovation hot spot for the maritime industry, founded in Malta in 2007 with industry and government support, MARSEC-XL has created MARSSA, Marine Systems Software Architecture, the first open source, open system reference architec-

ture for the maritime industry. MARSEC-XL is a full partner in the MONALISA 2.0 project providing expertise within maritime software engineering and open source solutions.
MARSEC-XL solutions contribute to increased safety at sea enabling easy communication, integration and interoperability between ships and shore based systems and communication with cost effectiveness in mind. MARSEC-XL brings in vast software engineering and maritime knowledge and competence. We utilize open source software and design our systems according to the best practices in software engineering, systems architecture, continuous software process improvement and multi-platform environments. Ref. www.marsec-xl.com

Profiles:
Krystyna Wojnarowicz (F)- For fifteen years Krystyna has been working with organizations and industries in the transition towards digitalization and technological advancement of their products and services, managing research and innovation projects as well as technology transfer and collaboration between academia, research institutions and industry. Krystyna holds a Master's degree in Information Technologies Management from the School of Management and Banking in Poland. She has also obtained her MBA specializing in software process improvement. She is also a commercial sea officer educated at Chalmers University, Sweden, specialized in the handling of fast moving vessels. In 2007 she co-founded MARSEC-XL, a centre of excellence specializing in maritime software engineering, and she has been holding positions of President and Chair of MARSEC-XL since then. Prior to founding MARSEC-XL she worked for the Software Engineering Institute - Europe of Carnegie Mellon University. Krystyna has been in management and leadership positions helping industries in their transition from legacy systems to state-of-the-art digital technologies in various domains including maritime, automotive, defense, bank and finance, and government, where software dependency of products and services has been growing exponentially for the past decades. Krystyna is a frequent speaker and presenter at ICT and maritime conferences and author of articles for various publications including a blog on open source in the maritime industry. She is advocating increase in quality of maritime digital systems and reduction of ownership costs, promoting open standards and user driven innovation as well as increased interoperability, usability and reliability of marine software systems. Krystyna is a project participant in the MONALISA 2.0 project.

Geir Fagerhus (M) - Holds a combined Masters degree in physics and computing science from the Glasgow University. Geir is a commercial mariner graduated from Chalmers University, Sweden. He also has completed the International Management of Technology professional training program at the Chalmers University in collaboration with Harvard Business School and multiple business schools in Japan. He has been working in executive positions for twenty-five years in areas including maritime, telecom, automotive, bank and finance, defense, consumer electronics and healthcare. Prior to co-founding MARSEC-XL together with Krystyna Wojnarowicz, he was the initiator and Managing Director of Carnegie Mellon University's Software Engineering Institute Europe located in Frankfurt, Germany. Earlier in his career he founded Q-Labs, a specialized international consultancy company in the software engineering field with offices in seven countries in Europe and the US. He is a senior executive experienced in working with and managing technology transfer between academia, research institutions and industry. An experienced, innovative, energetic business executive he is also a charismatic team builder, capable of creating and implementing new visions, setting goals and enthusing others to work towards a realization; Geir is a participant in the MONALISA 2.0 project.
Relevant publications:
MARSSA – Marine Systems Software Architecture - the first Open Reference System Architecture (ORSA) in the maritime industry. MARSSA sets out to provide a system reference architecture (RA), which serves as a base for the development of standards and, at the same time, an architecture to support the integration & interoperability of software-dependent devices and systems onboard and onshore. The RA learns from other domains such as avionics and automotive, however, it directly addresses and takes into account the specificity of the maritime domain. It provides an architectural blue print for a set of products / systems based on the pool of previously successfully implemented solutions and combined with a set of new requirements. Ref. www.marssa.org

Open Bridge Platform – OBP – an open innovation platform enabling development and deployment of innovative and affordable sea traffic management solutions. http://www.marsec-xl.no/MARSEC-XL_Norway/Products.html

Relevant projects:
- MARSSA Open Source project – 2008-2011

http://www.marssa.org/MARSSA/MARSSA.html
- The Demon-Strator – Electric drone boat – 2011-2012
- MONALISA 2.0 – 2013-2015 http://monalisaproject.eu/

Significant infrastructure/technical equipment:
MARSSA – System / Software infrastructure
OBP – Hardware and software open innovation platform

Supporting documentation:
Blog on open source in the maritime industry:
http://osdelivers.blackducksoftware.com/author/krystyna-wojnarowicz/

28. Rocketbrothers

Rocketbrothers.dk ApS is a Danish private limited company that contributes to the project by developing software solutions for tasks that involve visualizing data on maps/charts. Through our tehnology, MapTech (www.maptech.dk), Rocketbrothers.dk ApS specialize in development of custom solutions for data visualization on map in real time.

Profiles:
Thomas Salomon and Carsten Nørby (both male) are computer scientists (Cand.Scient) that are specialized in development of real time engines and applications using real time technology. They each have 10+ years of experience in this field and are experts on visualizing data on maps.

Relevant publications:
- MapTech (www.maptech.dk)
- Development of Safe Pilot for Marimatech (http://www.marimatech.com/products/piloting/safepilot-software-ipad/safepilot-app and https://itunes.apple.com/hk/app/safepilot-by-marimatech/id682376922?mt=8)

Relevant projects:
• Subcontractor to EU project called "SafePort" assisting with algorithms, interfacing and development of application.

Significant infrastructure/technical equipment:
Rocketbrothers will apply MapTech – Engine for real time visualization of data on map.

29. Thrane & Thrane A/S

Thrane & Thrane A/S is the leading entity in the Cobham SATCOM SBU, in the division Aerospace and Security, within COBHAM plc. Registered in the UK
Thrane & Thrane A/S, trading as Cobham SATCOM, is the world's leading manufacturer of communication equipment for ship/shore and ship/ship communication, both based on satellite and terrestrial systems.
On SATCOM we develop and manufacturer, terminals for all Inmarsat Systems, V-Sat, and iridium.
Terrestrial we develop and manufacturer, VHF with DSC, MF/HF with both radiotelex and DSC, hand held radios, AIS, and Navtex receivers. We are a full provider of GMDSS ship solutions.
As a part of preparing for e-navigation we are developing, networked solutions for our on-board communication products, and closely following the work in developing the standards for VDES. Additionally we are developing technologies which we intend to use in VDES, especially networked solutions and SDR.
Cobham SATCOM is active in the standardization work done in IEC, RTCM, and IALA additionally we are active in the work done in the main organizations within the maritime business such as IMO and CIRM.
Thrane & Thrane A/S, trading as Cobham SATCOM, has for many years been a leading provider of advanced communication solutions to the marine industry, and always been on the forefront of technology. The company has a strong development department employing 240 experienced engineers mastering all technologies required to take the lead into the next generation of maritime communication equipment needed to make e-navigation a success. The company is active in all relevant organization preparing the standards for these new solutions.

Profiles:

Ole Hansen: Director of R&D for radio and navigation. Ole is 66 years old and has the last more than 35 years worked within development of maritime communication equipment, first as hardware engineer and later on management level in charge of the radio and navigation development activities.

Henrik Kalstrup: Project manager in R&D for radio and navigation. Henrik is 50 years old, and has for more than 25 years worked within the marine industry, first as technician, later as HW development engineer and the latest more than 15 years as project manager. Today Henriks main focus on VHF based products and he will be the key driver in a VDES project.

Peter Andersen: Product planning manager in R&D for radio and navigation. Peter is 58 years old and has for more than 30 years worked within the marine industry. First as technician, follow with more than 10 years as service manager for an international marine organization, then 8 years as sales manager, and the last 10 years within business development/product planning. Peter is active as member of the board in CIRM, and participating in the work in IMO, RTCM, IALA, IEC and other related organizations.

Relevant publications:
Attached please find:
Product introduction for SAILOR AIS 628X. This unit is based on SDR technology. It works in the Thrane Link network, for full remote control from either the SAILOR 6204 Control Panel or any other system which includes an approved user interface. This architecture of this unit will be the basis for the work in developing the VDES prototype.
Test standard DNV TAP841-10. This test standard is developed jointly between DNV and Cobham SATCOM. It covers the requirements for test and acceptance of an integrated radio communication system, a network which can be interfaced to other networks onboard like INS, for transfer of data between these systems.
Power point presentation of the SAILOR Navtex receiver 6391, which like the AIS is a unit developed to work in a networked solution. The SAILOR 6391 is prepared for NAVDAT.


71 138916 SAILOR 628X AIS Lo pdf.pdf


TAP841-10 DNV teststandard.pdf


SAILOR_639x_Navtex_PowerPoint_Presentation pptx.pdf

Relevant projects:
Development of SAILOR AIS 628X including SDR, and dedicated marine LAN network technology
Development of SAILOR NAVTEX 6391 including SDR, includes dedicated marine LAN network technology and prepared for NAVDAT
Development of SAILOR Control Panel 6204, including dedicated marine network technology, and applications with user MMI on an Android platform.
Development of the test standard TAP841-10, for integrated radio communication system.
Participation in the IALA work for definition the VDES
50 years' experience within marine communication

Significant infrastructure/technical equipment:
SDR controlled radios
Networked solution
Development of applications with user MMI on an Android platform
High knowledge level within marine communication technology
High knowledge level within the marine environment for electronics.

30. Transas Marine International A/S:

Transas Marine International AB, Gothenburg Sweden, is a fully owned daughter company to Transas Marine Ltd Cork Ireland. Manufacture of Marine Electronics, Marine Training Simulators, Marine Tracking and surveillance system and e-Navigation solution. Transas is the market leader in ECDIS with a 35% market share. Focus for the last three years is ship to ship and ship to shore communication and sharing of data.

The task given to Transas in the proposal is in the line of our main business and development areas this will be beneficial booth for the project and for Transas.
Existing Onboard and shore based applications can be used as platform for test system and live test and demonstrations.

Profiles:

Project Manager;
Anders Rydlinger Product Director Navigation Transas, CIRM Board of Directors and CIRM Technical Steering committee has been working with Electronic Navigation since 1992.

Andreas Bergqvist, Product Manager Diploma in Electronic Engineering Uppsala University, Main task Fuel efficiency, data communication ship to shore, gateways and communication solutions.

Vladimir Kolyada, Product Expert Data with focus on user applications for ship to shore communications

Alex Rudnev, Product Expert Data with focus on compressing methods and data transfer.
Final project team will be defined when scope is ready

Relevant publications:

- Transas Navi Sailor 4000 ECDIS
- Transas Navi Planner 4000
- Fleet View On Line – tracking communication ship to shore
- The above products are used in MonaLisa Ice project in cooperation with Swedish maritime Administration
- Transas DIS, Draft Information System for St Lawrence Seaways. On line transfer of sea level-, looks- information combined with up to date high fidelity bathymetric data, squat model allowing vessel to sail with less UKC.

