EO4OG User Consultation Workshop
Stantec
St. John's, NL, Canada
August 28, 2014

AGENDA

THURSDAY, AUGUST 28		
12:30	**Welcome and Introductions**	E. Tracy
12:45	**Project Overview** Introduction to EO4OG	T. Puestow
13:00	**Review of Environmental Information Requirements** Confirm thematic content/parameters Confirm importance of each requirement Identify requirements not captured	F. Wiese, roundtable discussion
16:30	**Adjourn**	

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ACTIONS

Action		Responsibility	Due Date
SW_1	Verify importance of subtidal/near-shore pipeline integrity for all life cycle stages	T. McKeever	Sep. 26
SW_2	Circulate invitation to workshop on November 18	T. Puestow	Sep. 5
SW_3	Update requirements document based on workshop discussions	T. Puestow	Sep. 12
SW_4	Circulate minutes and updated requirements document	T. Puestow	Sep. 12

SUMMARY OF DISCUSSION

Introduction

- See presentation in Appendix A
- Review of requirements as captured in excel table (see Appendix B)
- Initial information gathering focused on separate requirements each geographic area of interest, together with general requirements applicable to all areas
- Several requirements appear in more than one geographic area and can therefore be combined (see Appendix C and D)

General Requirements

- Fish and fish habitat
    - Habitat includes bottom type for shallow areas
    - Need to have reference area(s) to estimate uniqueness/significance
    - Looking for any change in fish habitat
    - EO can be used to map bottom type in clear, shallow water (not applicable to deep water)
    - Seasonal changes of habitat parameters can be important (e.g. temperature)
    - Importance should be 4 in all life cycle stages

- Waste management
    - Plumes/slicks due to discharge of regular waste (kitchen waste, grey water, black water, etc.)
    - All operations have waste management protocol
    - Waste protocols cover different products in different jurisdictions

- Site surveys for geohazards
    - Currently monitored/mapped using side-scan sonar

    - Geohazards include earthquakes, mass movement, unexploded ordnance etc.
    - Importance
        - Pre: 3
        - Exp: 4
        - Dev: 4
        - Prod: 0
        - Decom: 1
    - Technology urgency
        - If feasible, large area coverage with satellite data would be very useful
        - Conventional seabed monitoring is very costly; if cost-competitive alternatives would be available, they would be rapidly implemented
    - Spatial resolution
        - Up to 1 m for unexploded ordnance
        - Different resolutions would apply to different stages of development

- Commercial shipping
    - Includes container vessels etc. (i.e. does not include O/G-related shipping)
    - Accurate shipping data is difficult to get
    - Most useful at pre-licensing stage (e.g. verify if AOI is located on shipping route)
    - Shipping/transit is a category in environmental impact assessments (EIA)
    - Knowledge of ship traffic especially relevant for confined areas
    - In international waters, knowledge of fishing vessel locations is also important (e.g. in case of claim against O/G development, use of regional areas)
        - Fishing is captured as a separate category in this analysis

- Natural and other existing oil seeps
    - Also includes newly appearing seeps
    - Key issue is differentiating between natural and man-made seeps
        - Seeps from old ship wrecks would be considered “natural” in this context
    - Being able to visualize water column from bottom to surface is very important

- Commercial and recreational fisheries
    - Detection and monitoring of fishing vessels to safeguard against liability claims
    - Identifying small boats is a challenge

- Importance
  - Pre: 3
  - Exp:3
  - Dev:2
  - Prod:2
  - Decom: 2
  - In operational rather than environmental context (e.g. during seismic activities), importance would be “4”

Ireland

- Monitoring of landfall site recovery and coastal vegetation
  - Coastline vulnerability; change detection
  - Initial impact and recovery time
  - Parameters of interest:
    - Shallow bottom vegetation and substrate
    - Terrestrial and intertidal/subtidal, two parameters
  - Baseline information is most critical
  - Need to interface with oil spill trajectory models
  - Need to cover sufficiently large area
  - General requirement, not specific to Ireland
  - Importance
    - Pre: 3
    - Exp:1
    - Dev:1
    - Prod:2
    - Decom: 1

- Submarine landslides and seabed stability
  - Captured above

- Shipwrecks and other archaeological value areas
  - Unexploded ordnance is a concern
  - Major issue in the Mediterranean

- Detection and monitoring of cement, cuttings, mud, oil discharge
  - Validation of models is tricky
  - Surface current data will be helpful (cross-reference to metocean)
  - Operational discharges (at depth/surface)
  - Accidental discharges (at depth/surface)
  - Authorized surface discharges can be used for validation
  - High-resolution imagery can be used to detect pollutant plumes and slicks
  - Importance at pre-licensing stage is “1” as modelling happens at this stage rather than monitoring

- Distribution and abundance of marine mammals
    - Consistently identified as gap in strategic environmental assessments
    - Seismic activities, noise and spills affect mammals
    - Importance is “4” for all life cycle stages
    - Applicable to all areas
    - Timeliness: hourly updates required in case of spills or seismic activity

- Distribution and abundance of sea birds
    - Includes interaction between birds and light, flare and ships
    - Importance is “3” for all life cycle stages
    - Coverage is regional and includes shipping route

Eastern Mediterranean

- Presence and abundance of deep water fauna
    - Parameters of interest include bottom type and topography
    - Importance is “3” form decommissioning, “4” for all other stages
    - Technology urgency is short-term, the sooner the better
    - Data coverage is regional

- Monitoring of operational and accidental discharges of oil and chemicals
    - Captured above

- Geophysical mapping etc.
    - Captured above

- Scientific independence in environmental monitoring of accidental spills
    - Often no independent verification
    - Due diligence tool
    - Everybody having the same information would be good as quality check
    - Geographic context: regional bias, lack of transparency in environmental monitoring and reporting

- Security and safety
    - Operational rather than environmental requirement
    - Issues include piracy, unauthorized access to installations, encroachment
    - Geographic context: importance depends on geography and political context
    - Update frequency and temporal resolution: hourly to daily

- Geophysical mapping etc.
    - Captured above

Falkland Islands

- Distribution and abundance of marine mammals
    - Captured above

- Monitoring of operational and accidental discharges of oil and chemicals
    - Captured above

