Maritime communication challenges, and the ArcticSat IAP project
• Background from Norway and the maritime sector
• Arctic
• Some initial ideas for services
On Site
Close Range
Long Range
Communication
Technological possibilities
Application groups
User groups
Government, Operation centre, Hyd/Met, etc.
On Site
Passengers, Arctic Operators
Condition monitoring
SAR, Monitoring, IO

Satellite and Terrestrial
Sensors, WiFi, Mobile
VHF, HF/MF, WiMAX, ..


5° elevation with optimum GEO satellite position (same longitude) (~76°N)

Theoretical limit for geostationary (GEO) satellites (0° elevation, ~81°N)

Only low-rate data Iridium!

Source: Dr. Philip A. McGillivary, US Coast Guard
Towing of fishing vessel KAMARO – late October 2012

• Engine problems – close to Bear Island

• Initially assisted by another fishing vessel
  – Towing towards Norwegian mainland was started

• Norwegian Coast Guard asked to take over the tow
Preparation on board NCG vessel HARSTAD

• The crew on NCG HARSTAD started planning the towing operation during the transit from Norwegian mainland to Bear Island
• They used experience from a similar situation as the baseline for their planning
• There had been a major change of crew since then
A large part of Arctic maritime activities takes place in waters under Norwegian jurisdiction.

Increased activity – more incidents?
On behalf of the Maritime Forum North and the SARiNOR project MARINTEK, SINTEF Fisheries and Aquaculture and SINTEF ICT completed work package 2 (WP2): Alerting and Notification. The focus of the work package was on how accidents reports today, analyses of requirements, technology and gaps within alerting and notification for "Search and Rescue" (SAR) services in the Norwegian sector.

The methodology behind this work consists of three main steps:

1. Collection of data on alerting and notification, including empirical knowledge from users, information technology and statistics about incidents
2. Any data collected is analysed to identify gaps and challenges with current systems and technology, and it is simultaneously made an assessment of risks related to notification and alerting
3. The results of the analysis are used to recommend measures, identify requirements for future systems, and to prioritize research and development tasks
• Basic map
• Radio stations and coverage
  – VHF/MF/HF public
  – DSC watch VHF/MF/HF
  – Coverage DSC VHF/MF
• Navigational aids
  – LORAN-C transmitters
  – CHAYKA transmitters
  – NAVTEX transmitters
• Vessel density
  – Month, type, zone
• Vessel accidents
  – Type, zone
• Combination
• Reports
Recommendations: Alerting and Notification

Technological recommendations

- Easier functionality on emergency equipment, less information, standardization is important
- Too many different system (integration of systems, use of daily systems such as the chart plotter also for alarm and notification)
- Receipt back to the sender of received alarm
- Position data as standard integrated in emergency equipment (suits, lifeboats, rafts, etc.)
- Higher focus on mobile equipment, also recommended regulated in to GMDSS
- New and better procedures for technical maintenances on equipment such as the emergency beacons
- Better procedures for maintenance of safety equipment, in order to avoid false alarms (in some contexts this counts for more than 90% of the alarms)

Organization and human recommendations

- Use of 120-number, a service number, should be investigated. Frequently used within the leisure fleet in Norway
- Better knowledge on communication limitations, should be part of the SAR-training courses.
- Better understanding of cultural differences as well as organizational barriers
- Establish procedures for vessels sailing in the northern waters, that not have the expertise on board
- Establish back-up resources regarding interpretation services
Activities in the ocean space
• The ArcticSat feasibility structure
The Tender (topic and timing)

The feasibility study is aimed at addressing the following needs expressed by the different user communities:

1. **Reliable data provision** regarding Arctic conditions and availability of infrastructure, including ice thickness and dynamics, Arctic sea routes, seasonal forecasts, etc.

2. **Reliable communication and positioning mechanisms**, in particular broadband communications and positioning of ships and helicopters.

