Standards and Guidelines for the Use of Satellite-Based Ice Information in the Oil and Gas Sector

A Proposal by C-CORE Polar Imaging Limited Bear Ice Technology on behalf of Shell
Agenda

• Introduction
• Context
• Scope of Proposed New Activity
• Discussion
• Actions by OGEO/ESA
Introduction

• Arctic regions are increasingly attracting the interest of O&G Industry
  – Significant reserves are thought to exist in ice prone areas

• The oil and gas industry are increasingly focusing activities on areas prone to ice cover
  – sea ice
  – icebergs.

• Approach being taken by companies who require ice information is to develop internal practices based on their experience.

• No industry-wide standards exist for Ice Charting
Oil and Gas Operations in Ice Prone Waters

Ability to operate dependent on a number of factors

- Type of structure
- Met Ice Ocean environment
- Knowledge of ice conditions
  - Icebergs
  - Sea ice
- Ability to manage ice conditions
- Knowledge of the ice loading on a particular structure
Role of EO in Design and Operational Ice Management

- **Sea Ice**
  - Ice charts
    - Encounter frequency from historical records
    - Tactical mapping as input into icebreaker support
  - Ice regime characterization
    - First year/multiyear, thin/thick
    - Ice structure interaction
  - Input to forecasting

- **Icebergs**
  - Historical aerial density
  - Population distribution
  - Drift speed assessment
  - Strategic and tactical surveillance
    - Threat assessment and decision making
    - Input to drift tracking and forecasting
    - Supports iceberg physical management
TransICE

- *Ice Information For Tactical Ice Management For The Oil And Gas Sector*

- ESA Project, funded through Value Adding Element

- Objectives:
  - Validate a set of ice information products derived primarily from EO,
  - Products tailored for tactical management operations by O&G companies in ice prone waters;
  - Demonstrate those products and obtain feedback;

- Pilots on the Grand Banks, US Beaufort, Baltic Sea and the Antarctic

- Led by C-CORE (Canada)
  - Polar Imaging (UK)
  - eOsphere (UK)
  - VTT (Finland)
  - KR Croasdale and Associates (Canada)
TransICE Findings

• Issues to adaptation of EO in O&G industry are similar with different companies

• Completely independent pilots encountered identical problems and resolutions

• The development of customized charting product was always the ‘first step’
  – Generally derived from WMO Ice Chart Standard
  – WMO standard developed with transportation and navigation in mind
  – Inadequate scale or information for O&G industry
Iceberg Areal Density Chart

- Based on Icebergs per degree square from Canadian Ice Service
- Iceberg counts within region
- ½ to ¼ degree square
- Derived from low resolution SAR
- Corrected for probability of detection
- Useful in strategic operations and design
Annotated Geo-referenced Image
Sea Ice and Iceberg Chart

- Based on WMO Ice Chart
- Fused imagery with ice type polygons and iceberg densities
- Useful for tactical and strategic operations
Iceberg Products

MANICE Text File

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RSA1 70000 020204
00000
75300 04921 Z0924 1XXXX 2XXXX 3035035 4XXXX
75142 04942 Z0925
11111
70924 52549 49479 01X30 14053 24033
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70924 51594 48465 01X50 14124 24032
60924 51442 49019 01X40 14073 24029
60924 52228 50143 01X40 14070 24025
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55555
60924 52278 50050
REMARKS
This message was generated automatically by the Canadian Ice Service using the target detection system.
Run Time: 3904-Feb-02 13:16:14
Input Data File:
F:\GMES_2004\IP\Radarsat\040202_43044_01\QC_Radarsat\dat_01.001
Input Data Type: RADARSAT
Image Acquisition Time: 3904-Feb-02 09:24:50
Beam Mode: W3
CFAR Parameter: 2.460e-005
Total Number of Targets: 8
Number of Icebergs: 7
Number of Ships: 1
Number of Unknown targets: 0
Start Left Point: 53.089542 -50.314575
Start Right Point: 52.901230 -48.401142
End Left Point: 51.610027 -48.777653
End Right Point: 51.798183 -50.635201
END
Context of Standards