Relevant projects:

- MonaLisa2- project,
- MonaLisa ICE project
- Transas Wave Fuel efficiency project whith data transfer ship to Shore and possibility for Shore based operations to set KPI for vessel performance online.

Significant infrastructure/technical equipment:
Transas Fleet View On Line track system with more than 4000 ships connected for SSAS service,
FVO integrates also Chart Data Management, Fuel Monitoring, Navigation Monitoring ECDIS in the cloud using real time navigation data, Ship to Shore text shat

31. Vissim A/S:

Vissim AS has a long experience and extensive knowledge in maritime surveillance domain. The main focus areas are Oil & Gas, Wind farms, Coastal Surveillance, Ports and Harbors as well as Voice Communications. Vissim has delivered solutions to 220 customer's projects in 27 countries. Our goal is to use comprehensive skills in advanced technologies to develop user friendly solutions for maritime traffic management and surveillance and assist users worldwide in safe and secure operational management and execution at sea.

Profiles:

All our specialist have broad tehnology skills gained through long experience of SW development, support, upgrades and expansion of one of the worlds largest VTS systems while keeping system integrity and uptime

Alexander Legkikh:

VISSIM

SOLUTION ARCHITECT

PERSONAL INFORMATION

Name	ALEXANDER LEGKIKH
Telefon	+47 974 27 811
Fax	+47 330 71 899
E-mail	alexander.legkikh@vissim.no
Date of birth	19.09.1975

EXECUTIVE SUMMARY

Customer oriented technical professional with broad technical and technological skills whithin development, installation and support of maritime surveillance systems.

Significant project portfolio experience including system and software development, requirement analysis, solutions and processes assessment, system design engineering.

PROFESSIONAL PROFILE

- System design, solution architecture
- Maritime surveillance systems
- Software assessment, design verification
- IT

EXPERIENCE

- Total experience: 17 years
- Work experience in VisSim: 11 years
- Work experience in similar areas: 16 years

2012 - present	Solution Architect, VisSim AS, Norway
2009 - 2012	Senior System Engineer, VisSim AS, Norway
2007 - 2009	System Engineer, VisSim AS, Norway
2002 - 2007	Software development engineer, Vissim AS, Russia
1997 - 2002	Software development engineer, FIT Ltd, Russia
1996 - 1997	Technical writer, Russia

EDUCATION

Automatisation data management systems , Master of Science, **Electro-Technical University, SPb, Russia**

LANGUAGES

English

Cyrille Verrie:

VISSIM

SOFTWARE ENGINEER

PERSONAL INFORMATION

Name	CYRILLE VERRIER
Telefon	+47 46 22 70 01
Fax	+47 330 71 899
E-mail	cyrille.verrier@vissim.no
Date of birth	24.11.1979

EXECUTIVE SUMMARY

12 years of experience in embedded C/C++ on wide range of devices:
OOP, large codebase, legacy code, refactoring, design patterns, multi-threading

International and multi-cultural experience.

PROFESSIONAL PROFILE

- C, C++
- Mobile Applications
- Software developmentMaritime surveillance systems
- Software assessment, design verification

EXPERIENCE

- Total experience: 12 years
- Work experience in VisSim: 2 years
- Work experience in similar areas: 12 years

2012 - present	Software engineer, VisSim AS, Norway
2008 - 2012	Software developer, Opera Software ASA, Oslo
2004 - 2008	Software developer and architect, Contractor for Sagem Mobiles, Paris Region
2002 - 2004	Software engineer, Johnson Controls Automotive Electronics, Paris Region

EDUCATION

MSc. in Software Project Management, University of Aberdeen, UK.

Master's degree in Embedded Software and Electronics, I.U.P. MIME, University of Maine, Le Mans, France

LANGUAGES

English, French

Espen Fjellheim:

VISSIM

PRODUCT MANAGER

PERSONAL INFORMATION

Name	ESPEN FJELLHEIM
Telefon	+47 915 62 535
Fax	+47 330 71 899
E-mail	espen.fjellheim@vissim.no
Date of birth	02.01.1973

EXECUTIVE SUMMARY

Customer oriented Management Professional with broad business and technology skills. More than 10 years of management, customer support and operational experience within a wide range of projects for offshore oil and gas, military firing ranges and coastal surveillance, commercial port and windfarm systems.

Beginning of career as software developer, has held numerous positions in Vissim being responsible for Remote Support Service, participating in Sales and Marketing activities and Product Development.
As a Key Account Manager for Statoil he was in charge of managed maintenance, upgrades and expansion of one of the worlds largest VTS systems while keeping system integrity and uptime.
Development Manager I period 2011 – Sep 2012
In September 2012 become a Product manager Oil&Gas to enchance Product & Market department

PROFESSIONAL PROFILE

- Product management
- System infrastructure and architecture
- Project assessment, validation and verification

EXPERIENCE

- Total experience: 15 years
- Work experience in VisSim: 13 years
- Work experience in similar projects : 15 years

2012 - present	Product Manager Oil & Gas, VisSim AS, Norway
2011 - 2012	Senior Development Manager , Vissim AS
2008 - 2011	Support Team Manager , Vissim AS
2005 - 2008	Remote Support Engineer, Vissim AS, Norway
2000 - 2005	Software development engineer. Sensors and radar interfaces. Technical support, project installations, Vissim AS, Norway
1998 - 2000	Software Developer , Norway

EDUCATION

Information Technology and Computer science , Candidatus magisteri
University of Oslo, Norway

LANGUAGES

Norwegian, English

Maxim Semenov:

VISSIM

CTO

PERSONAL INFORMATION

Name	MAXIM SEMENOV
Telefon	+47 992 32 000
Fax	+47 330 71 899
E-mail	maxim.semenov@vissim.no
Date of birth	08.02.1975

EXECUTIVE SUMMARY

Client oriented Senior Management Professional with broad business and technology skills gained through more then 20 years of business development, management and operational experience within a wide range of projects for offshore oil/gas and windfarm industry, onshore port systems and coastal surveillance.

Significant project portfolio experience including system and product development, tehnical project evaluation, requirement analysis, solutions and processes assessment, system design engineering, business development and customer communication.

PROFESSIONAL PROFILE

- Strategy
- Product management
- System architecture
- Project assessment, validation and verification

EXPERIENCE

- Total experience: 21 years (since 1992)
- Work experience in VisSim: 16 years
- Work experience in similar projects : 16 years

2013 - present	CTO, VisSim AS, Norway
2012 - 2013	Director of Product Management & Marketing ,VisSim AS, Norway
2008 - 2011	Technical Director, Development Manager, VisSim AS, Norway
2003 - 2007	Development Manager, VisSim AS, Norway
2000 - 2002	Software Development Engineer, Service engineer, Vissim AS, Norway
1998 - 2000	Software Engineer. Sensors and radar interfaces. Technical support, Maris AS , Norway

EDUCATION

Information Technology and Computer science, MSC
Sankt-Petersburg Electro- Technical University, Russia

LANGUAGES

Russian, English, Spanish, Norwegian

Øyvind Skille

VISSIM

TEST & INTEGRATION ENGINEER

PERSONAL INFORMATION

Name	ØYVIND SKILLE
Telefon	+47 416 10 623
Fax	+47 330 71 899
E-mail	Oyvind.skille@vissim.no
Date of birth	29.09.1978

EXECUTIVE SUMMARY

Experienced configuration, simulation & testing professional with engineering and management skills in different navigation systems projects.

Significant project portfolio experience including Testing Ship Bridge Navigation, Engine Room, Cargo, Offshore simulation SW/HW, testing new SW functionality, configuration standardization.

PROFESSIONAL PROFILE

- System architecture
- Test management: test cases, test scenario, evaluation
- Scripts/methods/procedures
- Servers / web

EXPERIENCE

- Total experience: 14 years (since 2000)
- Work experience in VisSim: 1 year
- Work experience in similar projects : 14 years

2013 - present	Test & Integration Engineer,VisSim AS, Norway
2012 - 2013	Configuration Manager, Kongsberg Maritime AS, Norway
2008 - 2012	Service coordinator/engineer, Kongsberg Maritime AS, Norway
2007 - 2008	Service engineer, Kongsberg Maritime AS, AUV department
2003 - 2007	IT-Consultant, Park Air Systems, Norway

EDUCATION

College of Vestfold, Computer science
Lodi High School, Wisconsin, USA
Mosjøen High School

LANGUAGES

English, Norwegian

Relevant publications:

- Vessel Traffic Management System – gather target data from radars and AIS, integrates these data and presents target data overlaid on electronic maritime charts.
- Oil Spill Detection - a module for operator assisted oil spill detection, monitoring oil spills around oil

platforms, in ports and along coast lines providing an early warning of possible oil spills for VTS operators.
- Wave Height Detection - wave parameters measurement module based on sea clutter analysis in X-band marine radar.
- Offshore Personnel Tracking System - an integrated solution for marine coordinators, providing a real time overview of personnel whereabouts which is vital during Emergency Situations & Search And Rescue
- Port Information Management System – system provides functionality for planning ship visits and controlling active ship visits.

Relevant projects:
- Vissim is an active IALA committee actor
- Vissim is an active member of NOSCA (Norwegian oil Spill Control Association)
- Vissim has participated in the EfficienSea I project

Significant infrastructure/technical equipment:
For 15 years VisSim has developed unified solutions for offshore oil and gas operations in some of the most challenging waters in the world. In total we have managed and delivered our solutions to 220 customer's projects in 27 countries.
Please, see enclosed project list for complete overview

Supporting documentation:
Please , see Vissim for Oil and gas / Vissim for Coastal Surveillance/ Vissim for Port and Harbors

32. United Kingdom Hydrographic Office:

The UKHO is a government organisation responsible for providing marine navigational products and services, and related safety information. It was founded in 1795, was established as an Executive Agency of the MOD in 1990 and has operated as a Trading Fund since 1 April 1996.

Based in Taunton in the South West of England, the UKHO employs approximately 1,000 people and generated revenues of £130M in the year ending 31 March 2013. Operating as a Trading Fund, UKHO is required to generate a profit, and is run as a commercial enterprise.

The UKHO exists to help preserve life and safety at sea. The hydrographic information it provides is crucial to support operations by the Royal Navy, and to the majority of commercial shipping throughout the world. The UKHO plays a central role in discharging the UK's 'Safety of Life at Sea' Treaty obligations to provide hydrographic services for waters of UK national responsibility, as required under the United Nations International Convention for the Safety of Life at Sea (SOLAS).

UKHO's main tasks are hydrographic data collection (bathymetric surveys, port information, navigational aids, etc) and data assessment, followed by compilation and delivery of products and services.

UKHO's main products and services are nautical charts and publications (paper and electronic), update services including Maritime Safety Information, and bespoke products as required for specialist maritime activities.

UKHO is an active member of the International Hydrographic Organization, chairing or vice-chairing 6 out of the 11 technical working groups.