3. **Monitoring mechanisms assessing the environmental impact of an increase in Arctic operations**. Three space-based capabilities are relevant for integration into the potential services:
   - **Earth Observation data**: for assessment of ice conditions and meteorology / sea-state.
   - **GNSS signals**: for tracking of ships and helicopters, and support to search and rescue operations.
   - **Satellite communications**, covering the lack of terrestrial infrastructure in many areas, and acting as an enabler of other services (data transmission, search and rescue, etc.).
ARCTICSAT
Optimising situational awareness in the Arctic through integrated space technologies

Volume 2 – Financial, Management and Administrative Proposal to ESA

In response to
Invitation to Tender
AO/1-7446/13/NL/AD

Submitted by MARINTEK
Situational Awareness: Key elements

- External data, expertise
- SATCOMS
- Virtual Operations Room
- Satellite Positioning
- Positions of all players
- Met-ice-ocean nowcasts, forecasts & hazard alerts
- Operational efficiency
- Hazard risk mitigation
- Emergency preparedness
- Earth Observation

Situational Awareness in the Arctic
Situational Awareness in the Arctic

Our own initial assessment suggests that situational awareness depends on three critical applications of space technologies, namely:

1. Effective **communications** to enable a complete virtual view of operations based on standards, compliant protocols and availability of all required data sources and information, allowing efficient and effective decision making, effectively mitigating the remoteness of the activities.

2. The ability to **access existing and locally forecasted met-ice-ocean conditions** (including **hazards**) over the field of operations, and upstream where potential hazards exist for dynamic risk assessment;

3. To monitor and be able to act upon the **positions of all players**, so that these can be deployed and monitored effectively for situational awareness, particularly in relation to efficiency and safety, emergency preparedness and compliance with relevant agreements and legislation.
Letter of Support

- Norsk Romsenter

Subject: ARTES Programme Element 20 – Authorisation of funding

In accordance with the requirement of article 4.2 of the Specific Implementing Rules for ARTES element 20, the Delegation of Norway authorises ESA to start the funding to be drawn from our financial contribution to ARTES element 20 for an amount of [amount] in favour of the following Norwegian companies for their activities related to the ArcticSat proposal from Marstel: ESA FTT #7461b "Improved situational awareness in the Arctic."

Company:
- Marstel
- Kongsvinger Satellite Services
- Kongsvinger SatCom
- Norwegian Coastal Administration
Letter of Intent

- Maritime 21
Cover letter

For the attention of Ms. Andrea Dean

Dear Madam,

Subject: ITT AGI/1-7446/3/76/AD
Improved Situational Awareness in the Arctic

MARINTEK is pleased to submit its firm Fixed Price (FFP) proposal entitled “ArcticSAT” in response to the above referenced Invitation to Tender.

In accordance with the ITT, this proposal is submitted in 8 (eight) paper copies and 8 (eight) PDF searchable, non-copyrighted or password protected USB sticks.

The proposal comprises the following:

1. This cover letter dated 13 May 2013 plus its Annex and attachment containing statements signed by the Delegates representing Norway and UK, authorizing the Agency to fix the quoted price from their contribution to the ARTOS 20 Programme.
2. Volume 1 - Technical Proposal
3. Volume 2 - Financial, Management and Administrative Proposal

1. Price, Price Type and Bidding Team Information

For this activity, led by MARINTEK, the team offers the combined expertise of MARINTEK, Kongsberg Satellite Services AS, Kongsberg Seatex AS, The Norwegian Coastal Administration, GeoCentro Ltd., British Antarctic Survey and Astrium Ltd.

In compliance with the ITT requirements, MARINTEK offers a total Firm Fixed Price of three hundred thousand euros (€300,000).

The Firm Fixed Price breakdown information and bidding team details are as shown in the following table:

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of tenderer / subcontractor</th>
<th>Amount</th>
<th>% of total amount of tender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>MARINTEK, Kongsberg Satellite Services,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kongsberg Seatex AS, The Norwegian Coastal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Administration, GeoCentro Ltd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>British Antarctic Survey and Astrium Ltd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United</td>
<td>Kingdom</td>
<td>GeoCentro Ltd., Astrium Satellites Ltd.,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Norway</td>
<td>British Antarctic Survey</td>
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</tr>
</tbody>
</table>
ARCTICSAT
Optimising situational awareness in the Arctic through integrated space technologies

