Industry Workshop

on

Satellite EO for the Oil and Gas Sector: New Technologies and Opportunities

Hosted by
European Space Agency
Directorate of EO Programmes
ESA/ESRIN, Frascati, Italy

14-15 September, 2010
Welcome from the European Space Agency

Dear delegate,

I am delighted to host your industry workshop at ESA. It is important to demonstrate that Earth Observation (EO) can deliver benefits to the scientific, public- and private-sector communities, and this workshop contributes to this goal within the context of the oil and gas industry.

ESA is implementing one of the most vigorous Earth Observation programs in the world, with 6 satellites currently in orbit and 18 more scheduled for launch in the next decade. These include the family of Earth Explorers that will measure key Earth system parameters to understand their role and impact in climate change, the fleet of Sentinels that will provide operational information services for Global Monitoring of the Environment and Security (GMES), and the next generation of satellites for operational meteorology.

The oil and gas sector is not a newcomer to EO. Many companies have been exploring the use of this technology over the last 20+ years, both in-house and via specialist companies. However, the stage is now set for EO to emerge from an R&D tool to a technology that provides, on a sustained basis, reliable and timely information services about the environment. With this prospect, ESA is keen to bring together specialist companies providing EO-based services and leading players from the oil & gas industry to better understand current and evolving information requirements. It is our hope that this workshop could identify a series of measures that can be taken within both communities to consolidate and expand the use of EO both within individual companies, but, more importantly, across the oil & gas industrial sector as a whole.

Stephen Coulson
Head of Industry Section
Directorate of EO Programmes
TerraSAR-X image showing flooding of the Mooba Oil & gas field on the 24th March 2010. Inundated areas appear as black in the data.
Welcome from the Steering Committee

Dear Delegate,

On behalf of the Steering Committee, I welcome you to the workshop, and encourage you to make the most of this exciting opportunity. The Steering Committee has worked hard to put together a programme of presentations and discussion sessions over two days that we hope will stimulate and inform. This is a unique gathering, bringing together colleagues from the Oil and Gas industry with the Earth Observation community to address real challenges that we face in the drive to meet world energy demands.

Whatever your background and interests, you have something to contribute to this workshop. The presentation and discussion sessions have been designed to cover the applications and earth observation technologies that are relevant to the range of delegates who have registered for the workshop. The challenges of exploring and operating in onshore and offshore environments, sometimes with extreme climates, around the world will be described, and solutions based on proven applications and technology will be presented.

This flyer is provided to you to assist in stimulating discussion at the workshop, looking forward to new technology and solutions to the challenges we face. We hope that as well as listening to the interesting range of presentations from the most pro-active organisations in our two industries, you will consider the material and the questions posed in this flyer and use this to assist you in contributing to the discussion sessions. The Steering Committee expect that this workshop will result in increased understanding and collaboration, creating opportunities for innovation, developing and enhancing the use of earth observation within the oil and gas sector.

Richard Eyers, Shell (Chair)  Colin Grant, BP  Ola Gråbak, ESA
Peter Hausknecht, Woodside  Emmanuel Garland, Total  Han Wensink, Chair of EARSC
Kim Partington, Polar Imaging (Secretary)
Objectives of the workshop

The workshop has the overarching goal of advancing the use of earth observation within the oil and gas sector. In support of this, the workshop has the following objectives:

- To ensure that key oil and gas industry personnel are aware of the capabilities of the current and new generation of earth observation sensors in relation to new technical operating challenges, obligations relating to legislation and new geographical areas of activity.
- To provide a forum where the combination of key personnel from both the oil and gas and space industries can exchange ideas and develop new approaches and possibilities for the enhanced use of earth observation within the oil and gas industry.
- To provide insight to ESA and other data providers on how the use of earth observation data and products may be assisted by changes to procedures and policies.
- To communicate evolving oil and gas industry requirements to satellite operators and service providers so that the space sector can work to meet these requirements.