UKHO is world renowned for its hydrographic experience and its Admiralty Brand is recognized by maritime navigators throughout the world.
Profiles:
Dr Edward Hosken
Gender - Male
Current Position Head of Technical Engagement
Qualifications: Fellow of the Chartered Quality Institute; Certificate in Company Direction (IOD) Directors PhD in Digital Mapping Information Systems; BSc in Surveying Science.

Current Role - Responsible for providing support to e-navigation and coordinating UKHO contribution to IHO technical working groups. This involves liaison with IMO, IHO and IALA, on matters relating to electronic navigational products and services and their effective use.
Previous roles include - Continual Improvement Manager: delivering tactical change based on Lean Sigma and Quality Assurance principles. Head of Hydrographic Data Services: managing the Hydrographic Data Centre (data receipt; archives; library); Bathymetric Data Centre (survey processing/verification); Geodesy & Imagery Centre (horizontal datums, satellite image processing); Data Service Centre (archive research; data supply services); and Archive & Records Management; Tides (data analysis and tidal prediction); and HM Nautical Almanac Office. ENC Production Manger: responsible for delivering Electronic Navigational Charts (ENCs) in support of the Admiralty Vector Chart Service (AVCS). Project Manager: coordinating UKHO's contribution to the 'ECHO' project (see below).

Mr Jonathan Pritchard
Gender - Male
Current Position: Lead R&D Engineer, Commercial Section, UKHO
Academic Qualifications: Honours degree in Mathematics

Description of current position within UKHO:
I currently hold the position of Lead Engineer within the UKHO's Commercial Research and Development division. The R&D group is charged with developing new ideas and concepts for commercial products and spans the range of product creation all the way from data origination to end user consumption of data.

Recent initiatives include:

- An investigation into automated methods for cartographic generalisation of paper and electronic chart features.
- Compression of vector chart data for transmission to vessels
- Automated production of routeing based on commercial ship movements mined from AIS data
- Crowd-sourcing and processing of crowd-sourced data within hydrographic production systems
-

The R&D group also have links with academic communities within the UK. A new 21 month project investigating the interactions between mariners and bridge systems on commercial ships has recently been instigated with Bristol University. We maintain a commercial framework contract for engaging industry on specific initiatives and a number of projects have been commercialised in this way. The group is committed to enhancing existing products and demonstrating where new possibilities lie within the UKHO's commercial fields.

Previous positions:
I managed the UKHO's relationships with ECDIS equipment manufacturers for six years after the formation of the Commericial division. This position entailed working with all ECDIS OEMs on issues of standards and various technical and regulatory issues. I also instigated commercial projects such as ECDIS data prefill and alternate distribution models in this time.
External responsibilities:
I have contributed to the International Hydrographic Office (IHO) standards processes for many years and am currently in my second 5 year tenure as chair of the Data Protection and Security working group (DPSWG). This group manages the IHO data protection scheme which sets the standards for commercial distribution of ENC data worldwide and its authentication within a digitally signed mechanism for all end users. I have contributed on a wide variety of subjects to other IHO standards groups including Transfer Standard Maintenance and Application Development (TSMAD) and various special interest groups. I had a leading role in the "ECDIS anomalies" issues which led to a refresh of many of the IHOs data standards and I authored the IHO Check Dataset, distributed worldwide to all ECDIS users. I maintain an active role within the IHO community and have presented technical talks to a wide variety of audiences around the world.

Mr Barrie Greenslade
Gender – Male
Over 40 years experience within the UK Hydrographic Office. Over 20 years as a developer of standards for Electronic Navigational Charts (ENCs) and Electronic Chart Display and Information Systems (ECDIS).

Long time involvement with the IHO TSMAD working group. As the Chairman of TSMAD, have led the development of the IHO's Universal Hydrographic Data Model (S-100) to support a wider variety of hydrographic-related digital data sources, products, and customers.

Mr Mark Halliwell
Gender – Male
Mark has worked at the UKHO for 35 years in a wide variety of roles. In addition to 2 periods in sections compiling and maintaining nautical charts for use by SOLAS shipping, he has expertise in photogrammetry and remote sensing, the databasing of oceanographic observations, and the quality assurance of multibeam echosounder data.
He has more recently acted as project manager for the INTERREG IVB 'BLAST' project and has been responsible for defining and implementing the UKHO's response to the INSPIRE directive.

Ms Su Marks
Gender – Female
Over 20 years experience within the UK Hydrographic Office, mostly within the development and production of Electronic Navigational Charts (ENCs). Worked in digital standards for 3 years with a current role supporting the development of the IHO's Universal Hydrographic Data Model (S-100). Represents UKHO at the IHO TSMAD working group. Secretary to the IHO North Sea ENC Harmonization working group

Relevant publications:
1. Admiralty Charts – the most comprehensive official paper chart series, maintained by weekly updates (Admiralty Notices to Mariners). Portfolio of 3,500 charts.
2. Admiralty Vector Chart Service (AVCS) – the world's leading source of unified Electronic Navigational Charts (ENCs), including the Admiralty Information Overlay (AIO) showing extra information to aid safe navigation.
3. Admiralty Raster Chart Service (ARCS) raster versions of paper chart series
4. Admiralty Digital Publications (Sailing Directions, Lights, Radios Signals, Tide Tables)
5. Admiralty e-Navigator – back of bridge system for voyage planning and nautical information management.

Relevant projects:
1. Bringing Land and Sea Together (BLAST) 2009-2012 - North Sea Region INTERREG IVB Project. Contribution to the investigation of integrating land and sea data.
2. Accessibility for Shipping, Efficiency Advantages and Sustainability (ACCSEAS) 2013-15 - North Sea Region INTERREG IVB Project. Consultancy support delivered relating to design of standards for Maritime Safety Information.
3. Solutions for Integrated Seamless Transport Across Land and Sea (SISTALS) 2014-15. Technical support to the consideration of the feasibility of a national transmodal integrated logistics information and command and control system.
4. ECHO (European Chart Hub Operations) 1996-98. TR1019 Telematics Applications for Transport, 4th Framework. UKHO a key partner in demonstrating a commercially based service for storage and distribution of ENCs, which led to the development of Regional ENC Coordinating Centres and the international adoption of the ECHO data protection scheme (modified to become S-63).

Significant infrastructure/technical equipment:
1. Electronic Navigational Chart production system
2. Notices to Mariners production system
3. Worldwide nautical products distribution infrastructure

ESTIMATED BUDGET FOR THE ACTION (page 1 of 3)

	Estimated eligible[1] costs (per budget category)									EU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs	E. Indirect costs[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
1. SØFARTSSTYREL	979506.00	0.00	0.00	0.00	0.00	0.00	264494.00	311000.00	1555000.00	100.00	1555000.00	1555000.00	0.00	No	
2. KMS	201500.00	0.00			15000.00	0.00	26500.00	57000.00	300000.00	100.00	300000.00	300000.00	0.00	No	
3. DANMARKS METEOROLOGISKI INSTITUT	227000.00	0.00			0.00	0.00	13000.00	60000.00	300000.00	100.00	300000.00	300000.00	0.00	No	
4. Veeteede Amet	20940.00	0.00			71200.00	0.00	2100.00	5760.00	100000.00	100.00	100000.00	100000.00	0.00	No	
5. LIIKENNEVIRAS	73440.00	0.00			0.00	0.00	6560.00	20000.00	100000.00	100.00	100000.00	100000.00	0.00	No	
6. Maritime Office in Gdynia	70000.00	0.00			28000.00	0.00	67600.00	34400.00	200000.00	100.00	200000.00	200000.00	0.00	No	
7. INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY	145400.00	0.00			0.00	0.00	94600.00	60000.00	300000.00	100.00	300000.00	300000.00	0.00	No	
8. SWEDISH MARITIME ADMINISTRATION	368000.00	0.00			35000.00	0.00	84000.00	113000.00	600000.00	100.00	600000.00	600000.00	0.00	No	
9. CHALMERS	312850.00	0.00			0.00	0.00	93550.00	101600.00	508000.00	100.00	508000.00	508000.00	0.00	No	
10. UCPH	137067.00	0.00			0.00	0.00	18933.00	39000.00	195000.00	100.00	195000.00	195000.00	0.00	No	
11. DTU	117000.00	0.00			0.00	0.00	3800.00	30200.00	151000.00	100.00	151000.00	151000.00	0.00	No	
12. LATVIAN MARITIME ACADEMY	18000.00	0.00			0.00	0.00	62000.00	20000.00	100000.00	100.00	100000.00	100000.00	0.00	No	
13. OFFIS EV	202680.00	0.00			0.00	0.00	37000.00	59920.00	299600.00	100.00	299600.00	299600.00	0.00	No	
14. BIMCO	147500.00	0.00			0.00	0.00	12500.00	40000.00	200000.00	100.00	200000.00	200000.00	0.00	No	
15. CIRM	77500.00	0.00			0.00	0.00	35000.00	28125.00	140625.00	100.00	140625.00	140625.00	0.00	No	
16. IALA	199000.00	0.00			0.00	0.00	41000.00	60000.00	300000.00	100.00	300000.00	300000.00	0.00	No	
17. MDCE	72500.00	0.00			0.00	0.00	7500.00	20000.00	100000.00	100.00	100000.00	100000.00	0.00	No	
18. SSPA	223560.00	0.00			0.00	0.00	16440.00	60000.00	300000.00	100.00	300000.00	300000.00	0.00	No	
19. FORCE TECHNOLOGY	141626.00	0.00			0.00	0.00	19174.00	40200.00	201000.00	100.00	201000.00	201000.00	0.00	No	
20. CLS	290643.00	0.00			120000.00	0.00	70500.00	90285.75	571428.75	70.00	400000.13	400000.13	0.00	No	

ESTIMATED BUDGET FOR THE ACTION (page 2 of 3)