Volume 1 – Technical Proposal to ESA

In response to Invitation to Tender No./1-7446/15/NI/AD
Submitted by MARINTEK

Table of Contents

1 Introduction
   1.1 Scope of the Document
   1.2 Structure of the Document
   1.3 Related Documents
   1.4 List of Acronyms
2 Background and Motivation
3 Study Plan
4 Workplan and Initial Concept
5.1 Existing Situational Awareness Capabilities
5.2 ARCTICSAT Concept for Situational Awareness
5.3 Task 1: User & Stakeholder Analysis and Requirements Definition
   5.3.1 Users and Stakeholders
   5.3.2 User Needs Identification
   5.3.3 Proposed UoA of Applications
6 Workshop
7 State-of-the-Art Analysis & Technology Identification
   7.1 State-of-the-Art and Gap: Satellite Communication
   7.2 State-of-the-Art and Gap: Earth Observation
   7.3 Technology Identification
8 Definition of the Integrated Solutions and Associated Services
9 Navigations
10 Arctic Oil Spill Response
11 Proof of Concept
12 Economic and Non-Economic Viability Analysis
13 Market Analyses
14 Cost Benefit Analyses
15 Non-commercial analyses and liability analyses
16 Roadmap and Recommendations
6 Table of Compliance with the SoW Technical Items

Table of Compliance with the SoW: Technical Items

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Description</th>
<th>Comments</th>
<th>Statement of Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>The Tenderer shall provide an introduction showing his understanding of the background and motivation of the objective of the feasibility study, as well as of the scope and the limits of the activity.</td>
<td>Chapter 3</td>
<td>FC</td>
</tr>
<tr>
<td>C-2</td>
<td>The Tenderer shall submit a study plan, in the form of a flow chart, showing the logic of the envisaged work to be undertaken. Furthermore, the Tenderer shall present an overview of the processes and methodologies which will be used during the feasibility study to arrive at the required results of the study and individual tasks.</td>
<td>Chapter 4</td>
<td>FC</td>
</tr>
<tr>
<td>C-3</td>
<td>The Tenderer shall make clear in this proposal which service provision value chain will be addressed in the feasibility study. This shall include the users and stakeholders relevant for this service provision value chain.</td>
<td>Chapter 5.3.3</td>
<td>FC</td>
</tr>
<tr>
<td>C-4</td>
<td>The Tenderer shall submit an initial elaboration, as far as practicable, of the work to be required in the Statement of Work.</td>
<td>This chapter</td>
<td>FC</td>
</tr>
<tr>
<td>C-5</td>
<td>The Tenderer shall submit a statement of compliance to the ESA Work Statement, clearly defining any proposed deviation with the relevant justification in open form.</td>
<td>This chapter</td>
<td>FC</td>
</tr>
<tr>
<td>C-6</td>
<td>If the Tenderer intends to make use of Background Intellectual Property or Third Party Products Rights, the Tenderer shall explain the rationale for this choice in technical terms. The impact of this approach or the technical activities and resulting products as well as their usage shall be indicated.</td>
<td>This chapter</td>
<td>FC</td>
</tr>
<tr>
<td>C-7</td>
<td>The Tenderer shall involve at least one service provider and may involve specific users / stakeholders.</td>
<td>Chapter 5.3.3</td>
<td>FC</td>
</tr>
</tbody>
</table>
Optimising situational awareness in the Arctic through integrated space technologies

Table of Contents

0 General ......................................................... 1
0.1 Document Info .................................................. 1
0.2 Change Record .................................................. 1