- Monitoring of phytoplankton
    - Broad context is impact of ocean productivity on marine organisms
    - Satellite imagery is routinely used for ocean colour applications
    - Data from SEAWIFS (now defunct) has not been widely used by O/G industry
    - In-situ measurement sets context for timing of primary production; goal is understanding the integrated productivity throughout water column
    - Possible to correlate wastewater discharge with chlorophyll-a, interface different
    - Importance is "3" for all life cycle stages, except "4" for exp., dev. and prod. in the event of a spill
    - Geographic context: applies to all areas
    - Temporal resolution: needs to be more frequently than daily during spill event or application of dispersant
    - Spatial resolution: 100m for coastal areas, 1 km in the open ocean

- Monitoring of waste management practices
    - Captured above

- Information on the intertidal and shallow marine environment
    - Captured above

- Distribution and abundance of sea bird populations
    - Captured above

South China Sea

- Monitoring of chlorophyll-a
    - Captured above

- Monitoring of sea surface height (SSH)
    - Parameter used to assess primary productivity, which affects species abundance
    - Primary productivity is also assessed using sea surface temperature, chlorophyll concentration
    - Effects on offshore structures (e.g. vibrations near risers)
    - Importance

        - Pre: 3
        - Exp: 4
        - Dev: 4
        - Prod: 3
        - Decom: 3

- Coastal resource mapping of mangroves, coral reefs, wetlands and sandbanks
    - No change to document required

- Monitor coastal and offshore oil pollution etc.
    - Captured above

- Monitor coastal sediment dynamics, estuarine fronts and land-ocean interactions
    - More important/necessary if coastal infrastructure is involved: equipment, terminal
    - Does not include bottom; discharges from land, siltation, coastal erosion (link with water quality/turbidity)
    - Currently achieved using modelling
    - Satellite images used to identify fronts, especially off-shore
    - Importance
        - Pre: 2
        - Exp: 2
        - Dev: 2
        - Prod: 2
        - Decom: 0
    - Update frequency: hourly to daily

- Timing, location and extent of harmful algal blooms
    - Covered above

- Index of seasonal and inter-annual variations in summer upwelling
    - Indicates high productivity
    - Provides context
    - Can be achieved via SSH or SST or ocean colour
    - EO can provide context, time series, help explain what is observed
    - EO not really widely used, but if something happens, people would come looking for EO-derived information
    - Importance: pre-license is “2”, “1” for all other stages
    - Spatial resolution: 100 m to 1 km

- Provide near real-time data products derived from satellite images and monitoring stations at coral reef areas
    - Captured above

Myanmar

- Monitor land-based and ocean-based pollution
    - Capture above

- Presence, extent and health of coastal and marine habitats
    - Captured above

- SSH anomalies and chlorophyll concentration
    - Captured above

Morocco/Western Sahara

- Monitor coastal upwelling
    - Captured above

- SSH anomalies and chlorophyll concentration
    - Captured above

- Distribution and abundance of seabird populations
    - Captured above

- Document extant of submarine landslides
    - Captured above

- Monitoring of pollution arising from oil spillage and gas flaring
    - Captured above

Other Parameters of Interest

- Ice is key operational parameter for O/G industry
    - EO4OG precursor activity addresses the generation of ice charting guidelines for the O/G sector
        - Phase 1 has been completed under ESA funding
        - Phase 2 is being considered for funding by OGP
    - Ice edge is information is important from environmental perspective
        - Primary productivity
        - Mammal activity

- Asset integrity
    - Pipeline to shore, annual survey would be helpful to assess stress on near-shore pipelines
    - Pipelines in subtidal areas can be subjected to high current; would be helpful to monitor more than every few years
    - **ACTION:** T. McKeever to verify importance for all life cycle stages
    - Estimating fouling rates on structures would be heloful (e.g. via growth in girth)

- Bottom type
    - Proportion of organic matter
    - Assessment of benthic health
    - Redox potential

- Methane in sediment
    - Current approaches use box core over sediment, capture water directly above to analyze for methane

- Invasive species
    - Monitor ballast water discharges (e.g. via temperature as main difference to surrounding waters)

Next Steps

- Existing requirements document will be updated with findings of this workshop
    - **ACTION:** Thomas to circulate updated document
- Project findings to date, including industry requirement, EO capabilities and gaps will be presented at EO4OG workshop to be held on November 18 in London, UK
    - **ACTION:** Thomas to circulate formal workshop invitation
    - Workshop output will include roadmap for the developments of formal guidelines for using EO within the O/G industry

APPENDIX A: EO4OG PROJECT OVERVIEW

Earth Observation for Oil and Gas (EO4OG) - Offshore -

Review of Information Requirements
August 28, 2014

Stantec, St. John's, NL

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Context

- Collaboration between European Space Agency (ESA) and OGP
  - Facilitate the use of satellite remote sensing by the oil and gas industry
  - Generation of EO sub-committee of standing Geomatics Committee in 2012
- Goal is development of OGP guidelines/best practices for use of earth observation (EO)

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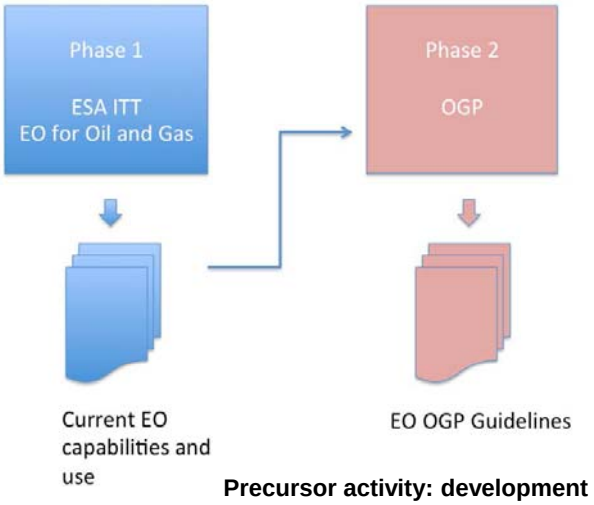
Context

- 2 onshore projects
- 2 offshore projects
- Mar. '14 – Jan. '15
- Project life cycle stages
  - Pre-license
  - Exploration
  - Development
  - Production
  - Decommissioning



Precursor activity: development of ice charting guidelines

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Project Overview

- Key activities
  - Capture geo-information requirements
  - Describe EO capacities (service/product specifications, case studies)
  - Identify gaps
    - No existing EO capacity
    - EO capacity exists but is under-utilized
  - Stakeholder workshop, Nov. 18 at Arup, London UK
    - Review results of all teams
    - Design roadmap for development of guidelines