	Estimated eligible[1] costs (per budget category)									EU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs	E. Indirect costs[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
21. Danelec Marine	317642.00	0.00	0.00	0.00	0.00	0.00	25215.00	85714.25	428571.25	70.00	299999.88	299999.88	0.00	No	
22. FREQUENTIS	309267.00	0.00			0.00	0.00	33590.00	85714.25	428571.25	70.00	299999.88	299999.88	0.00	No	
23. FUR	519428.00	0.00			0.00	0.00	52000.00	142857.00	714285.00	70.00	499999.50	499999.50	0.00	No	
24. GateHouse A/S	339857.00	0.00	0.00	0.00	0.00	0.00	4600.00	86114.25	430571.25	70.00	301399.88	301399.88	0.00	No	
25. Litehauz ApS	169000.00	0.00			30000.00	0.00	58000.00	56750.00	313750.00	70.00	219625.00	219625.00	0.00	No	
26. LYNGSO MARINE AS	161280.00	0.00			0.00	0.00	42000.00	50820.00	254100.00	70.00	177870.00	177870.00	0.00	No	
27. MARSEC-XL	97500.00	0.00	0.00	0.00	0.00	0.00	16785.71	28571.43	142857.14	70.00	100000.00	100000.00	0.00	No	
28. Rocket Brothers	108855.00	0.00			0.00	0.00	6230.00	28771.25	143856.25	70.00	100699.38	100699.38	0.00	No	
29. Thrane & Thrane A/S	792286.00	0.00			0.00	0.00	122000.00	228571.50	1142857.50	70.00	800000.25	800000.25	0.00	No	
30. Transas Marine International AB	295557.00	0.00			0.00	0.00	47300.00	85714.25	428571.25	70.00	299999.88	299999.88	0.00	No	
31. Vissim AS	160714.00	0.00	0.00	0.00	0.00	0.00	10714.00	42857.00	214285.00	70.00	149999.50	149999.50	0.00	No	
32. UKHO	228857.00	0.00			0.00	0.00	26000.00	63714.25	318571.25	100.00	318571.25	222999.88	0.00	No	
Total consortium	7525955.00	0.00		0.00	299200.00	0.00	1420685.71	2236660.18	11482500.89		9918389.53	9822818.16	0.00		0.00

ESTIMATED BUDGET FOR THE ACTION (page 3 of 3)

(1) See Article 6 for the eligibility conditions
(2) The indirect costs covered by the operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant (see Article 6.2.E).
(3) This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Commission/Agency decided to grant for the action) (see Article 5.1).
(4) The 'maximum grant amount' is the maximum grant amount decided by the Commission/Agency. It normally corresponds to the requested grant, but may be lower.
(5) Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.
(6) See Article 5 for the forms of costs
(7) Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to beneficiary's usual accounting practice
(8) See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).
(9) Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs
(10) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).
(11) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc)
(12) Only specific unit costs that do not include indirect costs
(13) See Article 9 for beneficiaries not receiving EU funding
(14) Only for linked third parties that receive EU funding

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GEODATASTYRELSEN (KMS), 62965916, established in RENTEMESTERVEJ 8, KOBENHAVN 2400, Denmark, DK62965916, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘2’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Christian RISHOJ with ECAS id nrishoch signed in the Participant Portal on 27/04/2015 at 07:55:13 (transaction id SigId-12024-9TJmVP6oZBizwML1troFziF7TDAomRWSeeSsJJyNqYIoA5XE2eHHVtiy203YqDc6H1u77VI4qeyI89QfuqJ0OW-Jj71zxYb8yrsWziRzxU0uBm-fCpjQOzZfOrlCjZH8ozZ4dIEjIESNGiWfzIZzfyOVsAu). Timestamp by third party at Mon Apr 27 08:55:19 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DANMARKS METEOROLOGISKE INSTITUT (DANMARKS METEOROLOGISKE INSTITUT), 18159104, established in Lyngbyvej 100, KOBENHAVN 2100, Denmark, DK18159104, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘3’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Karl HANSEN with ECAS id nhanskrl signed in the Participant Portal on 29/04/2015 at 15:44:37 (transaction id SigId-18606-rGZF6ixvMq8w9wna0KVSdCctVdeZ8QcPDZjf2pNQsBxn2ntWQWgOE9VoDfKpiBhDzSOCRVCNGdswTjWtZGkmra-Jj71zxYb8yrsWziRzxU0uBm-RoNIkLLxNjnjEVYI6RPTd2GdybxZUhewpVQAHFFUaFy). Timestamp by third party at
Wed Apr 29 16:44:52 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

VEETEEDE AMET (Veeteede Amet), 70002414, established in VALGE T 4, TALLINN 11413, Estonia, EE100220188, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘4’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Alar SIHT with ECAS id nsihtsal signed in the Participant Portal on 27/04/2015 at 11:56:42 (transaction id SigId-26-h5s6OOJ2i1V1EzVh2kzreoAU8gnIRxy9rhbKX34XmyB3j2otyprzIJ9xyopE4DU5pulTqGPRUrUBSICHuhloTcW-PHslUMVSXYCActVGZGu4ya-OupBzlPpuzXyb51zkjUvGcKPixfFhJ40V0T7QIkCxKIa). Timestamp by third party at Mon Apr 27 12:56:49 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LIIKENNEVIRASTO (LIIKENNEVIRASTO), 1015471, established in OPASTINSILTA 12A, HELSINKI 00520, Finland, FI10105471, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘5’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Virpi ANTTILA with ECAS id nanttvir signed in the Participant Portal on 27/04/2015 at 13:10:12 (transaction id SigId-13120-yPxKi28E3gS9jszKPOe2zxFcsD42lZjL0AMNQ9v7D8UyszUACprx06PklRbuRK9Bx0HnGXAwQ783SRxuKFmeFg0-Jj71zxYb8yrsWziRzxU0uBm-U938VdOzqWezKze5lP60oKRRRpyreIlZGIrSj3ciQBs4). Timestamp by third party at
Mon Apr 27 14:10:24 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

URZAD MORSKI W GDYNI (Maritime Office in Gdynia), established in UL. CHRZANOWSKIEGO 10, GDYNIA 81 338, Poland, PL5860014932, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘6’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Andrzej KROLIKOWSKI with ECAS id nkroarze signed in the Participant Portal on 29/04/2015 at 11:27:17 (transaction id SigId-17641-Rm9xGsNYP62MncrBi0w1XVTN1ijOAOw8PMfJBKJmOIBL1SvXdaceH53DDIQxG9ywAzUdcVJlquvb76CcHrzW9Q-Jj71zxYb8yrsWziRzxU0uBm-f9izfBoUizX2zo7Ab5ffYPQ7WwruKIA4ocC8zdMbe7K6). Timestamp by third party at Wed Apr 29 12:27:32 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY (INSTYTUT LACZNOSCI - PANSTWOWY INSTYTUT BADAWCZY), 0000023097, established in UL. SZACHOWA 1, WARSZAWA 04-894 , Poland, PL5250009312, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘7’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jerzy ZUREK with ECAS id nzurejer signed in the Participant Portal on 29/04/2015 at 11:00:03 (transaction id SigId-17537-9WqHSGjhPbjpNZ4c9ZU0V5mkjqzqwwGaU54kichApR7gV30pxjcoYKgaAZS6aTtpZbfCHDIv6UbJVAlb0Wq6Ri-Jj71zxYb8yrsWziRzxU0uBm-yILjxMQ51tlydoinIEzpOAxdnCzZZ3zNiLKq8R9hxI9C). Timestamp by third party at
Wed Apr 29 12:00:18 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SWEDISH MARITIME ADMINISTRATION (SWEDISH MARITIME ADMINISTRATION), established in , NORRKÖPING 60178 , Sweden, SE202100065401, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘8’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Anna WEIDING with ECAS id nweidina signed in the Participant Portal on 07/05/2015 at 12:26:41 (transaction id SigId-2470-ZV7matIyuMPYt969DTWLv0yxPfVg42GRVGyBM4zSlZRUst2YvrPW8S GefAJLUk078FzRwJvKYRYCKPcJUkYuKI-Jj71zxYb8yrdSFDAzJE3Wl-BzVS0RQlTVr0r43KW6aQKtvm5RupHBb1EKB6dnK5Uks). Timestamp by third party at Thu May 07 13:26:58 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CHALMERS TEKNISKA HOEGSKOLA AB (CHALMERS) AB, 5564795598, established in -, GOETEBORG 41296, Sweden, SE556479559801, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘9’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Lennart JOSEFSON with ECAS id njosefle signed in the Participant Portal on 25/04/2015 at 15:09:24 (transaction id SigId-11700-K7Xt5yenwEv223lX0AlYNOm4zuMeuaJzbGyMRdCoCXRCkxDcyhzyhI8LTP4QFFbyBgVsXF86s9mhq0yFZ8d1XUm-Jj71zxYb8yrsWziRzxU0uBm-EM1Y6Th5a6qgnLWHxzzJBXKry1AYmgZJ4dOPMrZiYznO). Timestamp by third party at Sat Apr 25 16:09:30 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

KOBENHAVNS UNIVERSITET (UCPH), 29979812, established in NORREGADE 10, KOBENHAVN 1165, Denmark, DK29979812, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘10’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Kim BRINCKMANN with ECAS id nbrinkim signed in the Participant Portal on 19/05/2015 at 11:04:40 (transaction id SigId-8850-F0RWzRKVszaw0p17hvMuclw46T1uapv7JBUKKOsw0Nr8ZOcwC6p8D fE8heUfVBtUKkizjldztzRYzjLOMXLO7HZm-Jj71zxYb8yrdSFDAzJE3Wl-RGaMS9ik0RlkkE592fsshptzIkJxeUbzIW1M78OgbQym). Timestamp by third party at
Tue May 19 12:05:27 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DANMARKS TEKNISKE UNIVERSITET (DTU), 30060946, established in Anker Engelundsvej 1, Bygning 101, KONGENS LYNGBY 2800, Denmark, DK30060946, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘11’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jes HERBERT with ECAS id nhrberje signed in the Participant Portal on 04/05/2015 at 12:05:24 (transaction id SigId-21880-hqjgfDetMgdujNRtzWHl7vUDdG90YupxvMcn5NaEyMxU6jeAgYicLywefxymIO5ogjaKlCN4LWxgpMoqJzMFX6-Jj71zxYb8yrsWziRzxU0uBm-JZkV5XPmDbKPFjfYfxxpYzZ1IPKYAb8FaYBD12Z4gwk). Timestamp by third party at
Mon May 04 13:05:43 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LATVIJAS JURAS AKADEMIJA (LATVIAN MARITIME ACADEMY), 90000040638, established in FLOTES 12 K-1, RIGA LV 1016, Latvia, LV90000040638, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘12’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Inese BARBARE with ECAS id nbainese signed in the Participant Portal on 29/04/2015 at 09:51:52 (transaction id SigId-17271-6oSbCBcEw4tRQm93EpFqs0kozkd19L3vP5Y5a7aziJcS8FBtuezpjIs91euCJtFLPzw6REw2I97ThLSKkaGhFgm-Jj71zxYb8yrsWziRzxU0uBm-RQPjZilzfmCxTH4lSix1h0lIRejwZUKLyi2KwYFeW60). Timestamp by third party at
Wed Apr 29 10:52:12 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