- Industry has spent significant effort developing standards for operations in the Arctic

- ISO 19906 - Arctic Offshore Structures
  - Attempt to harmonize existing standards
  - First Workgroup Meeting (WG8) in 2002
  - Participation by Canada, China, Denmark/Greenland, Finland, France, Germany Italy, Japan Kazakhstan, Norway, Russia, The Netherlands, United Kingdom and United States
  - Standard delivered in 2010

- Since precedent exists, there is rationale for an ice charting standard specifically for O&G industry
A Standard for Ice Charting in the O&G Industry

• Identify minimum standards and best practices
  – for the provision of ice information derived from satellites
  – for companies operating in the polar and sub-polar regions

• Benefits
  – Clear charting options available to industry
  – Information content is documented & based on capabilities of existing satellites
  – Processes exist for standards to adapt to increasing EO capabilities
  – Companies can build processes and systems around standards
  – Companies can be assured that service providers who adhere to the standard will be compatible with their systems
  – Knowledge of ice charting capabilities are not LOST with staff attrition
  – Increased access of the market to a wider variety of service providers
  – Increased uptake, increased competition, lower costs
Development of an Ice Charting Standard - Scope

- Project proposed to cover offshore oil and gas industry
  - Requirements for ice assessment and monitoring
  - From the polar regions to mid-latitudes
  - For current and future developments

- Identify requirements through the oil and gas project lifecycle
  - Match these to different regions
  - Categorise satellite-derived ice information by services and products
  - Review current practices

- Establish standards and guidelines with input and validation from the industry
  - Consider current constraints and future opportunities.

- Limited to sea ice and icebergs; will not cover other met-ocean conditions.
**Approach and Schedule**

- **Phase 1.** Establish requirements and current practices in relation to the use of satellite based ice information in the oil and gas sector (6 months duration).

- **Phase 2.** Establish guidelines and standards for the use of satellite based ice information in the oil and gas sector (12 months duration).
Establish requirements and current practices

Propose guidelines and standards

Requirements and Current Practices Report v.1

Update report

Linkages to EO and OG communities

Requirements and Current Practices Report v.2

Guidelines and Standards Report v.1

Workshop

Comments

Guidelines and Standards Report v.2

ESA/Shell

Phase 1

O&G Industry

Phase 2

OGEO Working Group.
Phase 1 Proposed Detail

1. The O&G lifecycle and Ice Assessment and Monitoring Needs
   a) Pre-license acquisition
   b) Exploration (seismic, surveys, drilling etc.)
   c) Development (structure design criteria, tow out, installation, etc.)
   d) Production (re-supply logistics, HSE, pollution monitoring etc.)
   e) Decommissioning

2. Ice Assessment and Monitoring Product/Service Requirements by Region
   a) Beaufort Sea
   b) Chukchi Sea
   c) Sea of Okhotsk
   d) Canada East Coast
   e) Greenland
   f) Barents Sea (Shtokman Field)
   g) North Caspian Sea
   h) Bohai Sea
   i) Southern Atlantic (Falklands)
Phase 1 Proposed Detail

3. Current practices: use of earth observation

4. Preliminary Identification of Constraints and Opportunities
   a. Sensors useful in design, planning and operations
   b. Design and Planning
      • Ice climatology and hazard assessment (e.g. for assessment of a new lease, precursor for structure design criteria, etc.)
      • ISO 19906 (recommendation for action equations and ice environment input criteria)
   c. Operational Support
      • Seasonal outlook (e.g. ice freeze-up and break-up date)
      • Regional ice monitoring (e.g. weekly regional ice charts and forecasts)
      • Tactical sea ice support
      • Iceberg monitoring
      • Regional ice navigation needs for re-supply logistics and offloading on an as required basis.

5. Conclusions and Recommendations
Discussion