On-Shore Project - Hatfield Consultants

Project team

This project was driven by the needs of the oil & gas industry with regards to meeting the challenges of **onshore exploration and production, health and safety, and compliance with national and international regulations**. The goal was to understand industry needs and to identify new technologies that support industry across all phases of oil and gas lifecycle. Our team worked closely with the oil & gas industry and key service providers to define expectations and information requirements for geospatial data and services.

Our project team focused on the following emerging areas for oil and gas exploration and production:

- Canada
- Australia
- Indonesia, Malaysia, Brunei
- Kenya
- Papua New Guinea
- Peru
- Poland

Project Team Members

Hatfield Consultants

Provided environmental services to industry and government for 40 years, with more than 2500 projects completed in Canada, Southeast Asia, and Southern Africa. Hatfield helps Oil and Gas clients improve their environmental programs. Hatfield's geographic focus is western and northern Canada, Southeast Asia, and Southern and Western Africa.

Key contacts: Dr. Andy Dean (adean@hatfieldgrouop.com) and Jeff Clark (jclark@hatfieldgroup.com)

Arup

An international engineering consultancy with over 10,000 staff in 90 offices in 37 countries. Served Oil and Gas clients for over 30 years, operating from skills bases in Houston, London and Perth
Projects in more than 160 countries. Wide range of service areas during all phases of project lifecyle in a wide range of geographies and environments.

Key contact: Jason Manning (jason.manning@arup.com)

RPS Group

Consultancy employing over 5,000 professionals with major regional offices in North America, Europe, Middle East, Australia and South East Asia . RPS Group helps clients develop natural energy resources across the complete asset life cycle. Clients include governments, National Oil Companies, International Oil Companies, independents, financial institutions, and companies in the broader energy industry.

Key contacts: Ron Larson (ron.larson@rpsgroup.com) and Paul Nolan (nolanp@rpsgrouop.com)

C-CORE

Not-for-profit research and development corporation that undertakes applied research and development. Multi-disciplinary organization with world-leading capability in Remote Sensing, Ice Engineering and Geotechnical Engineering. Hosts LOOKNorth, a Canadian Centre of Excellence for remote sensing innovation to support northern resource development, and the Centre for Arctic Resource Development (CARD) – a long term R&D initiative in partnership with the oil and gas industry.

Key contacts: Des Power and Paul Adlakha

Space Research Centre

Part of the Polish Academy of Sciences, the Space Research Centre Earth Observation Group is dedicated to satellite image processing and to GIS applications. Involved in several European Copernicus projects and related services. Specialized in land cover and land use classification using object-oriented tools, change detection (optical and SAR data), advanced GIS analysis, programming, internet and mobile applications.

Key contacts: Sebastian Aleksandrowicz (saleksandrowicz@cbk.waw.pl) and Aleksandra Grzegorczyk (agrzegorczyk@cbk.waw.pl)

Description

Hatfield Consultants has now completed our component of this EO4OG project. We welcome comments or questions, and will continue to work with OGEO and ESA to support the Oil and Gas Industry.

EO4OG Onshore Geo-Information Requirements

Hatfield's team has published its EO4OG Onshore Geo-Information Requirements report that documents the challenges posed by conventional and unconventional oil and gas development. The document establishes a standard set of geo-information requirements in seismic planning, surface geology mapping, subsidence monitoring, environmental monitoring, and logistic operations and survey planning. The challenges and geo-information requirements documented are those identified based on consultation with the oil and gas industry and key service providers.

The geo-information requirements were used in the next phase of the EO4OG project to assess existing mature and available EO-based products and services that can address industry requirements. The project evaluated the current gap between requirements and EO capabilities, including technologies that are expected to become operational within five years. The EO4OG project findings were presented at an **EO4OG Industry Workshop** on November 18, 2014, in London.

• The Geo-Information Requirements report is available **here** (link to the PDF document).

EO4OG Geo-Information Challenges

Across the oil and gas project lifecycle and within the range of environments around the globe where the oil and gas industry operates, the challenges faced are generally consistent and ultimately focused on obtaining information needed to reduce environmental, health and safety, and economic risks. Reliable information can help industry make better informed and timelier decisions regarding oil and gas development.

• Hatfield's complete list of industry challenges is available by clicking on the 'Challenges' tab to view the list.

• **Feedback is encouraged and can be submitted for each challenge.** Simply click on a link for a geo-information challenge then add your comments at the bottom of the page. Thanks!