OFFIS EV (OFFIS EV) EV, VR1956, established in ESCHERWEG 2, OLDENBURG 26121, Germany, DE811582102, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘13’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Bernhard JOSKO with ECAS id njosbern signed in the Participant Portal on 27/04/2015 at 12:46:04 (transaction id SigId-213-YhketRkSft6SBIs5YJWhNkd3Htis1UtZXhGCkDsGKMmNyIoZRzp5gNq9CX4at5HD35oPHBJepL7ZjtjsKM3im0-PHslUMVSXYCActVGZGu4ya-SDgxsmE2OorNkimNUFOlHSgLEOulj7Yg4ifJbciHn8u). Timestamp by third party at Mon Apr 27 13:46:13 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THE BALTIC AND INTERNATIONAL MARITIME COUNCIL/BIMCO (BIMCO) DK1, 62480610, established in BAGSVAERDVEJ 161, BAGSVAERD 2880, Denmark, DK62480610, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘14’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jeppe JUHL with ECAS id njuhljep signed in the Participant Portal on 27/04/2015 at 08:03:28 (transaction id SigId-12045-OyiMtIcvzgA7uPHNR3RiS91O1gmizUr3Y8w8Qyd4fSVltP5GHfKM8J1Jy1epVp7KgZzg6zfcvjoxazzR7t2pCjzu-Jj71zxYb8yrsWziRzxU0uBm-pW7ve47ty2lBZzWTzorfI0my2wObZqsNzSOPIKoQbHau). Timestamp by third party at Mon Apr 27 09:03:33 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

COMITE INTERNATIONAL RADIO MARITIME- (CIRM) (CIRM) GB5, 02494458, established in 202 LAMBETH ROAD, LONDON SE1 7JW, United Kingdom, GB547917504, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘15’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Richard DOHERTY with ECAS id ndohertr signed in the Participant Portal on 25/04/2015 at 09:12:03 (transaction id SigId-11649-kRUXNEILGcznhFGNKb2IzGOjIAQQf8RjIIN4SsOBveF44zj5eaJZzk64qXHXV4knqy43u36s1e76sOPXVjL4vl0-Jj71zxYb8yrsWziRzxU0uBm-exABwdy5DqeZbNrkndqCS7m82q8SZRSTPl6WggxJWmy).
Timestamp by third party at
Sat Apr 25 10:12:13 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ASSOCIATION INTERNATIONALE DE SIGNALISATION MARITIME (IALA) FR20, 784670812/0305974, established in 10 RUE DES GAUDINES, SAINT GERMAIN EN LAYE 78100, France, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘16’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Christine PHILIP with ECAS id nphcstin signed in the Participant Portal on 28/04/2015 at 13:10:38 (transaction id SigId-15548-6D2draMMvJ2QESUyDsAm7SfOBu5rFehPDywzyCu43mPwkzPSnqMCzzUIpFBSuI2gHA0znrjzzzakJGrzhjjeiozzk-Jj71zxYb8yrsWziRzxU0uBm-1Bcq5xNhwzqFDYcInWowVzwMKsTJ8SEPtPAe3TboQnOG).
Timestamp by third party at
Tue Apr 28 14:10:52 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

Europas Maritime Udviklingscenter (MDCE) DK1, 1004919694, established in amaliegade 33b, copenhagen 1256 , Denmark, DK21415332 , ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘17’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jan BOYESEN with ECAS id nboyesej signed in the Participant Portal on 26/04/2015 at 20:49:32 (transaction id SigId-11817-IcEbc1MQMKJ9pzhuKenUstbGGlccsA1khUzhEmb48MCARnUiGsFGzYFIzV40lik34QHWA5nlHMFuX1H2cV4XzuG-Jj71zxYb8yrsWziRzxU0uBm-xFahS4dipkAEG4XahPzOFqWzOljPTGdocCEJzroVVrlS). Timestamp by third party at
Sun Apr 26 21:49:40 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SSPA SWEDEN AB. (SSPA) AB, 5562241918, established in Chalmers Tvaergata 10, GOETEBORG 40022, Sweden, SE556224191801, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘18’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Peter GRUNDEVIK with ECAS id ngrundpr signed in the Participant Portal on 11/05/2015 at 15:05:40 (transaction id SigId-4726-J6zpoXaT7d6zaAvwUHoB07EtzL3w7XB0NSXDps1OP57H2XJq12TOnEfi2ngo189ougV1h17Vx07yrQlrutA1sam-Jj71zxYb8yrdSFDAzJE3Wl-MzPUBnouooHspG3fPzkDPdlYYGzv73udwQzQB4TeTilv). Timestamp by third party at Mon May 11 16:06:00 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FORCE TECHNOLOGY (FORCE TECHNOLOGY) DK1, 55117314, established in PARK ALLE 345, BRONDBY 2605, Denmark, DK55117314, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘19’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Maria STRANDESEN with ECAS id nsndesma signed in the Participant Portal on 30/04/2015 at 09:01:53 (transaction id SigId-19211-wRV0VUN1t6kTVzVzl9SJUsXNph2h13fVStDkDVwjR5wYWbrUHJX9KOKI1CH3amF3hWhWjug6ccHqHsDMDNkFKk-Jj71zxYb8yrsWziRzxU0uBm-3SiBaxWqzjSYzZU68h7qp5pg6oFlxi9DbwVN5ziO710K). Timestamp by third party at
Thu Apr 30 10:02:13 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

COLLECTE LOCALISATION SATELLITES SA (CLS) FR39, 338034390, established in RUE HERMES 8, RAMONVILLE ST AGNE 31520, France, FR95338034390, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘20’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Christophe VASSAL with ECAS id nvacstop signed in the Participant Portal on 27/04/2015 at 12:08:59 (transaction id SigId-87-iXkpHCRuXNvzpqSnZN0rmezI4SZhhN4pODNzsDnhslXcrLPXYUREocigJEGkrzNY4zouHs22ONBFBJMXpRiZSDX-PHslUMVSXYCActVGZGu4ya-IcMvv58XQicsPFajofE5iDsNHi7rIq8zsYlscIXIzuE0). Timestamp by third party at
Mon Apr 27 13:09:06 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DANELEC ELECTRONICS AS (Danelec Marine) AS, 18630877, established in BLOKKEN 44, BIRKEROD 3460, Denmark, DK18630877, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘21’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Susanne BECH SØRENSEN with ECAS id nbechsus signed in the Participant Portal on 28/04/2015 at 07:35:38 (transaction id SigId-14255-a6WPC351NdD3prMJDEiJyVOGYmEEjAk7QziZ801al5LzS78QXLukRxfFkMcaqA2azcsoEWE1uN2kIW62uVt1wN0-Jj71zxYb8yrsWziRzxU0uBm-9sFwchPrJfiHOoN8W7K3A5Csea3UVL4WhBa1pCx4zr9). Timestamp by third party at Tue Apr 28 08:35:56 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FREQUENTIS AG (FREQUENTIS) AG, FN72115B, established in Innovationsstrasse 1, WIEN 1100, Austria, ATU14715600, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘22’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Peter SKERLAN with ECAS id nskerlpe signed in the Participant Portal on 29/04/2015 at 08:17:31 (transaction id SigId-16845-zzb4vimokfxkElmXzOZAXc2ZqLdW01x0m7xAsXIzyrvQOcA6UQuZgUvAvEwbQevnyD8VEmPhh7mUoMhWstAzQC5-Jj71zxYb8yrsWziRzxU0uBm-BwJzQiEMyVDqDzc5trdzGcQLoRMZjHyT1TX9cxEy8uVm). Timestamp by third party at
Wed Apr 29 09:17:43 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

Furuno Finland Oy (FUR), 17546608, established in Niittyrinne 7, Espoo 2270, Finland, FI17546608, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘23’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Marja-Liisa NYKYRI with ECAS id nnykyrma signed in the Participant Portal on 04/05/2015 at 08:28:23 (transaction id SigId-21418-8x0yTPabkPbVb3gTXeSEw3SawnOqzG2fBtewYpxakzt2zjnWEH577vshw51tPKy04OfjDxxp5AenozklbLpHxI0-Jj71zxYb8yrsWziRzxU0uBm-QZT6GUmgwOwvZ13l1bjikq0ACW6yKu9ULKWzWYzRAoh0).
Timestamp by third party at
Mon May 04 09:28:36 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GateHouse A/S (GateHouse A/S) AS, DK26040299, established in Lindholm Brygge 31, NORRESUNDBY 9400, Denmark, DK26040299, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘24’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Poul BONDO with ECAS id nbondopo signed in the Participant Portal on 27/04/2015 at 05:51:08 (transaction id SigId-11843-e1Es8FyfIqGO0lvPzjb4gmSXzeCq9be4mFgxPhPR2bp98njxOozgE6Zb04dBb7D2vK406lrYxbRzzWCyXeBrANzG-Jj71zxYb8yrsWziRzxU0uBm-e2CBRmJGyQoFzi17HqnnFafbnoGmECzrxrTwHF401vHW).
Timestamp by third party at
Mon Apr 27 06:51:19 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LITEHAUZ APS (Litehauz ApS) APS, 30557328, established in BROFOGEDVEJ 10 ST, KOBENHAVN NV 2400, Denmark, DK30557328, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘25’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Frank STUER-LAURIDSEN with ECAS id nstuefan signed in the Participant Portal on 27/04/2015 at 12:53:58 (transaction id SigId-239-Rg1kNCzjwLzsCvFEskitSs27VMh0hS5YdBdbRzwYlsqhWjOQp9kE239BT32hSg1q3zanDKJzooBvlZzYmIW7T6eW-PHslUMVSXYCActVGZGu4ya-HzqYWPEbyxrqbJhII8fYZfZwU7bbVw49RhAJwkU9vRw). Timestamp by third party at
Mon Apr 27 13:54:06 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LYNGSO MARINE AS (LYNGSO MARINE AS) AS, 63053112, established in LYNGSO ALLE 2, HORSHOLM 2970, Denmark, DK63053112 , ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘26’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Erik Styhr PETERSEN with ECAS id npeteiks signed in the Participant Portal on 27/04/2015 at 11:49:53 (transaction id SigId-13118-QtcAL7bn1EkcEAxvxiBx8e0tmDropfqZ5Ypa9UvYMCy8p1adb336pwct2SRtFiVdIKNRazWVJTOUvsC2bjiGMi-Jj71zxYb8yrsWziRzxU0uBm-6qjoa4btLWKX3HLa09dzeEozYHXD1iwKnYVztPKqnn1q). Timestamp by third party at Mon Apr 27 12:50:00 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MARSEC-XL INTERNATIONAL LTD (MARSEC-XL) LTD, C55913, established in Fuq San Pawl, Cospicua BML1910, Malta, MT20781036, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘27’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Krystyna WOJNAROWICZ with ECAS id nwojnakr signed in the Participant Portal on 27/04/2015 at 16:55:02 (transaction id SigId-13914-RgZEBIU1dZEmvKylzkSHZmOO4aJLDOuNzxPzRg54TMhxx6Ov6wf99cC4zdoCMb4hoExm04yJTprLHBHbUX6YR9y-Jj71zxYb8yrsWziRzxU0uBm-CEmRAZFAiwNFe56hQlzzZynzqyPzJeUN3ht7oKzWkwZY0). Timestamp by third party at Mon Apr 27 17:55:11 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ROCKETBROTHERS.DK APS (Rocket Brothers) APS, 34480362, established in ABOGADE 15, AARHUS N 8200, Denmark, DK34480362, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘28’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jathavan SHANMUGAM with ECAS id nshanmja signed in the Participant Portal on 11/05/2015 at 19:47:43 (transaction id SigId-4946-YqLp8dEnDzqinCDMErzulRItPPB2ofe3XIDjQB3mYWrJhiCT02m7Snm HN7EzPQMI4oqNPQnsp0kcWIzXMyJF43e-Jj71zxYb8yrdSFDAzJE3WI-hRj5uw62hljIKw5JLAdALSrjtgLZ1zKVCgtUQjc2eU1). Timestamp by third party at
Mon May 11 20:48:01 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THRANE & THRANE AS (Thrane & Thrane A/S) AS, 65724618, established in LUNDTOFTEGARDSVEJ 93D, KONGENS LYNGBY 2800, Denmark, DK65724618, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘29’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