Our expectation is that the workshop would help develop the following:

- A move towards identification of best practises/guidelines for use of earth observation in the industry.
- Identified requirements for demonstrations in order to consolidate newly developed application capabilities.
- Identified R&D with respect to new sensors/products to develop/enhance applications.
- Future studies related to requirements for new sensors, constellations etc.
Earth Observation in the Oil and Gas industry

The use of satellite earth observation is now firmly embedded within the oil and gas industry, through the whole oil and gas lifecycle from pre-acquisition to full operations, but the challenge for industry is to optimise the technology by incorporating enhanced capabilities from the new generation of satellite missions. Earth observation can save costs and support health and safety, often at the same time (for example in reducing reliance on aircraft operations). As the oil and gas industry confronts new challenges, for example in moving into high latitudes and in addressing increasingly stringent legislative requirements for environmental sustainability, so it is likely that earth observation will become increasingly important to the oil and gas industry.

<table>
<thead>
<tr>
<th>Exploration</th>
<th>Environmental Sustainability</th>
<th>Infrastructure &amp; Transportation</th>
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<tbody>
<tr>
<td>❖ Base mapping</td>
<td>❖ Infrastructure design</td>
<td>❖ Logistical planning</td>
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<tr>
<td>❖ Structure / stratigraphy</td>
<td>❖ Asset identification and monitoring</td>
<td>❖ Pipeline route and access planning</td>
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<td>❖ Fracture analysis</td>
<td>❖ Hazard monitoring</td>
<td>❖ Construction monitoring</td>
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<td>❖ Integration of gravity and magnetics</td>
<td>❖ Regulatory compliance</td>
<td>❖ Infrastructure monitoring</td>
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<td>❖ 2D/3D/4D visualisation</td>
<td>❖ Environmental change</td>
<td>❖ Environmental change</td>
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<tr>
<td>❖ Seepages (on &amp; offshore)</td>
<td>❖ Pollution monitoring</td>
<td>❖ Pollution monitoring</td>
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<tr>
<td>❖ Exploration logistics</td>
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<td>❖ Security</td>
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Some oil and gas industry applications of earth observation.
Opportunities for the Oil and Gas Industry

New earth observation missions and observations are opening up opportunities for the oil and gas industry. Capabilities are improving continually, with radical improvements taking place in the range, quality, quantity and reliability of earth observation. Between now and 2016, there are 151 satellites proposed for launch by organisations from 29 countries. This decade will see the deployment of many more sensors operating at a very high resolution (<1m to 2.5m), with new spectral capabilities (notably VNIR for optical, TIR for hyperspectral and X and L band for SAR). The current period also represents in many ways the coming of age of satellite Synthetic Aperture Radar (SAR), with multiple missions offering a range of high spatial resolutions, polarisations and operating frequencies, as well as improvements in interferometric capabilities. Observations across the electromagnetic spectrum are becoming more flexible, with daily monitoring capabilities becoming more routine as a result of constellation missions and providers reacting to commercial users by providing more flexible ordering, planning and distribution of products, supporting more tactical decision making. Datasets are also becoming more easily available, through the opening up of archives and some data providers moving towards “free” access of pre-planned earth observation data.