Challenges

The goal of Earth Observation solutions support for the Oil and Gas industry was approached by first defining industry challenges. Based on the typical life-cycle of Oil and Gas projects, five top-level categories were defined to organise and encompass the range of industry information needs to address these challenges. Sub-categories were also been defined to further refine the industry challenges. We encourage comments - thanks! The five top-level categories are:

1. **Seismic Planning**
2. **Surface Geology Mapping**
3. **Subsidence Monitoring**
4. **Environmental Monitoring**
5. **Logistics, Planning and Operations**

The hierarchy of challenges arranged by theme are depicted graphically in a Challenge Tree Diagramme.

Seismic Planning

1.1 Areas of poor coupling

- Hatfield-1101: Identify areas with soft sediments to avoid strong attenuation
- Hatfield-1102: Identify rock-strewn areas to avoid point loading
- Hatfield-1103: Identify soft and hard ground as areas of potentially poor source and receiver coupling
- Hatfield-1104: Identify lake, river and coastal ice grounding status for data quality
- Hatfield-1105: Identify permafrost zone for data analysis

1.2 Identification of adverse terrain for trafficability

- Hatfield-1201: Identify up-to-date general land use patterns to plan access and apply safe setback distances.
- Hatfield-1202: Identify rivers, lakes and wet areas to apply safe setback distances
- Hatfield-1203: Identify areas with soft sediments to plan access and assess hazards
- Hatfield-1204: Assess forest characteristics to plan access and assess hazards
- Hatfield-1205: Identify steep slopes to assess potential constraints to access in forested areas
- Hatfield-1206: Identify steep slopes to assess potential constraints to access
- Hatfield-1207: Identify claypan surfaces to be avoided
- Hatfield-1208: Identify optimal seasonal land use to reduce permitting costs - in particular commercial and subsistance farming practices.
- Hatfield-1209: Identify land parcel boundaries for impact compensation
- Hatfield-1210: Identify soft ground to reduce environmental impacts
- Hatfield-1211: Planning bridging through a tropical forest
- Hatfield-1212: Identify sabkahs / salt lake areas

- Hatfield-1213: Identify ice thickness and status for travel safety
- Hatfield-1214: Identify restricted areas that must be avoided
- Hatfield-1215: Identify UXO related hazards

1.3 Identification of environmentally sensitive areas

- Hatfield-1302: Assess and map forest fire risk and provide situational awareness of fire occurrence.
- Hatfield-1301: Identify sensitive habitat to minimise and manage impacts of activities
- Hatfield-1303: Planning heliports, camps, and drop zones in forested areas

Surface Geology Mapping

2.1 Mapping Geological features

- Hatfield-2102: Understanding hydrogeology
- Hatfield-2101: Lineament mapping

2.2 Structural interpretation

- Hatfield-2201: Identify geological structure through landform

2.3 Lithological discrimination

- Hatfield-2301: Identify discreet lithology

2.4 Terrain evaluation and Geomorphology characterization

- Hatfield-2401: Identify geohazards and landscape change rates

2.5 Engineering geological evaluation

- Hatfield-2501: Characterization of surface/near-surface structural geological properties for infrastructure planning
- Hatfield-2503: Assessment of duricrusts and rock excavability
- Hatfield-2504: Identification of slope instability
- Hatfield-2505: Identify geophysical properties of the subsurface
- Hatfield-2502: Identification of problem soils

Subsidence Monitoring

3.1 Land motion relating to fault lines or other causes

- Hatfield-3101: Baseline and monitoring of areas with active faults and subsidence

3.2 Infrastructure monitoring

- Hatfield-3201: Assessment of infrastructure placement and effects to the surrounding environment
- Hatfield-3202: Monitoring pipeline stability in discontinuous permafrost
- Hatfield-3203: Management of surface impacts due to ground deformation from operations
- Hatfield-3204: Monitor stability of surface reservoirs such as settling ponds

3.3 Reservoir management

- Hatfield-3301: Monitoring carbon capture storage reservoir leaks
- Hatfield-3302: Assessing ground deformation to support enhanced recovery operations
- Hatfield-3303: Monitoring effectiveness of steam assisted gravity drainage (SAGD) operations

Environmental Monitoring

4.1 Baseline historic mapping of environment and ecosystems

- Hatfield-4101: Assess fragmentation of natural habitat and cumulative disturbance
- Hatfield-4102: Land cover and land use for environmental baseline and/or impact assessment
- Hatfield-4103: Social baseline information to support compensation and/or resettlement
- Hatfield-4104: Mapping of forest extent and quality for environmental baseline and/or impact assessment
- Hatfield-4105: Identification of cultural heritage and archeology assessment
- Hatfield-4106: Air quality monitoring on an airshed and site specific basis
- Hatfield-4107: Detection of unexpected methane leakage on a regional basis
- Hatfield-4108: Assess habitat quality for key species for environmental baseline and/or impact assessment
- Hatfield-4109: Understand temporal and spatial extent of usable fish habitat to maintain acceptable levels