peter ANDERSEN with ECAS id nanderfh signed in the Participant Portal on 08/05/2015 at 08:44:25 (transaction id SigId-3056-yzzWxwey71YD9iX35N99YInQIF6LB8s6Kw7KowKYJtwrD65vCAqDJI0nYKvLvqi5UCYx9nKyUn7Wlj9wzZdRjgG-Jj71zxYb8yrdSFDAzJE3Wl-MrNe1Uv20GQp5tSTT6g9DBNOlcDYaSuZ1EirqPZJwm0). Timestamp by third party at Fri May 08 09:44:46 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TRANSAS MARINE INTERNATIONAL AB (Transas Marine International AB) AB, 5564892866, established in DATAVAGEN 37, ASKIM 436 32, Sweden, SE556489286601, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘30’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Kenny ANDERSSON with ECAS id nankenny signed in the Participant Portal on 28/04/2015 at 09:18:03 (transaction id SigId-14589-o6hxybbdc6lbzpsrbQyBwt3QCY1mAndUumD3serQcDzTiMwp1MvXKtFiVNvZg6sZygYWQnJVEziWdZIKMtEm1zS-Jj71zxYb8yrsWziRzxU0uBm-2rlEol9hNUXcjjLsvSzXSAXWJYzoKepDx1CeltvAX0xG). Timestamp by third party at
Tue Apr 28 10:18:19 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

VISSIM AS (Vissim AS) AS, 946671975, established in VOLLVEIEN 5, HORTEN 3138, Norway, NO946671975MVA, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘31’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Max SEMENOV with ECAS id nsemenom signed in the Participant Portal on 04/05/2015 at 23:01:40 (transaction id SigId-105-jkgNGRfcAbyZxwKEgSlnPuQo1GPgQhJC5jYtC8FTDu6LW54zlKZE9oVu9N6Vjk5EzQ9UwlYiOGTglvMJxYClYs-PHslUMVSXYCgQcH8KRzmGK-RPObKBM9CjQq1XhTznCOTns3ZlH5SyRhahNc0Jk1PiE). Timestamp by third party at
Tue May 05 00:01:55 CEST 2015

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNITED KINGDOM HYDROGRAPHIC OFFICE (UKHO), established in ADMIRALTY WAY, TAUNTON TA1 2DN, United Kingdom, GB888805264, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary (‘32’)

in Grant Agreement No 636329 (‘the Agreement’)

between SØFARTSSTYRELSEN **and** *the Innovation and Networks Executive Agency (INEA) ('the Agency'), under the power delegated by the European Commission ('the Commission'),*

for the action entitled ‘EfficienSea 2 - Efficient, Safe and Sustainable Traffic at Sea (EfficienSea 2)’.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement the grant in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

CATHERINE PORTER with ECAS id npocathe signed in the Participant Portal on 01/05/2015 at 09:43:01 (transaction id SigId-20889-YdaLN4xivzxIv4qFvriJRNu6yJXYdfJimxT6kG3Jp19w83A2zYFIjADTlyzWd6Olrw9gIBM0UKrBM3KJjM8acbW-Jj71zxYb8yrsWziRzxU0uBm-ItdGzSHn7Q6f50x2oZydVB7I3wolfrL6vrU2cKjOkic). Timestamp by third party at
Fri May 01 10:43:15 CEST 2015

ⓘ print format A4 landscape

MODEL ANNEX 4 FOR H2020 GENERAL MGA — MULTI

FINANCIAL STATEMENT FOR *[BENEFICIARY [name]/ LINKED THIRD PARTY [name]]* FOR REPORTING PERIOD [reporting period]

	Eligible[1] costs (per budget category)											Receipts	EU contribution			Additional information
	A. Direct personnel costs				B. Direct costs of subcontracting	*[C. Direct costs of fin. support]*	D. Other direct costs		E. Indirect costs[2]	*[F. Costs of …]*		Total costs	Receipts	Reimbursement rate %	Maximum EU contribution[3]	Requested EU contribution	Information for indirect costs :
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons *[A.6 Personnel for providing access to research infrastructure]*		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services	*[D.4 Costs of large research infrastructure]*		*[F.1 Costs of …]*			Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises
Form of costs[4]	Actual	Unit	Unit		Actual	Actual	Actual	Actual	Flat-rate[5] 25%	Unit	Unit						
	a	Total b	No hours	Total c	d	*[e]*	f	*[g]*	h=0,25 x (a+b+ c+f+*[g]* + *[i1]*[6] +*[i2]*[6] - o)	No units	Total *[i1]*	Total *[i2]*	j = a+b+c+d+*[e]* +f +*[g]* +h+*[i1]* +*[i2]*	k	l	m	n	o
[short name beneficiary/linked third party]																	

The beneficiary/linked third party hereby confirms that:
The information provided is complete, reliable and true.
The costs declared are eligible (see Article 6).
The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).
For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

ⓘ Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

[1] See Article 6 for the eligibility conditions

[2] The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim any indirect costs.

[3] This is the *theoretical* amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may have to be less (e.g. if you and the other beneficiaries are above budget, if the 90% limit (see Article 21) is reached, etc).

[4] See Article 5 for the form of costs

[5] Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)

[6] Only specific unit costs that do not include indirect costs

ANNEX 5

MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- **For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.**
- **For fields in [grey in square brackets]: enter the appropriate data**

TABLE OF CONTENTS

Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the '**Terms of Reference (ToR)**' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[**insert legal name of the auditor**] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the Financial Statement(s)[1] drawn up by the *[Beneficiary] [Linked Third Party]* for the Horizon 2020 grant agreement [insert number of the grant agreement, title of the action, acronym and duration from/to] ('the Agreement'), and

to issue a Certificate on the Financial Statements' ('CFS') referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the Commission.

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').]*

[1] By which costs under the Agreement are declared (see template 'Model Financial Statements' in Annex 4 to the Grant Agreement).

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union][Euratom][Agency]* is not a party to this engagement.

1.1 Subject of the engagement

The coordinator must submit to the *[Commission][Agency]* the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement..

The CFS is composed of two separate documents:

- The Terms of Reference ('the ToR') to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;
- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the *[Commission,][Agency,]* the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

1.2 Responsibilities

The *[Beneficiary] [Linked Third Party]:*

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the *[Beneficiary's] [Linked Third Party's]* accounting and book-keeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the *[Beneficiary's] [Linked Third Party's]* staff and accounting as well as any other relevant records and documentation.

The Auditor:

- *[Option 1 by default:* is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations*]*.
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer:* is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary*].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation:* is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation*].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the *[Beneficiary's] [Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with[2]:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the *[Commission][Agency]* requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]*, and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the [*Commission*] [*Agency*], the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [*the European Union*] [*Euratom*] budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the *[Commission] [Agency]*, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by *[*dd Month yyyy*]*.

[2] Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

1.6 Other terms

[*The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.*]

[legal name of the Auditor]	[legal name of the *[Beneficiary][Linked Third Party]*]
[name & function of authorised representative]	[name & function of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor	Signature of the *[Beneficiary][Linked Third Party]*

Independent Report of Factual Findings on costs declared under Horizon 2020 Research and Innovation Framework Programme

(To be printed on the Auditor's letterhead)

To

[name of contact person(s)], [Position]

[[*Beneficiary's*] [*Linked Third Party's*] name]

[Address]

[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with *[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')],*

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial Statement(s)[3] of the *[Beneficiary] [Linked Third Party]* concerning the grant agreement

[insert grant agreement reference: number, title of the action and acronym] ('the Agreement'),

with a total cost declared of

[total amount] EUR,

and a total of actual costs and 'direct personnel costs declared as unit costs calculated in accordance with the [*Beneficiary's*] [*Linked Third Party's*] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in accordance with the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practices] EUR

and **hereby provide our Independent Report of Factual Findings ('the Report')** using the compulsory report format agreed with you.

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

The Procedures were carried out solely to assist the [*Commission*] [*Agency*] in evaluating whether the [*Beneficiary's*] [*Linked Third Party's*] costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The *[Commission] [Agency]* draws its own conclusions from the Report and any additional information it may require.

[3] By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in Annex 4 to the Agreement).

The scope of the Procedures was defined by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the *[Beneficiary's] [Linked Third Party's]* Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

Not applicable Findings

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

Explanation (to be removed from the Report):

*If a Finding was not applicable, it must be marked as '**N.A.**' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.*

The reasons of the non-application of a certain Finding must be obvious i.e.

i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;

ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.

….

Exceptions

Apart from the exceptions listed below, the *[Beneficiary] [Linked Third Party]* provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

Explanation (to be removed from the Report):

- *If the Auditor was not able to successfully complete a procedure requested, it must be marked as '**E**' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.*
- *If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as '**E**' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.*

List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.

….

Example (to be removed from the Report):

1. *The Beneficiary was unable to substantiate the Finding number 1 on … because ….*
2. *Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: …*
3. *After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of _____ EUR. The difference can be explained by …*

Further Remarks

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

Example (to be removed from the Report):

1. *Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because …*
2. *In order to be able to confirm the Finding number 15 we carried out the following additional procedures: ….*

Use of this Report

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the *[Beneficiary] [Linked Third Party]* and the [*Commission*] [*Agency*], and only to be submitted to the [*Commission*] [*Agency*] in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the *[Beneficiary] [Linked Third Party]* or by the [*Commission*] [*Agency*] for any other purpose, nor may it

be distributed to any other parties. The [*Commission*] [*Agency*] may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the *[Commission] [Agency]* by the *[Beneficiary] [Linked Third Party]* for the Agreement. Therefore, it does not extend to any other of the [*Beneficiary's*] [*Linked Third Party's*] Financial Statement(s).