Table of Contents .................................................. 2
1 Introduction .................................................... 5
1.1 Scope of the Document ........................................ 5
1.2 Structure of the Document .................................... 5
1.3 Applicable Documents ........................................ 5
1.4 List of Acronyms .............................................. 6
2 Consortium Presentation and Relevant Experience .......... 7
2.1 MARINTEK - The Norwegian Marine Technology Research Institute – Coordinator .......... 7
2.1.1 General Information and Relevant Experience .......... 7
2.1.2 Synergies with other MARINTEK Projects and Activities .......... 8
2.1.3 Internal Organisation ....................................... 9
2.2 Kongsvinger Satellite Services AS (KSAT) ................. 10
2.2.1 General Information and Relevant Experience .......... 10
2.2.2 KSAT Internal organisation ................................ 11
2.3 Kongsvinger Satellite AS ..................................... 12
2.3.1 General Information and Relevant Experience .......... 12
2.3.2 Internal Organisation ....................................... 13
2.4 British Antarctic Survey ....................................... 14
2.4.1 General Information and Relevant Experience .......... 14
2.4.2 Synergies with other BAS Projects and Activities .......... 14
2.4.3 Internal Organisation ....................................... 15
2.5 GeoCento Ltd .................................................. 15
2.5.1 General Information and Relevant Experience .......... 15
2.5.2 Synergies with other GeoCento Projects and Activities .......... 16
2.5.3 Internal Organisation ....................................... 16
2.6 Astrium Ltd ................................................... 16
2.6.1 General Information and Relevant Experience .......... 16
2.6.2 Norwegian Coastal Administration ......................... 18
2.6.3 General Information and Relevant Experience .......... 18
2.6.4 Synergies with other NCA Projects and Activities .......... 19
2.6.5 Internal Organisation ....................................... 20
3 Organisation and Management ................................ 20
3.1 Project Management Structure and Interfaces to ESA .......... 20
3.1.1 Roles and Responsibilities .................................. 21
3.1.2 Settlement of Disagreements ............................... 24
3.2 Project Management, Coordination and Control .......... 24
3.2.1 The Project Management Process .......................... 24
3.2.2 Project Plans .............................................. 24
3.2.3 Team Management ........................................ 25
3.2.4 Progress Monitoring and Reporting ......................... 25
3.3 Risk Management ............................................ 26
4 Facilities ....................................................... 26
4.1 MARINTEK Facilities ......................................... 26
4.2 Kongsvinger Satellite Services Facilities ..................... 27
4.3 Kongsvinger Systems Facilities .............................. 27
4.4 British Antarctic Survey Facilities ........................... 28
4.5 GeoCento Facilities .......................................... 28
4.6 Astrium Facilities ............................................. 28
4.7 Norwegian Coastal Administration Facilities ............... 29
5 Key Personnel .................................................. 30
5.1 Key Personnel Contact List ................................... 30
6 Deliverable Items .............................................. 36
7 Work Breakdown Structure .................................... 36
7.1 Work Package Overview ..................................... 36
7.2 Work Package Descriptions .................................. 37
8 Time Planning .................................................. 43
9 Financial Section ............................................... 44
9.1 Price Proposal and Cost Price Data ............................ 44
9.2 Milestone Payment Plan ....................................... 45
9.3 Geographical Return .......................................... 45
9.4 Currency and Conversion Rates ................................ 45
9.5 Taxes and Government Duty .................................. 45
9.6 Travel and Subsistence Plan .................................. 45
9.7 Contractual Conditions ....................................... 47
Appendix I: Background IPFs ................................... 48
Appendix II: Letters of Intent for Project Reference Group .... 49
Appendix III: Utilities of intent for Project Reference Group .... 49
Appendix IV: U.S. Coast Guard (USCG) .......................... 52
Appendix V: Other (OMC) ......................................... 52
Appendix VI: Other (OMC) ......................................... 53
Appendix VII: Other (OMC) ......................................... 54
Appendix VIII: Other (OMC) ....................................... 55
Appendix IX: Other (OMC) ......................................... 56
Appendix X: Other (OMC) ......................................... 57
Appendix XI: Other (OMC) ......................................... 58
Appendix XII: Other (OMC) ....................................... 59
Appendix XIII: Other (OMC) ....................................... 60
Appendix XIV: Other (OMC) ....................................... 60
Appendix XV: Other (OMC) ....................................... 61

AOI-1446/13/NL/AD Financial, Management & Administrative Proposal 2/90
Business cases

OIL SPILL Application

- Other Supporting Infrastructure
- UAV Leaser
- EO Satellite System
- METEO Sensors
- Other Data Proc.
- UAV Sensor Processing
- EO Services
- METEO Services
- National Rescue Authorities
- Satcom SP
- Centre Supplier
- Software Supplier
- Oil Co HQ
- Oil Co Insurers
- Non SatCom SPs

Mature
Emerging
Non-existent

e-Navigation Application

- Other Supporting Infrastructure
- Galileo EGNOS Local
- EO Satellite System
- Other Services
- GNSS Services
- EO Services
- AIS System SP
- SAR System SP
- Rescure Authorities
- SatCom SP
- e-Nav Service Provider
- SHIPS or other crafts
- e-Nav Hardware Manufacturer
- Other Communications (e.g. VHF)
- Inmarsat SP
- Inmarsat System
- e-Nav Software Manufacturer
- Other SatCom SPs
- Other Data Proc.
- UAV Sensor Processing
- EO Services
- METEO Services
- National Rescue Authorities
- Satcom SP
- Centre Supplier
- Software Supplier
- Oil Co HQ
- Oil Co Insurers
- Non SatCom SPs

Mature
Emerging
Non-existent
7.2 Work Package Descriptions

The following work package's descriptions are compliant to the (slightly modified) PSS-A20 form:

**WORK PACKAGE DESCRIPTION**

<table>
<thead>
<tr>
<th>Project</th>
<th>Optimizing situational awareness in the Arctic through integrated space technologies</th>
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<tr>
<td>WP Title</td>
<td>User and Stakeholder Analysis and User Requirements Definition</td>
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<td>Contractor</td>
<td>MARINTEK</td>
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<tr>
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<td>End Event</td>
<td>PRM-1</td>
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<tr>
<td>End Date</td>
<td>TD-3</td>
</tr>
<tr>
<td>WP Manager</td>
<td>Beate Ivensdahl</td>
</tr>
</tbody>
</table>

**Purpose:**

To identify Arctic users and stakeholders who will benefit from improved services for shared situational awareness, to identify and describe their needs and requirements.