4.2 Continuous monitoring of changes throughout the lifecycle

- Hatfield-4201: Remediation and reclamation monitoring
- Hatfield-4202: Map coastal habitat and built environment/settlement sensitivity to strengthen tactical oil spill response and preparedness
- Hatfield-4203: Monitor "induced access" corridors to assess indirect impacts or effects as a result of project development.
- Hatfield-4204: Monitoring local communities and land use in the project area
- Hatfield-4205: Remediation monitoring related to agriculture impacts
- Hatfield-4206: Monitoring lake and wetland levels and recharge rates following water use for exploration/operations
- Hatfield-4207: Understanding and predicting changes in hydrological processes
- Hatfield-4208: Identification of groundwater table to reduce potential issues during seismic activity
- Hatfield-4209: Monitor onshore pipeline right of way (RoW) to evaluate successions of vegetation communities

4.3 Natural Hazard Risk Analysis

- Hatfield-4301: Map and monitor induced seismic hazards
- Hatfield-4302: Floodplain mapping and understanding flood extent and flood frequency.
- Hatfield-4303: Understand extent of lakes and wet areas for hazard assessment
- Hatfield-4304: Situational awareness information on water levels and lake extents and potential flooding
- Hatfield-4305: Monitoring air quality related to seasonal fires
- Hatfield-4306: Assess and manage forest fire risk to facilities and infrastructure
- Hatfield-4307: Coastal elevation data for tsunami risk analysis

Logistics, Planning and Operations

5.1 Baseline mapping of terrain and infrastructure

- Hatfield-5101: Obtaining baseline land use for pipeline route planning
- Hatfield-5102: Assess potential project site for historical use
- Hatfield-5103: Identify subsurface infrastructure for planning of pipeline crossings
- Hatfield-5104: Baseline elevation data for project planning and design

5.2 Support to surveying crews for planning surveys and H&S

- Hatfield-5201: Monitoring assets for risk management

5.3 Facility siting, pipeline routing and roads development

- Hatfield-5301: Planning and assessing borrow pits as source of aggregate material
- Hatfield-5302: Terrain stability for route planning
- Hatfield-5303: Mapping land cover trends over the project area
- Hatfield-5304: Baseline imagery for project planning and design
- Hatfield-5305: Identify existing linear routes for co-location of pipelines in wilderness areas
- Hatfield-5306: Assessing terrain stability for infrastructure planning in permafrost environments
- Hatfield-5307: Assess coastal environment for infrastructure planning

5.4 Monitoring of assets

- Hatfield-5401: Monitor pipeline corridor hazards
- Hatfield-5404: Monitoring of pipeline right of way for third party mechanical damage
- Hatfield-5405: Monitor potential pipeline corridor encroachment by communities
- Hatfield-5402: Detection of oil contamination and oil seeps
- Pipeline Encroachment Monitoring

Meetings

Participants to discussions

Meeting	Date	Location	Documents	Notes
Kick-off	7th March 2014	ESA, Frascati, Rome		
Progress Review	KO+2 months			
Oil & Gas Industry Workshop	18th November 2014	Arup Conference Facility, 13 Fitzroy Street London W1T 4BQ	EO4OG Workshop summary report (final).pdf	The workshop was open to OGEO members and other selected partners who participated in the EO4OG project.

Documents

This is the area to show published documents for review or for use. Documents in preparation by the team should be kept on the project team page.

Document	Source	Date	Description
Kick-off Presentation	Hatfield	7th March 2014	Outline of the project and planning
Project Brochure	Hatfield & OTM	7 April 2014	Project overview
ESA6503_Deliverable 1_information_Requirements_v2_OGEO.pdf	Hatfield	31 July 2014	EO4OG D1 - Geo-Information Requirements
Hatfield Challenge Tree.pdf	Hatfield	8 January 2015	Diagram of Oil and Gas EO Challenges
ESA6503_Deliverable 2.1_Current_EO_Capabilities_and_Use 20150130_v2.pdf	Hatfield	30 January 2015	EO4OG D2.1 - EO Capabilities Report
ESA6503_Deliverable 2.2_Gap-Analysis-Synthesis-Report_v1.0.pdf	Hatfield	19 December 2014	EO4OG D2.2 - Gap Analysis Report
ESA6503_Deliverable 3.1_Roadmap-Report_v1.pdf	Hatfield	23 January 2015	EO4OG D3 - Roadmap for Development