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Desired Outcomes for Today

1. Confirm thematic content/parameters (incl. resolution, MMU, update frequency)
2. Confirm importance of each requirement in each life cycle stage
3. Describe level to which is EO being used today, reasons for under-utilization, if applicable
    1. Identify drivers (e.g. safety, environment, climate change)

APPENDIX B: INITIAL ENVIRONMENTAL INFORMATION REQUIREMENTS

IRELAND	
Challenge ID	OFF2.1
Title	Monitoring of landfall site recovery in terms of coastal vegetation. Includes initial characterization and vulnerability of coastline and nearshore environment
Challenge originator: interviewed company	Enterprise Energy Ireland Ltd
General Description	
What data/products do you use?	Data currently collected through shoreline surveys, but satellite imagery has been used to help with broad classification
When do you use this kind of dataset?	when offshore produced in transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis.
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of coastal vegetation and coastal substrate
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.07 - Ireland
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High

Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

IRELAND	
Challenge ID	OFF2.2
Title	Seismic related submarine landslides and seabed instability,. Detection, aging of submarine slides
Challenge originator: interviewed company	ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources
General Description	
What data/products do you use?	Sidescan, multibeam sonar bathymetry maps if available
When do you use this kind of dataset?	During seismic surveys to determine susceptibility of substrate to seismic activities and gain information on substrate stability
What are your actual limitations and do you have a work around?	This data is currently not available unless the area has seen recent multibeam mapping
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor
Challenge classification	
Pre license	3
Exp.	3
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	OFF.REG.07 - Ireland
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off

Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

IRELAND	
Challenge ID	OFF2.3
Title	Shipwrecks and other archaeological value areas
Challenge originator: interviewed company	Enterprise Energy Ireland Ltd and ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources
General Description	
What data/products do you use?	Historic database showing location of shipwrecks and map of documented archeological sites where available, ROV survey data
When do you use this kind of dataset?	Impact assessments, seismic surveys
What are your actual limitations and do you have a work around?	Use the aforementioned databases but they are limited to knowledge from areas that have previously been surveyed for other purposes
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor
Challenge classification	
Pre license	4
Exp.	4
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	OFF.REG.07 - Ireland
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)

Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

IRELAND	
Challenge ID	OFF2.4
Title	Detection and monitoring of cement, cuttings, mud, oil discharge (dispersal rates, trajectories)
Challenge originator: interviewed company	ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery, drifter buoys, in situ monitoring at platforms
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather limitations of current technology
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.07 - Ireland

Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

IRELAND	
Challenge ID	OFF2.5
Title	Distribution and abundance of marine mammals
Challenge originator: interviewed company	OSPAR Commission. 2009 document. Assessment. ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources
General Description	
What data/products do you use?	Abundance and distribution data from ship-based or aerial surveys
When do you use this kind of dataset?	During seismic and drilling activities to determine impacts of noise on marine mammals and during discharges to determine vulnerability and impact
What are your actual limitations and do you have a work around?	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability, seasonal data and weather dependant
Needs and expectations on EO data	High resolution imagery that would allow counting and possibly identifying marine mammals when at the surface. Could be visual or IR
Challenge classification	
Pre license	3
Exp.	3

Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.07 - Ireland
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys, improved project planning
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important except for spill
Existing standards	

IRELAND	
Challenge ID	OFF2.6
Title	Distribution and abundance of seabirds and interaction with light
Challenge originator: interviewed company	OSPAR Commission. 2009 document. Assessment of impacts of offshore oil and gas activities in the North-East Atlantic
General Description	
What data/products do you use?	Direct observations of bird-light/flare interactions
When do you use this kind of dataset?	During exploratory drilling and production when lighted platforms are out there and/or there is flaring
What are your actual limitations and do you have a work around?	Bird mortality due to light and flares is sporadic and dependent on time of year (migration periods) and weather. Assessment is difficult for those reasons, requires constant monitoring, but can affect large numbers of birds (up to 10% of migrating birds in North Sea)
Needs and expectations on EO data	Unclear - requires high temporal spatial resolution and cloud penetration
Challenge classification	
Pre license	

Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.07 - Ireland
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based surveys
Technology Urgency	Long Term (10+ years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	<1m
Data quality	High
Data Coverage and extent	In vicinity of drill site
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.7
Title	Information on presence and abundance of deep water fauna, coral and other vulnerable seabed habitat
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2011
General Description	
What data/products do you use?	ROV surveys and multibeam
When do you use this kind of dataset?	During environmental impact assessments (EIAs), oil spill response, environmental damage assessment
What are your actual limitations and do you have a work around?	ROV and multibeam surveys are expensive and time consuming
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor and species and/or habitat identification
Challenge classification	
Pre license	4
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	Yearly, for monitoring of change, but hourly during oil spills
Temporal resolution	Seasonal or yearly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	In vicinity of drill site and along possible submarine pipelines for monitoring, but regional for spills
Example format	High resolution image

Timeliness	Reference data - timeliness not important, near real time for spill
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.8
Title	Monitoring of operational and accidental discharges of oil and chemicals resulting from routine operations
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2012
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery, in situ monitoring, drifter buoys
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather dependant
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m

Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.9
Title	Geophysical mapping of the upper sub-surface to map the type of the upper sub-surface (sand, mud, rock) and to detect man made features on the seafloor
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2013
General Description	
What data/products do you use?	Historic database showing location of shipwrecks, maps of documented archeological sites where available, ROV survey data, multibeam data, sediment grabs
When do you use this kind of dataset?	Impact assessments, seismic surveys, drilling
What are your actual limitations and do you have a work around?	Use the aforementioned databases but they are limited to knowledge from areas that have previously been surveyed for other purposes
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor
Challenge classification	
Pre license	4
Exp.	4
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler

Technology Urgency	Long Term (10+ years)
Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.10
Title	Scientific independence in environmental monitoring of accidental spills, drill cuttings, atmospheric emissions, light and noise
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2014
General Description	
What data/products do you use?	Aerial surveillance, self-reporting
When do you use this kind of dataset?	Any time once exploratory drilling commences
What are your actual limitations and do you have a work around?	Public confidence in self-reporting is low, aerial surveillance or other types of independent monitoring are few, expensive or non-existent
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean

Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Due diligence tool
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily
Temporal resolution	Daily
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.11
Title	Security and safety
Challenge originator: interviewed company	U.S. Energy Information Administration. Easter Mediterranean Region. Overview of oil and natural gas in the Eastern Mediterranean region. Last updated August 12, 2013.
General Description	
What data/products do you use?	Aerial surveillance, coast guard, satellite imagery
When do you use this kind of dataset?	Any time once exploratory drilling commences
What are your actual limitations and do you have a work around?	Physical security of offshore operations due to political instability is a concern and could cause environmental damage in the area
Needs and expectations on EO data	High resolution imagery capable of detecting unauthorized shipping and other activity in the vicinity of offshore operations
Challenge classification	
Pre license	
Exp.	3
Dev.	3
Prod.	3

Decom.	3
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily
Temporal resolution	Daily
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Eastern Mediterranean	
Challenge ID	OFF2.12
Title	Document the extent (area, volume) of submarine landslides and calculate the probability of their occurrence
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2016
General Description	
What data/products do you use?	Sidescan, multibeam sonar bathymetry maps if available
When do you use this kind of dataset?	During seismic surveys to determine susceptibility of substrate to seismic activities and gain information on substrate stability
What are your actual limitations and do you have a work around?	This data is currently not available unless the area has seen recent multibeam mapping
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor
Challenge classification	

Pre license	3
Exp.	3
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	OFF.REG.05 - Eastern Mediterranean
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Falkland Islands	
Challenge ID	OFF2.13
Title	Distribution and abundance of marine mammals
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC.
General Description	
What data/products do you use?	Abundance and distribution data from ship-based or aerial surveys
When do you use this kind of dataset?	During seismic and drilling activities to determine impacts of noise on marine mammals and during discharges to determine vulnerability and impact
What are your actual limitations and do you have a work around?	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability, seasonal data and weather dependant
Needs and expectations on EO data	High resolution imagery that would allow counting and possibly identifying marine mammals when at the surface. Could be visual or IR
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys, improved project planning
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image

Timeliness	Reference data - timeliness not important except for spill
Existing standards	

Falkland Islands	
Challenge ID	OFF2.14
Title	Monitoring of operational and accidental discharges of oil and chemicals resulting from routine operations
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC.
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery, in situ monitoring, drifter buoys
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather dependant
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High

Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Falkland Islands	
Challenge ID	OFF2.15
Title	Monitoring of phytoplankton
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC.
General Description	
What data/products do you use?	Ship-based sampling (plankton tows), MODIS and SeaWifs ocean colour
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	EEM data is generally collected around production platforms without a broader spatial or temporal environmental context. If changes in productivity or biota are detected around the site, it may not be clear whether it is a human induced effect or if it reflects an independent regional shift in ocean conditions. Data is sparse and SeaWifs is offline
Needs and expectations on EO data	Ocean colour imagery
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)

Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month
Existing standards	

Falkland Islands	
Challenge ID	OFF2.16
Title	Monitoring of waste management practices
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC.
General Description	
What data/products do you use?	Self-reporting , ship-based water sampling, aerial surveys, ship to shore waste transfer
When do you use this kind of dataset?	Environmental and compliance monitoring
What are your actual limitations and do you have a work around?	Self-reporting is not trusted, other sampling is infrequent and expensive
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking plumes of discharged materials
Challenge classification	
Pre license	
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Ocean

Activity impacted/concerned	Public trust, compliance, environmental liability
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	District area, vessel route and onshore site
Example format	Mid-high resolution image
Timeliness	As close to real-time as possible
Existing standards	

Falkland Islands	
Challenge ID	OFF2.17
Title	Information on the intertidal and shallow marine environment
Challenge originator: interviewed company	Falkland islands Biodiversity Strategy: 2008 – 2018. 2008. Falkland Islands Government: Environmental Planning Department. Available at: http://www.epd.gov.fk/wp-content/uploads/BiodiversityStrategy09.pdf
General Description	
What data/products do you use?	Data currently collected through shoreline and small boat surveys, but satellite imagery has been used to help with broad classification
When do you use this kind of dataset?	When offshore produced in transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of inter and sub-tidal environment
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1

Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Falkland Islands	
Challenge ID	OFF2.18
Title	Distribution and abundance of seabird populations
Challenge originator: interviewed company	Woods, R., R. Ingham, & A. Brown. 2009. Falkland Islands (Malvinas). Pp 205 – 212 in C. Devenish, D. F. Díaz Fernández, R. P. Clay, I. Davidson & I. Yépez Zabala Eds. *Important Bird Areas Americas - Priority sites for biodiversity conservation.* Quito, Ecuador: BirdLife International (BirdLife Conservation Series No. 16).
General Description	
What data/products do you use?	Direct observations of birds using ship-based and/or aerial surveys
When do you use this kind of dataset?	During seismic and drilling activities to determine impacts of light on seabirds and during discharges to determine vulnerability and impact
What are your actual limitations and do you have a work around?	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability
Needs and expectations on EO data	High resolution imagery that would allow counting and possibly identifying seabirds. Could be visual or IR
Challenge classification	
Pre license	3
Exp.	3

Dev.	3
Prod.	3
Decom.	
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

South China Sea	
Challenge ID	OFF2.19
Title	Monitoring of chlorophyll a
Challenge originator: interviewed company	DanLing Tang, Hiroshi Kawamura, Tran Van Dien, MingAn Lee. 2004. *Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea.* Marine Ecology Progress Series. Vol. 268: 31-41.
General Description	
What data/products do you use?	Ship-based sampling (plankton tows), MODIS and SeaWifs ocean colour
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	EEM data is generally collected around production platforms without a broader spatial environmental context. If changes in productivity or biota are detected around the site, it may not be clear whether it is a human induced effect or if it reflects an independent regional shift in ocean conditions. Data is sparse and SeaWifs is offline
Needs and expectations on EO data	Ocean colour imagery
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m

Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month
Existing standards	

South China Sea	
Challenge ID	OFF2.20
Title	Monitoring of Sea Surface Height (SSH)
Challenge originator: interviewed company	DanLing Tang, Hiroshi Kawamura, Tran Van Dien, MingAn Lee. 2004. *Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea.* Marine Ecology Progress Series. Vol. 268: 31-41.
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	Environmental assessment and effects monitoring, characterizations of currents (eddies) and possible foraging hotspots for birds and mammals
What are your actual limitations and do you have a work around?	Ship-based surveys are expensive and there are always safety concern when putting people in the field. Data is often seasonally limited due to weather conditions
Needs and expectations on EO data	Satellite imagery to monitor eddy activity and impacts on productivity and species distribution
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability, reduction of HSE risks
Technology Urgency	Immediately (0-2 years)

Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Within a month
Existing standards	

South China Sea	
Challenge ID	OFF2.21
Title	Coastal resource mapping of mangroves, coral reefs, wetlands, and sandbanks
Challenge originator: interviewed company	Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002.
General Description	
What data/products do you use?	Data currently collected through shoreline and small boat surveys, but satellite imagery has been used to help with broad classification
When do you use this kind of dataset?	When offshore produced in transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis.
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of inter and sub-tidal and nearshore environment
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1

Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

South China Sea	
Challenge ID	OFF2.22
Title	Monitor coastal and offshore oil pollution to assess the impact of pollution on the marine environment
Challenge originator: interviewed company	Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002.; UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden.
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather dependant

Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

South China Sea	
Challenge ID	OFF2.23
Title	Monitor coastal sediment dynamics, estuarine fronts, and land–ocean interactions.
Challenge originator: interviewed company	Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002.
General Description	

What data/products do you use?	Models, aerial surveillance, satellite imagery
When do you use this kind of dataset?	To monitor coastal erosion, freshwater run-off and other dynamics that can influence currents and sedimentation in the nearshore environment
What are your actual limitations and do you have a work around?	Acquiring data of this type is difficult and expensive, requires modeling and in-situ data validation
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking plumes and oceanic fronts
Challenge classification	
Pre license	
Exp.	1
Dev.	1
Prod.	1
Decom.	
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

South China Sea	
Challenge ID	OFF2.24
Title	Timing, location, and extent of Harmful Algal Blooms (HABs)

Challenge originator: interviewed company	Jing Yu, Dan-Ling Tang, Im-Sang Oh, and Li-Jun Yao. 2007. *Response of Harmful Algal Blooms to Environmental Changes in Daya Bay, China*. Terr. Atmos. Ocean. Sci., Vol. 18, No. 5, 1011-1027.
General Description	
What data/products do you use?	Ship-based sampling (plankton tows), MODIS and SeaWifs ocean colour
When do you use this kind of dataset?	To determine timing and magnitude of HABs in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	EEM data is generally collected around production platforms without a broader spatial environmental context. If changes in productivity or biota are detected around the site, it may not be clear whether it is a human induced effect or if it reflects an independent regional shift in ocean conditions. Data is sparse and SeaWifs is offline
Needs and expectations on EO data	Ocean colour imagery
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month
Existing standards	

South China Sea	
Challenge ID	OFF2.25
Title	Index of seasonal and interannual variations of summer upwelling
Challenge originator: interviewed company	Xie, S.-P., Q. Xie, D. Wang, and W. T. Liu. 2003. *Summer upwelling in the South China Sea and its role in regional climate variations.* J. Geophys. Res., Vol. 108(3261), doi:10.1029/2003JC001867, C8.
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	To detect timing and extent of upwelling would require extensive ship surveys which are time consuming and expensive
Needs and expectations on EO data	Satellite imagery to detect upwelling features such a productivity, SSH, temperature
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Weekly-seasonal
Temporal resolution	Weekly-seasonal
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery

Timeliness	Within a month
Existing standards	

South China Sea	
Challenge ID	OFF2.26
Title	Provide near real-time data products derived from satellite images and monitoring stations at coral reef areas
Challenge originator: interviewed company	UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden.
General Description	
What data/products do you use?	Data currently collected through small boat and dive surveys, but satellite imagery has been used to help with broad identification of reefs
When do you use this kind of dataset?	When offshore products are transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of coral reefs
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.06 - Falklands
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off for initial assessment and monthly for monitoring purposes

Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	high
Data Coverage and extent	District area, vessel route and onshore site
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Myanmar	
Challenge ID	OFF2.27
Title	Monitor land-based and ocean-based pollution
Challenge originator: interviewed company	BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-13; Ramamurthy, V.D. and J. Sreenivasan. 1983. Sources of Oil Pollution along the Indian Coasts of Arabian Sea, Bay of Bengal Indian Ocean, and its Impact on Commercial Fisheries. Anales Del Instituto de Ciencias del Mar Y Limnología.
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather dependant
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.10 - Myanmar
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image

Timeliness	As close to real-time as possible
Existing standards	

Myanmar	
Challenge ID	OFF2.28
Title	Presence, extent and health of coastal and marine habitats, including coral reefs, seagrass beds, mangroves, sandy beaches and mudflats
Challenge originator: interviewed company	BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-14
General Description	
What data/products do you use?	Data currently collected through shoreline and small boat surveys, but satellite imagery has been used to help with broad classification
When do you use this kind of dataset?	When offshore produced in transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of inter and sub-tidal and nearshore environment
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.10 - Myanmar
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High

Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Myanmar	
Challenge ID	OFF2.29
Title	Sea Surface Height (SSH) anomalies and chlorophyll concentration
Challenge originator: interviewed company	Patidar, B. 2006. *Application of remote sensing and GIS in the analysis of environment of Bay of Bengal*. MSc., Dissertation, Barkatullah University, Bhopal(MP)- National Institute of Oceanography, Goa, India
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	To collect all these environmental data would require extensive ship surveys which are time consuming and expensive
Needs and expectations on EO data	Satellite imagery to detect features such a productivity (colour), SSH, temperature, winds, waves, fronts, etc.
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.10 - Myanmar
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability, safety
Technology Urgency	Immediately (0-2 years)
Information requirements	

Update frequency	Daily-seasonal
Temporal resolution	Daily-seasonal
Spatial resolution	1-100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	As close to real-time as possible
Existing standards	

Morocco / Western Sahara	
Challenge ID	OFF2.30
Title	Monitor Coastal Upwelling
Challenge originator: interviewed company	Pelegrí, J.L. et al. 2005. *Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter*. Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: http://www.sciencedirect.com/science/article/pii/S0924796304002027
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	To detect timing and extent of upwelling would require extensive ship surveys which are time consuming and expensive
Needs and expectations on EO data	Satellite imagery to detect upwelling features such a productivity, SSH, temperature
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	OFF.REG.08 - Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Weekly-seasonal
Temporal resolution	Seasonal
Spatial resolution	100m

Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month
Existing standards	

Morocco / Western Sahara	
Challenge ID	OFF2.31
Title	Sea Surface Height (SSH) anomalies and chlorophyll concentration
Challenge originator: interviewed company	Pelegrí, J.L. et al. 2005. *Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter*. Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: http://www.sciencedirect.com/science/article/pii/S0924796304002027
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	To collect all these environmental data would require extensive ship surveys which are time consuming and expensive
Needs and expectations on EO data	Satellite imagery to detect features such a productivity (colour), SSH, temperature, winds, waves, fronts, etc.
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.08 - Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability, safety

Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily-seasonal
Temporal resolution	Daily-seasonal
Spatial resolution	1-100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	As close to real-time as possible
Existing standards	

Morocco / Western Sahara	
Challenge ID	OFF2.32
Title	Distribution and abundance of seabird populations
Challenge originator: interviewed company	Camphuysen CJ. & J. van der Meer. 2010. *Wintering seabirds in West Africa: foraging hotspots off Western Sahara and Mauritania driven by upwelling and fisheries.* African Journal of Marine Science, Vol. 27(2), pp. 427-437
General Description	
What data/products do you use?	Direct observations of birds using ship-based and/or aerial surveys
When do you use this kind of dataset?	During seismic and drilling activities to determine impacts of light on seabirds and during discharges to determine vulnerability and impact
What are your actual limitations and do you have a work around?	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability
Needs and expectations on EO data	High resolution imagery that would allow counting and possibly identifying seabirds. Could be visual or IR
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	
Geographic context/ restrictions	OFF.REG.08 - Morocco / Western Sahara

Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Morocco / Western Sahara	
Challenge ID	OFF2.33
Title	Document the extent (area, volume) of submarine landslides and calculate the probability of their occurrence
Challenge originator: interviewed company	Georgiopoulou, A., S. Krastel, D. G. Masson and R. B. Wynn. 2007. *Repeated Instability Of The New African Margin Related To Buried Landslide Scarps.* Pp. 29-36 in *Submarine* Mass Movements and Their Consequences*,* Advances in Natural and Technological Hazards Research Vol. 27.
General Description	
What data/products do you use?	Sidescan, multibeam sonar bathymetry maps if available
When do you use this kind of dataset?	During seismic surveys to determine susceptibility of substrate to seismic activities and gain information on substrate stability
What are your actual limitations and do you have a work around?	This data is currently not available unless the area has seen recent multibeam mapping
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor
Challenge classification	
Pre license	3
Exp.	3

Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	OFF.REG.08 - Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Morocco / Western Sahara	
Challenge ID	OFF2.34
Title	Monitoring of pollution arising from oil spillage and gas flaring
Challenge originator: interviewed company	Akpomuvie, Orhioghene, Benedict. 2011. Tragedy of Commons: Analysis of Oil Spillage, Gas Flaring and Sustainable Development of the Niger Delta of Nigeria. Journal of Sustainable Development. Vol. 4, No. 2.
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather dependant
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials

Challenge classification	
Pre license	1
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.08 - Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

General Requirements	
Challenge ID	OFF2.35
Title	Fish and Fish habitat
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Sidescan and multibeam survey data for habitat, stock-assessment and fishing effort data for fish distribution and abundance
When do you use this kind of dataset?	During impact assessment, environmental monitoring, spill response and damage assessment
What are your actual limitations and do you have a work around?	Data is highly seasonal and expensive to collect through dedicated surveys
Needs and expectations on EO data	High resolution imagery capable of detecting fish habitat features
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
Temporal resolution	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
Spatial resolution	1-10m
Data quality	high
Data Coverage and extent	District area, vessel route and onshore site
Example format	High resolution image

Timeliness	Reference data - timeliness not important
Existing standards	

General Requirements	
Challenge ID	OFF2.36
Title	Waste Management
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Self-reporting , ship-based water sampling, aerial surveys, ship to shore waste transfer
When do you use this kind of dataset?	Environmental and compliance monitoring
What are your actual limitations and do you have a work around?	Self-reporting is not trusted, other sampling is infrequent and expensive
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking plumes of discharged materials
Challenge classification	
Pre license	
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Public trust, compliance, environmental liability
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high

Data Coverage and extent	District area, vessel route and onshore site
Example format	Mid-high resolution image
Timeliness	As close to real-time as possible
Existing standards	

General Requirements	
Challenge ID	OFF2.37
Title	Site Surveys for Geohazards
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Multi-beam and sidescan sonar, sub-surface data
When do you use this kind of dataset?	During exploration and development to help determine of anchor placement or location of production platform
What are your actual limitations and do you have a work around?	Current data acquisition is vessel based and thus expensive and time consuming
Needs and expectations on EO data	Unclear - require sub-sediment penetration into ocean floor
Challenge classification	
Pre license	
Exp.	4
Dev.	4
Prod.	
Decom.	
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based surveys
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off
Temporal resolution	None

Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	In vicinity of drill site
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

General Requirements	
Challenge ID	OFF2.38
Title	Commercial shipping (not including shipping activity related to offshore oil operations)
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Aerial surveillance, satellite imagery, AIS, logbook port-inspections
When do you use this kind of dataset?	During initial assessment to determine placement of offshore installation in context of commercial shipping lanes
What are your actual limitations and do you have a work around?	AIS is not available everywhere, other shipping data is hard to get or confidential
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking ship traffic
Challenge classification	
Pre license	2
Exp.	
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Data accessibility and logistic feasibility
Technology Urgency	Mid-Term (5-10 years)

Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

General Requirements	
Challenge ID	OFF2.39
Title	Natural and other existing oil seeps
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Any visual detection of oil seeps from unknown sources (through aerial surveillance, sat imagery, oiled wildlife, ship based reports)
When do you use this kind of dataset?	During initial environmental assessment and during environmental monitoring
What are your actual limitations and do you have a work around?	Observations are by chance, not due to dedicated surveys. Operators may be charged for pollution in cases where they are not the cause
Needs and expectations on EO data	High resolution imagery capable of detecting slicks
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean

Activity impacted/concerned	Operational, environmental monitoring, spill response
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	
General Requirements	
Challenge ID	OFF2.40
Title	Commercial and recreational fisheries
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Data from resource management agency responsible for fisheries
When do you use this kind of dataset?	During initial environmental assessment and during oil spills
What are your actual limitations and do you have a work around?	Exact location of fisheries effort and not always easy to come by and in case of a spill real-time information is needed to determine economic impact
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking fishing activity
Challenge classification	
Pre license	2
Exp.	2
Dev.	2
Prod.	2
Decom.	2
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean

Activity impacted/concerned	Strategic decision enabler and spill response
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Weekly
Temporal resolution	Weekly
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

APPENDIX C: SUMMARY OF INITIAL AND REVISED ENVIRONMENTAL INFORMATION REQUIREMENTS

REVISED ENVIRIONMENTAL CHALLENGES			IMPORTANCE IN LIFE CYCLE STAGE					INITIAL CHALLENGES ID
Challenge ID	Title	Region	Pre	Exp	Dev	Prod	Decom	
OFF2.1	Monitoring of landfall site recovery and coastal vegetation	West of Ireland	3	1	1	2	1	2.1, 2.17
OFF2.2	Submarine landslides and seabed stability	West of Ireland, Eastern Med, Morocco/Western Sahara	3	4	4		1	2.2, 2.9, 2.12, 2.33, 2.37
OFF2.3	Shipwrecks and other archaeological value areas	West of Ireland, Eastern Med	4					2.3
OFF2.4	Detection and monitoring of pollutant discharges	All	1	3	3	3	3	2.4, 2.8, 2.14, 2.22, 2.27, 2.34
OFF2.5	Distribution and abundance of marine mammals	West of Ireland, Falklands	4	4	4	4	4	2.5, 2.13
OFF2.6	Distribution and abundance of seabirds	West of Ireland, Falklands, Morocco/Western Sahara	3	3	3	3	3	2.6, 2.18, 2.32
OFF2.7	Information on presence and abundance of deep water fauna	Eastern Med	4	4	4	4	3	2.7
OFF2.8	Scientific independence in environmental monitoring of pollution	Eastern Med		3	3	3	3	2.10
OFF2.9	Security and safety	Eastern Med		3	3	3	3	2.11
OFF2.10	Monitoring of chlorophyll-a	Falklands, South China Sea, Myanmar, Morocco/Western Sahara	3	3*	3*	3*	3	2.15, 2.19, 2.24
OFF2.11	Monitoring of waste management practices	All		1	1	1	1	2.16, 2.36
OFF2.12	Coastal resource mapping of mangroves, coral reefs, wetlands, and sandbanks	South China Sea, Falklands, Myanmar	1	1	1	1	1	2.21, 2.26, 2.28
OFF2.13	Coastal sediment dynamics, estuarine fronts, and land–ocean interactions.	South China Sea	2	2	2	2		2.23

OFF2.14	Coastal upwelling	South China Sea, Morocco/Western Sahara	2	1	1	1	1	2.25, 2.30
OFF2.15	Fish and fish habitat	All	4	4	4	4	4	2.35
OFF2.16	Commercial shipping	All	2					2.38
OFF2.17	Natural and other existing c	All	3	3	3	4	3	2.39
OFF2.18	Commercial and recreation	All	3	3	2	2	2	2.4
OFF2.19	Monitoring of sea surface height	All	3	4	4	3	3	2.20, 2.29, 2.31

*Importance is "4" in the event of a spill

Mature EO-based services and products exist to address the parameter at least partially in a meaningful way within acceptable bounds of error
Extracting the parameter of interest at least partially may be possible
EO is unlikely to contribute in a meaningful way to the parameter

ADDITIONAL PARAMETERS

Operational ice information

Ice edge as envrionmental parameter

Asset integrity onshore and offhsore

Bottom type charaterization

Methane in sediment

Invasive species (through ballast water)

APPENDIX D: REVISED ENVIRONMENTAL INFORMATION REQUIREMENTS

REVISED ENVIRONMENTAL INFORMATION REQUIREMENTS

Challenge ID	OFF2.1

Title	**Monitoring of landfall site recovery and coastal vegetation**
	Includes initial characterization and vulnerability of coastline and nearshore environment
	
	• Coastline vulnerability; change detection
	• Initial impact and recovery time
	• Parameters of interest:
	  o Shallow bottom vegetation and substrate
	  o Terrestrial and intertidal/subtidal, two parameters
	• Baseline information is most critical
	• Need to interface with oil spill trajectory models
	• Need to cover sufficiently large area
	• General requirement, not specific to Ireland

Challenge originator: interviewed company	Falkland islands Biodiversity Strategy: 2008 – 2018. 2008. Falkland Islands Government: Environmental Planning Department. Available at: http://www.epd.gov.fk/wp-content/uploads/BiodiversityStrategy09.pdf
General Description	
What data/products do you use?	Vegetation data currently collected through shoreline surveys, but satellite imagery has been used to help with broad vegetation classification
When do you use this kind of dataset?	When offshore production transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily be repeated on a seasonal basis.
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of coastal vegetation and coastal substrate
Challenge classification	
Pre license	3
Exp.	1
Dev.	1

Prod.	2
Decom.	1
Geographic context/ restrictions	- Ireland;all areas
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.2
Title	**Submarine landslides and seabed stability** Detection, aging of submarine slides Site Surveys for Geohazards • Currently monitored/mapped using side-scan sonar • Geohazards include earthquakes, mass movement, unexploded ordnance etc.
Challenge originator: interviewed company	ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2016 Georgiopoulou, A., S. Krastel, D. G. Masson and R. B. Wynn. 2007. *Repeated Instability Of The New African Margin Related To Buried Landslide Scarps.* Pp. 29-36 in *Submarine* Mass Movements and Their Consequences*,* Advances in Natural and Technological Hazards Research Vol. 27. General requirement
General Description	
What data/products do you use?	Sidescan, multibeam sonar bathymetry maps, sub-surface data if available
When do you use this kind of dataset?	During seismic surveys to determine susceptibility of substrate to seismic activities and gain information on substrate stability During exploration and development to help determine of anchor placement or location of production platform
What are your actual limitations and do you have a work around?	This data is currently not available unless the area has seen recent multibeam mapping. Current data acquisition is vessel based and thus expensive and time consuming
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor Unclear - require sub-sediment penetration into ocean floor