There was no conflict of interest[4] between the Auditor and the Beneficiary *[and Linked Third Party]* in establishing this Report. The total fee paid to the Auditor for providing the Report was EUR _____ (including EUR_____ of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]

[name and function of an authorised representative]

[dd Month yyyy]

Signature of the Auditor

[4] A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:
- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

The European Commission reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

The 'result' column has three different options: 'C', 'E' and 'N.A.':

- 'C' stands for 'confirmed' and means that the auditor can confirm the 'standard factual finding' and, therefore, there is no exception to be reported.
- 'E' stands for 'exception' and means that the Auditor carried out the procedures but cannot confirm the 'standard factual finding', or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- 'N.A.' stands for 'not applicable' and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than the euro' the Procedure related to 'beneficiaries with accounts established in euro' is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A	**ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE**		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A. (*The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)* The Auditor sampled _____ people out of the total of _____ people.		
A.1	**PERSONNEL COSTS** <u>For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs)</u> To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: ○ a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract; ○ the payslips of the employees included in the sample; ○ reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; ○ information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent;	1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices.	
		2) Personnel costs were recorded in the Beneficiary's accounts/payroll system.	
		3) Costs were adequately supported and reconciled with the accounts and payroll	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); ○ applicable national law on taxes, labour and social security and ○ any other document that supports the personnel costs declared. The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.	records.	
		4) Personnel costs did not contain any ineligible elements.	
		5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.	
	Further procedures if 'additional remuneration' is paid To confirm standard factual findings 6-9 listed in the next column, the Auditor: ○ reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation…); ○ recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, etc.) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system').	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	
		7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE IS NOT MANDATORY ACCORDING TO THE NATIONAL LAW OR THE EMPLOYMENT CONTRACT ("ADDITIONAL REMUNERATION") AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT: *(A) IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;* *(B) IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR* *(C) IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.*	8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary regardless of the source of funding used.	
		9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).	
	Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied: Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard factual findings 10-13 listed in the next column:	10) The personnel costs included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice. This methodology was consistently used in all H2020 actions.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;. ○ reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; ○ verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records; ○ verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts; ○ verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents.	11) The employees were charged under the correct category.	
		12) Total personnel costs used in calculating the unit costs were consistent with the expenses recorded in the statutory accounts.	
		13) Any estimated or budgeted element used by the Beneficiary in its unit-cost calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.	
	<u>For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).</u> To confirm standard factual findings 14-18 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary: ○ the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary;	14) The natural persons reported to the Beneficiary (worked under the Beneficiary's instructions).	
		15) They worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the employment conditions of staff in the same category to compare costs and; ○ any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.).	16) The results of work carried out belong to the Beneficiary.	
		17) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		18) The costs were supported by audit evidence and registered in the accounts.	
	<u>For personnel seconded by a third party and included in the sample (not subcontractors)</u> To confirm standard factual findings 19-22 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: ○ their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; ○ if there is reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in its accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit;	19) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		20) The results of work carried out belong to the Beneficiary.	
		If personnel is seconded against payment: 21) The costs declared were supported with documentation and recorded in the	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ if there is no reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution free of charge): a proof of the actual cost borne by the Third Party for the resource made available free of charge to the Beneficiary such as a statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll; ○ any other document that supports the costs declared (e.g. invoices, etc.).	Beneficiary's accounts. The third party did not include any profit.	
		If personnel is seconded free of charge: 22) The costs declared did not exceed the third party's cost as recorded in the accounts of the third party and were supported with documentation.	
A.2	**PRODUCTIVE HOURS** To confirm standard factual findings 23-28 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time records of the persons included in the sample, to verify that: ○ the annual productive hours applied were calculated in accordance with one of the methods described below, ○ the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated.	23) The Beneficiary applied method [*choose one option and delete the others*] [**A**: 1720 hours] [**B**: the 'total number of hours worked'] [**C**: 'annual productive hours' used correspond to usual accounting practices]	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours. If the Beneficiary applied method C, the auditor verified that the 'annual productive hours' applied when calculating the hourly rate were equivalent to at least 90 % of the 'standard annual workable hours'. The Auditor can only do this if the calculation of the standard annual workable hours can be supported by records, such as national legislation, labour agreements, and contracts. *BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:* ***A.*** *1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)* ***B.*** *THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).*	24) Productive hours were calculated annually.	
		25) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	
		If the Beneficiary applied method B. 26) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.	
		If the Beneficiary applied method C. 27) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS. *'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.*	28) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	**HOURLY PERSONNEL RATES** <u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u> If the Beneficiary has a "Certificate on Methodology to calculate unit costs " (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary. If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the	29) The Beneficiary applied [*choose one option and delete the other*]: [Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"] [Option II: Individual hourly rates were applied]	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	Commission, or if the methodology approved was not applied, then the Auditor: o reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; o recalculated the unit costs (hourly rates) of staff included in the sample following the results of the procedures carried out in A.1 and A.2. II) For individual hourly rates: The Auditor: o reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; o recalculated the hourly rates of staff included in the sample following the results of the procedures carried out in A.1 and A.2. *"UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES":* *IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF THE CATEGORY TO WHICH THE EMPLOYEE BELONGS VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF FTE AND THE ANNUAL TOTAL PRODUCTIVE HOURS OF THE SAME CATEGORY CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2.* *HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:* *IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH*	*For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):* 30) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost accounting practices and was applied consistently for all activities irrespective of the source of funding.	
		For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission: 31) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
		For option II concerning individual hourly rates:	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.	32) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
A.4	**TIME RECORDING SYSTEM** To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records: o description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system); o its actual implementation; o time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; o the hours declared were worked within the project period; o there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below) ;	33) All persons recorded their time dedicated to the action on a **daily/ weekly/ monthly** basis using a **paper/computer-based** system. (*delete the answers that are not applicable)*	
		34) Their time-records were authorised at least monthly by the project manager or other superior.	
		35) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ the hours charged to the action matched those in the time recording system. *ONLY THE HOURS WORKED ON THE ACTION CAN BE CHARGED. ALL WORKING TIME TO BE CHARGED SHOULD BE RECORDED THROUGHOUT THE DURATION OF THE PROJECT, ADEQUATELY SUPPORTED BY EVIDENCE OF THEIR REALITY AND RELIABILITY (SEE SPECIFIC PROVISIONS BELOW FOR PERSONS WORKING EXCLUSIVELY FOR THE ACTION WITHOUT TIME RECORDS).*	36) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	<u>If the persons are working exclusively for the action and without time records</u> For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.	37) The exclusive dedication is supported by a declaration signed by the Beneficiary's and by any other evidence gathered.	
B	**COSTS OF SUBCONTRACTING**		
B.1	**The Auditor obtained the detail/breakdown of subcontracting costs and sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). To confirm standard factual findings 38-42 listed in the next column, the Auditor reviewed the	38) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the subcontracting category.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	following for the items included in the sample: o the use of subcontractors was foreseen in Annex 1; o subcontracting costs were declared in the subcontracting category of the Financial Statement; o supporting documents on the selection and award procedure were followed; o the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment). In particular, i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC or of Directive 2004/17/EC, the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement. ii. if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.. For the items included in the sample the Auditor also verified that: o the subcontracts were not awarded to other Beneficiaries in the consortium;	39) There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. Subcontracts were awarded in accordance with the principle of best value for money. *(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)*	
		40) The subcontracts were not awarded to other Beneficiaries of the consortium.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ there were signed agreements between the Beneficiary and the subcontractor; ○ there was evidence that the services were provided by subcontractor;	41) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.	
		42) There was evidence that the services were provided by the subcontractors.	
C	**COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES**		
C.1	**The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). The Auditor verified that the following minimum conditions were met: a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were	43) All minimum conditions were met	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	respected.		

D	OTHER ACTUAL DIRECT COSTS		
D.1	**COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest*). The Auditor inspected the sample and verified that: ○ travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged with this policy; ○ travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference; ○ no ineligible costs or excessive or reckless expenditure was declared.	44) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels.	
		45) There was a link between the trip and the action.	
		46) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting.	
		47) No ineligible costs or excessive or reckless expenditure was declared.	
D.2	**DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest*). For “equipment, infrastructure or other assets” [from now on called “asset(s)”] selected in the	48) Procurement rules, principles and guides were followed.	
		49) There was a link between the grant agreement and the asset charged to the action.	

	sample the Auditor verified that: ○ the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; ○ they were correctly allocated to the action (with supporting documents such as delivery note invoice or any other proof demonstrating the link to the action) ○ they were entered in the accounting system; ○ the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table); The Auditor recalculated the depreciation costs and verified that they were in line with the applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value). The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, excessive or reckless expenditure were declared (see Article 6.5 GA).	50) The asset charged to the action was traceable to the accounting records and the underlying documents. 51) The depreciation method used to charge the asset to the action was in line with the applicable rules of the Beneficiary's country and the Beneficiary's usual accounting policy. 52) The amount charged corresponded to the actual usage for the action. 53) No ineligible costs or excessive or reckless expenditure were declared.	
D.3	**COSTS OF OTHER GOODS AND SERVICES** **The Auditor sampled _____ cost items selected randomly** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest*). For the purchase of goods, works or services included in the sample the Auditor verified that: ○ the contracts did not cover tasks described in Annex 1;	54) Contracts for works or services did not cover tasks described in Annex 1. 55) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment.	

	○ they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and accounting); ○ the goods were not placed in the inventory of durable equipment; ○ the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices; ○ no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). In addition, the Auditor verified that these goods and services were acquired in conformity with the Beneficiary's internal guidelines and procedures, in particular: ○ if Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC or of Directive 2004/17/EC, the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement. ○ if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement. For the items included in the sample the Auditor also verified that: ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment); *SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE*	56) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported. 57) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups. 58) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money. *(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the*	

	AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.	*caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)*	
D.4	**AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE** The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020. ***In the cases that a positive ex-ante assessment has been issued*** *(see the standard factual findings 59-60 on the next column)****,*** The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment; ***In the cases that a positive ex-ante assessment has NOT been issued*** *(see the standard factual findings 61 on the next column),* The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;	59) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report. 60) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly. 61) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.	

	In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes *(see the standard factual findings 61 on the next column),* • The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations.		
E	**USE OF EXCHANGE RATES**		
E.1	a) For Beneficiaries with accounts established in a currency other than euros **The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest)*: *COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL JOURNAL OF THE EUROPEAN UNION (https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.* *IF NO DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN UNION FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm),*	62) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.	

	DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.		
	b) For Beneficiaries with accounts established in euros **The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement** (*full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest)*: *COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.*	63) The Beneficiary applied its usual accounting practices.	

[legal name of the audit firm]

[name and function of an authorised representative]

[dd Month yyyy]

<Signature of the Auditor>

ANNEX 6

MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- **For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.**
- **For fields in [grey in square brackets]: enter the appropriate data.**

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Terms of reference for an audit engagement for a methodology certificate in connection with one or more grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the '**Terms of Reference (ToR)**' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[**insert legal name of the auditor**] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and claiming direct personnel costs declared as unit costs ('the Methodology') in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

[title and number of the grant agreement(s)] ('the Agreement(s)')

The Agreement(s) has(have) been concluded between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').]*.