Current and planned synthetic aperture radar and multispectral imaging sensors.
<table>
<thead>
<tr>
<th>Category</th>
<th>Improved capability</th>
<th>Application</th>
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<tbody>
<tr>
<td>New observables</td>
<td>Radar polarimetry</td>
<td>Sea ice mapping; discrimination of icebergs and vessels; vegetation mapping; oil slick discrimination</td>
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<td>New lower atmospheric obs.</td>
<td>Low level atmospheric pollutant detection and monitoring; dust and volcanic ash monitoring.</td>
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<td>L band radar</td>
<td>Buried paleogeography in dry environments; observations beneath vegetation and dry snow.</td>
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<td>Interferometric polarimetry</td>
<td>Vertical discrimination and mapping of vegetation and structures</td>
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<td>Improved observations</td>
<td>Spatial (resolution sub-metre)</td>
<td>Mapping of infrastructure; iceberg and vessel detection, security applications, pipeline leakage, pollution detection.</td>
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<td>Spectral (hyperspectral)</td>
<td>More definitive land cover and surficial geology; pollution detection; onshore seeps.</td>
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<td>Temporal (revisit)</td>
<td>Daily monitoring; observation and forecasting of mesoscale metocean phenomena</td>
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<td>Digital elevation models</td>
<td>Accurate elevation mapping in new areas; improved subsidence monitoring</td>
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<td>Enhanced data Access</td>
<td>More competition between providers</td>
<td>More customer focus and options, e.g. data subscription data options; more robust supply.</td>
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<td>Additional routes to data access</td>
<td>More flexibility and control in access to EO data; UAVs, O&amp;G ownership of data rights, etc.</td>
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<td>Improved communications</td>
<td>Remote access to EO imagery; global broadband access on the horizon</td>
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<td>Changing EO data policies</td>
<td>Potential “freely available” pre-planned GMES Sentinel data; International Charter for emergency data access.</td>
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<td>Opening up of data archives</td>
<td>Improved assessment of environmental risks; optimized infrastructure designs.</td>
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<td>Increasingly NRT capabilities:</td>
<td>Tactical EO support in the field (e.g. vessel navigation)</td>
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<td>EO integration</td>
<td>Communications and EO</td>
<td>New location-based EO applications; services providing integrated environmental data.</td>
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<tr>
<td>with other technologies</td>
<td>EO, models and in situ observations</td>
<td>New forecasting capabilities; enhanced metocean parameters.</td>
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Some potential earth observation opportunities for the oil and gas industry.
Workshop Discussions

The workshop includes discussions during the parallel and afternoon plenary sessions. The discussions at the end of the parallel sessions will draw recommendations from the presentations that have been made in the areas of “Exploration”, “Sustainable Development” and “Infrastructure and Transportation” respectively, on each of days 1 (Offshore) and 2 (Onshore). The discussions during the afternoon plenary sessions will draw together recommendations in relation to opportunities and constraints in the use of earth observation. To assist in formulating these recommendations, delegates are invited to consider the following questions in advance of these sessions.

Questions for Oil and Gas Sector Delegates

- How are EO based services being used within your company?
  - Is EO value adding done in-house or outsourced within your company?
  - What do you use EO based services for? (R&D, operations etc)
  - What are the major benefits from EO based services identified so far?
  - What is the level of corporate acceptance of EO based technology?

- How do you rate the following in terms of using information from satellites (compared to conventional/alternative technologies)?
  - Accuracy of information
  - Reliability
  - Standards of service
  - Cost and affordability
  - Ease of access
  - Use, in terms of required expertise
  - Etc

- Industry drivers & EO
  - What are the major current and future geo-information drivers within the oil and gas sector?
  - To what extent would currently available EO based services be appropriate in responding to these drivers?
Questions for EO Service Sector Delegates

- What are the EO based services being provided today to the oil and gas sector?
- What are the innovative EO products (improved observation capabilities and/or new applications) coming from the new generation of EO sensors, addressing:
  - Status of development
  - Initial results from trials
  - Issues still to be resolved before service is marketable
- What are the main difficulties/bottleneck (if any) in generating, promoting and selling EO based services to the sector, addressing issues like:
  - Knowing who to talk to within the oil and gas companies
  - Understanding their requirements
  - Lack of EO awareness among oil and gas companies on what EO can provide
  - Having the appropriate and cost effective EO based products and services to meet the requirements
  - Having access to EO data under acceptable conditions (standards of provision, reliability, ordering flexibility, licensing terms, etc)
  - Integrating EO products with broader services or integrating EO data with other products such as models.
  - Lack of good communication material showing what EO and the European Value adding sector can provide
- What role should ESA (and other funding bodies) play (if any) in supporting further development of this market sector?
- Is EO data being appropriately priced by satellite owners and resellers in order to exploit properly the opportunities coming from this demand sector?
- What impact are the upcoming Sentinel satellites with its data policy (free and open) going to bring in terms of developing this market?