**Inputs:**

1. See for AO1-7449/13NLJAD
2. Reference documents
3. Results from previous projects (ArcticSat, MarCom, MarSafe North)

**Tasks:**

- WP 110 - Stakeholder overview
  - Based on literature studies, reference group and project partner networks, identify and describe the potential users and stakeholders of shared situational awareness services.
  - Select one or two user communities for detailed analysis
- WP 120 - User needs and use cases
  - Run a workshop where representatives from different user communities are invited
  - Participate in workshops and detailed analysis in WP 110.
  - Produce use cases which describes the behaviour and operation of these users and stakeholders, related to shared situational awareness.
- WP 130 - User requirements
  - Further detail the use cases from WP 120 to describe the user needs in detail.
  - Identify already existing applications or services for shared situational awareness
  - Identify the gap between user requirements and already existing applications and services.
  - WP 140 - Assessment of potential for space-based services
  - Propose new potential services for space-based services related to shared situational awareness
  - Develop CTPs for measurement the success of implementation of such services.

**Outputs:**

- O1: "User 7 Stakeholder overview, Applications and User Requirements".

## Appendix III: CURRICULA VITAE of Project Managers and WP Leaders

### Kay Endre Fjørtoft (General Project Manager and WP700 Leader)

**SUMMARY:** Kay Fjørtoft has been a Senior Research Scientist at MARINTEK since 1995, and is currently Research Manager at the department of Maritime Transport Systems, where he is leading an RTD team of about 15 researchers specialized in logistics, maritime communications and integrated operations. He has been leading and participating in numerous EU projects, mainly covering software architecture and developments, freight transport, safety management, port community systems, and communications within shipping and the oil & gas business sectors. Previously he has o.a. been working as a sailor within the fishery and the transport sector, where he also was co-owner of a deep sea trawler. Kay has published several papers and articles mainly focusing maritime communications, software architecture and logistics challenges, and he is currently also heading the recently established Maritime Communication Center.

**NAME:** Kay Endre Fjørtoft

**DATE OF BIRTH:** 01.05.1957

**NATIONALITY:** Norwegian

**FAMILY:** Married, three kids

**LANGUAGES:** Scandinavian and English

**POSITION:** Research Manager at MARINTEK, Maritime Transport Systems (Norwegian Marine Technology Research Institute A/S)

**Contact details:** Mobile: +47 90057006, email: k.fjortoft@marintek.mnf.no

**EDUCATION:**

- 1984 M.Sc. In Computer Sciences at University of Essex, Colchester UK

**EXPERIENCE:**

- 1956-87 Sailor, crew on board a cargo container vessel operating in the Norwegian Sea pool
- 1980-90 Supervisor-Leader of the MinVess section, Maritime and Media Institute, Isfjord, Norway
- 1994-95 Teacher at info-partner learning system, Ålesund, Norway
- 1995-2010 Senior Research Engineer at MARINTEK, Trondheim, Norway
- 2010 - Research Manager, Dep of Maritime Transport Systems, MARINTEK

**MAIN FIELDS OF COMPETENCE:**

- Project management,
- Software architecture,
- Software development,
- Freight transport and logistics,
- Port community,
- Communication,
- Arctic challenges

**Short list of essential projects:**

- 1995-97 Emergency Management ability - a safety system on-board ships
- 1995-97 Maritime National Information Network
- 1997-97 TRANSDATA, Data modeling and standardization
- 1998-99 INFRA(struct), Architecture, data modeling and demonstrator
- 1999-99 INFRA(TRANS), Standardisation, and architecture, dangerous goods transport
- 1999-2002 ShipLog, Architecture, prototyping of a chain management system (TCMS)
- 2000-2001 Intermodal Portal, Exchange of data between port systems in Europe (WP)

**AO1-7449/13NLJAD Financial, Management & Administrative Proposal**

37/00