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union] [Euratom] [Agency]* is not a party to this engagement.

1.1 Subject of the engagement

According to Article 18.1.2 of the Agreement, beneficiaries *[and linked third parties]* that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the *[Commission] [Agency]*, for approval, a certificate on the methodology ('CoMUC') stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference ('the ToR') to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;

- the Auditor's Independent Report of Factual Findings ('the Report') issued on the Auditor's letterhead, dated, stamped and signed by the Auditor which includes; the standard statements ('the Statements') evaluated and signed by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') performed by the Auditor and the standard factual findings ('the Findings') assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

1.2 Responsibilities

The parties to this agreement are the *[Beneficiary] [Linked Third Party]* and the Auditor.

The *[Beneficiary] [Linked Third Party]:*

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the *[Beneficiary's] [Linked Third Party's]* accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading 'Statements to be made by the Beneficiary/ Linked Third Party' in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the *[Beneficiary] [Linked Third Party]* providing full and free access to the *[Beneficiary's] [Linked Third Party's]* staff and to its accounting and other relevant records.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations]*.
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary]*.
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation]*.

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the Beneficiary's *[and Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with[1]:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]* that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the Commission, *[the Agency]*, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are claimed from [*the European Union*] [*Euratom*] budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the Commission*, [the Agency]*, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

[1] Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

1.6 Other Terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]	[legal name of the [Beneficiary] [Linked Third Party]]
[name & title of authorised representative]	[name & title of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor Signature	Signature of the *[Beneficiary] [Linked Third Party]*

Independent report of factual findings on the methodology concerning grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

(To be printed on letterhead paper of the auditor)

To

[name of contact person(s)], [Position]

[[Beneficiary's] [Linked Third Party's] name]

[Address]

[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with *[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]*,

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the Commission uses to draw conclusions regarding the acceptability of the Methodology applied by the *[Beneficiary] [Linked Third Party]*.

The Report covers the methodology used from [dd Month yyyy]. In the event that the *[Beneficiary] [Linked Third Party]* changes this methodology, the Report will not be applicable to any Financial Statement[2] submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not

[2] Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

give a statement of assurance on the costs declared on the basis of the *[Beneficiary's] [Linked Third Party's]* Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

Exceptions

Apart from the exceptions listed below, the *[Beneficiary] [Linked Third Party]* agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.

…..

Explanation of possible exceptions in the form of examples (to be removed from the Report):

i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number … because…;

ii. the Auditor could not carry out the procedure … established because …. (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);

iii. the Auditor could not confirm or corroborate the standard Finding number … because ….

Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

Example (to be removed from the Report):

Regarding the methodology applied to calculate hourly rates …

Regarding standard Finding 15 it has to be noted that …

The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner: …

Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the Commission:

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
2. Brief description of the time recording system in place;
3. An example of the time records used by the [*Beneficiary] [Linked Third Party*];
4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
5. A summary sheet with the hourly rate for direct personnel declared by the [*Beneficiary*] [*Linked Third Party*] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
6. A comparative table summarising for each person selected in the sample a) the time claimed by the [*Beneficiary*] [*Linked Third Party*] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
7. A copy of the letter of representation provided to the Auditor.

Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

The Report:

- is confidential and is intended to be submitted to the Commission by the [*Beneficiary*] [*Linked Third Party*] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [*Beneficiary*] [*Linked Third Party*] or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [*Beneficiary*] [*Linked Third Party*].

No conflict of interest[3] exists between the Auditor and the Beneficiary *[and the Linked Third Party*] that could have a bearing on the Report. The total fee paid to the Auditor for producing the Report was EUR _____ (including EUR _____ of deductible VAT).

[3] A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor]

[name and title of the authorised representative]

[dd Month yyyy]

Signature of the Auditor

- stands to benefit directly should the certificate be accepted;

- has a close relationship with any person representing the beneficiary;

- is a director, trustee or partner of the beneficiary; or

- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor

The Commission reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
A. Use of the Methodology I. The cost accounting practice described below has been in use since *[*dd Month yyyy*]*. II. The next planned alteration to the methodology used by the Beneficiary will be from [dd Month yyyy*]*.	**Procedure:** ✓ The Auditor checked these dates against the documentation the Beneficiary has provided. **Factual finding:** 1. The dates provided by the Beneficiary were consistent with the documentation.
B. Description of the Methodology III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures. *[Please describe the methodology your entity uses to calculate personnel costs, productive hours and hourly rates, present your description to the Auditor and annex it to this certificate]* *[If the statement of section "B. Description of the methodology" cannot be endorsed by the Beneficiary or there is no written methodology to calculate unit costs it should be listed here below and reported as exception by the Auditor in the main Report of*	**Procedure:** ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology. **Factual finding:** 2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed. 3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
Factual Findings: - *…]*	
C. **Personnel costs** <u>General</u> IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act; V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility; VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s); VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice; VIII. Personnel costs are based on the payroll system and accounting system. IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. *[Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].* X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses	**Procedure:** *The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.* *[The Auditor has drawn a random sample of 10 full-time equivalents made up of employees assigned to the action(s). If fewer than 10 full-time equivalents are assigned to the action(s), the Auditor has selected a sample of 10 full-time equivalents consisting of all employees assigned to the action(s), complemented by other employees irrespective of their assignments.].* For this sample: ✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax , labour and social security law and any other documents corroborating the personnel costs claimed; ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: i. they were employed directly by the Beneficiary in accordance with applicable national legislation; ii. they were working under the sole technical supervision and responsibility of the latter; iii. they were remunerated in accordance with the Beneficiary's usual practices; iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices; ✓ the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the Commission/Agency; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action. XI. Personnel costs were not declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the Commission/Agency for the purpose of implementing the EU budget). <u>If additional remuneration as referred to in the grant agreement(s) is paid</u> XII. The Beneficiary is a non-profit legal entity; XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required; XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding; XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action). *[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of*	into account when calculating the personnel costs; ✓ the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system. ✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information; ✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8 000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s). ✓ the Auditor recalculated the personnel costs for the employees in the sample. **Factual finding:** 4. All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation. 5. The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility. 6. Their employment contracts were in line with the Beneficiary's usual policy; 7. Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.); 8. The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records; 9. To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
Factual Findings: - *…]*	relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: — (indicate the elements and their values). 10. Personnel costs contained no ineligible elements; 11. Specific conditions for eligibility were fulfilled when additional remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).
D. Productive hours XVI. The number of productive hours per full-time employee applied is *[delete as appropriate]*: A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time). B. the total number of hours worked in the year by a person for the Beneficiary C. the standard number of annual hours generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the standard annual workable hours. <u>If method B is applied</u> XVII. The calculation of the total number of hours worked was done as follows: annual workable hours of the person according to the employment contract, applicable labour agreement or national law plus overtime worked minus absences (such as sick leave and special leave). XVIII. 'Annual workable hours' are hours	**Procedure (same sample basis as for Section C: Personnel costs):** ✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C. ✓ The Auditor checked that the number of productive hours per full-time employee is correct and that it is reduced proportionately for employees not exclusively assigned to the action(s). ✓ If method B is applied the Auditor verified i) the manner in which the total number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national legislation, labour agreements and contracts. ✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours per year used for these calculations was at least 90% of the standard number of working hours per year.

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Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation. XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours. <u>If method C is applied</u> XX. The standard number of productive hours per year is that of a full-time equivalent; for employees not assigned exclusively to the action(s) this number is reduced proportionately. XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary's usual accounting practices; ii) is at least 90% of the standard number of workable (working) hours per year. XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal preforming the duties described in the relevant employment contract, collective labour agreement or national labour legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence. *[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* - *…]*	**Factual finding:** <u>General</u> 12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column. 13. The number of productive hours per year per full-time employee was accurate and was proportionately reduced for employees not working full-time or exclusively for the action. <u>If method B is applied</u> 14. The number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate. 15. The contract specified the working time enabling to calculate the annual workable hours. <u>If method C is applied</u> 16. The calculation of the number of productive hours per year corresponded to the usual costs accounting practice of the Beneficiary. 17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary. 18. The number of productive hours per year used for the calculation of the hourly rate was at least 90% of the number of workable (working) hours per year.
E. Hourly rates The hourly rates are correct because: XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel	**Procedure** ✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used. ✓ The Auditor has obtained a list of all the relevant employees, based on which the

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology applied) and they are in line with the statements made in section C. and D. above. *[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* - *…]*	personnel rate(s) are calculated. For 10 full-time equivalent employees selected at random (same sample basis as Section C: Personnel costs): ✓ The Auditor recalculated the hourly rates. ✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding. **Factual finding:** 19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.
F. Time recording XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a **daily/weekly/monthly** basis *[delete as appropriate]* using a **paper/computer-based system** *[delete as appropriate]*; XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put arrangements in place to record their working time; XXVI. Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly; XXVII. Measures are in place to prevent staff from: i. recording the same hours twice, ii. recording working hours during absence periods (e.g. holidays, sick leave), iii. recording more than the number of productive hours per year used to calculate the hourly rates, and	**Procedure** ✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time. The Auditor reviewed the time records of the random sample of 10 full-time equivalents referred to under Section C: Personnel costs, and verified in particular: ✓ that time records were available for all persons with not exclusive assignment to the action; ✓ that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working exclusively for a Horizon 2020 action; ✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled; ✓ that the persons worked for the action in the periods claimed; ✓ that no more hours were claimed than the productive hours used to calculate the hourly

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
iv. recording hours worked outside the action period. XXVIII. No working time was recorded outside the action period; XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates. *[Please provide a brief description of the time recording system in place together with the measures applied to ensure its reliability to the Auditor and annex it to the present certificate[4]].* *[If certain statement(s) of section "F. Time recording" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:* *- …]*	personnel rates; ✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per person per year for Horizon 2020 actions than the number of productive hours per year used to calculate the hourly rates; that working time is recorded outside the action period; ✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that no time worked outside the action period was charged to the action. **Factual finding:** 20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements. 21. For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available; 22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly. 23. Working time claimed for the action occurred in the periods claimed; 24. No more hours were claimed than the number productive hours used to calculate the hourly

[4] The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as it information flow up to its use for the preparation of the Financial Statements.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
	personnel rates; 25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period. 26. Working time claimed is consistent with that on record at the human-resources department.

[official name of the** [Beneficiary] [Linked Third Party]**]	***[official name of the Auditor]***
[name and title of authorised representative]	***[name and title of authorised representative]***
[dd Month yyyy]	***[dd Month yyyy]***
<Signature of the** [Beneficiary] [Linked Third Party]**>	***<Signature** of the Auditor**>***

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