Challenge classification	
Pre license	3
Exp.	4, **4**(2.37)
Dev.	**4**(2.37)
Prod.	
Decom.	1
Geographic context/ restrictions	Western Ireland, Eastern Mediterranean, Morocco / Western Sahara Everywhere(2.37)
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler Cost reduction, reduction of HSE risk associated with vessel based surveys (2.37)
Technology Urgency	Mid-Term (5-10 years); the cheaper it is the faster we want it (if better than current); large area coverage with satellite would be very useful (high-res altimetry?)
Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m up to 1 m for unexploded ordnance; different resolution for different development stages
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.3
Title	**Shipwrecks and other archaeological value areas** Geophysical mapping of the upper sub-surface and detection of man-made features on the seafloor • Unexploded ordnance is a concern • Major issue in the Mediterranean
Challenge originator: interviewed company	Enterprise Energy Ireland Ltd and ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2013
General Description	
What data/products do you use?	Historic database showing location of shipwrecks and map of documented archeological sites where available, ROV survey data, multibeam data, sediment grabs
When do you use this kind of dataset?	Impact assessments, seismic surveys
What are your actual limitations and do you have a work around?	Use the aforementioned databases but they are limited to knowledge from areas that have previously been surveyed for other purposes
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor Maybe in very shallow water?? Not really
Challenge classification	
Pre license	4
Exp.	
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	Western Ireland, Eastern Mediterranean
Topographic classification / Offshore	Ocean

classification	
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years) Long Term (10+ years)(Eastern Mediterranean)
Information requirements	
Update frequency	One-off
Temporal resolution	None
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.4
Title	**Detection and monitoring of pollutant discharges** Parameters: Cement, cuttings, mud, oil discharges • Monitor coastal and offshore oil pollution to assess the impact of pollution on the marine environment • Monitoring of pollution arising from oil spillage and gas flaring • Validation of models is tricky • Surface current data will be helpful (cross-reference to metocean) • Operational discharges (at depth/surface) • Accidental discharges (at depth/surface) • Authorized surface discharges can be used for validation • High-resolution imagery can be used to detect pollutant plumes and slicks
Challenge originator: interviewed company	ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2012. RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC. Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002.; UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden. BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-13; Ramamurthy, V.D. and J. Sreenivasan. 1983. Sources of Oil Pollution along the Indian Coasts of Arabian Sea, Bay of Bengal Indian Ocean, and its

	Impact on Commercial Fisheries. Anales Del Instituto de Ciencias del Mar Y Limnología. Akpomuvie, Orhioghene, Benedict. 2011. Tragedy of Commons: Analysis of Oil Spillage, Gas Flaring and Sustainable Development of the Niger Delta of Nigeria. Journal of Sustainable Development. Vol. 4, No. 2. IPIECA publications on oil spill avoidance, preparedness response and best practices (http://www.ipieca.org/topic/oil-spill-preparedness/oil-spill-report-series)
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery, drifter buoys, in situ monitoring at platforms
When do you use this kind of dataset?	To aid in trajectory modeling, spill response and protection of important ecological and archeological areas
What are your actual limitations and do you have a work around?	Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather limitations of current technology
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	1 modelling happens at this phase
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	All Regions
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, response capability enhancement
Technology Urgency	Short term (2-5 years)
Information requirements	

Update frequency	1-6 h during time of discharge
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.5
Title	**Distribution and abundance of marine mammals** • Consistently identified as gap in strategic environmental assessments • Seismic activities, noise and spills affect mammals • Importance is "4" for all life cycle stages • Applicable to all areas • Timeliness: hourly updates required in case of spills or seismic activity
Challenge originator: interviewed company	OSPAR Commission. 2009 document. Assessment. ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources. RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC.
General Description	
What data/products do you use?	Abundance and distribution data from ship-based or aerial surveys
When do you use this kind of dataset?	During seismic and drilling activities to determine impacts of noise on marine mammals and during discharges to determine vulnerability and impact; seismic noisy and spills affect mammals
What are your actual limitations and do you have a work around?	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability, seasonal data and weather dependant
Needs and expectations on EO data	High resolution imagery that would allow counting and possibly identifying marine mammals when at the surface. Could be visual or IR
Challenge classification	
Pre license	4
Exp.	4
Dev.	4
Prod.	4
Decom.	4
Geographic context/ restrictions	Western Ireland, Falklands; all areas?

Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys, improved project planning
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	1-10m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important except for spill or seismic…hourly needed
Existing standards	

Challenge ID	OFF2.6
Title	**Distribution and abundance of seabirds** • Includes interaction between birds and light, flare and ships • Importance is "3" for all life cycle stages • Coverage is regional and includes shipping route
Challenge originator: interviewed company	OSPAR Commission. 2009 document. Assessment of impacts of offshore oil and gas activities in the North-East Atlantic. Woods, R., R. Ingham, & A. Brown. 2009. Falkland Islands (Malvinas). Pp 205 – 212 in C. Devenish, D. F. Díaz Fernández, R. P. Clay, I. Davidson & I. Yépez Zabala Eds. *Important Bird Areas Americas - Priority sites for biodiversity conservation.* Quito, Ecuador: BirdLife International (BirdLife Conservation Series No. 16). Camphuysen CJ. & J. van der Meer. 2010. *Wintering seabirds in West Africa: foraging hotspots off Western Sahara and Mauritania driven by upwelling and fisheries.* African Journal of Marine Science, Vol. 27(2), pp. 427-437
General Description	
What data/products do you use?	Direct observations of bird-light/flare interactions Direct observations of birds using ship-based and/or aerial surveys
When do you use this kind of dataset?	During exploratory drilling and production when lighted platforms are out there and/or there is flaring During seismic and drilling activities to determine impacts of light on seabirds and during discharges to determine vulnerability and impact
What are your actual limitations and do you have a work around?	Bird mortality due to light and flares is sporadic and dependent on time of year (migration periods) and weather. Assessment is difficult for those reasons, requires constant monitoring, but can affect large numbers of birds (up to 10% of migrating birds in North Sea) Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability
Needs and expectations on EO	Unclear - requires high temporal spatial resolution and cloud penetration

data	High resolution imagery that would allow counting and possibly identifying seabirds. Could be visual or IR
Challenge classification	
Pre license	3
Exp.	(Ireland), 3
Dev.	(Ireland), 3
Prod.	(Ireland), 3
Decom.	3(Ireland)
Geographic context/ restrictions	Western Ireland, Falklands, Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Cost reduction, reduction of HSE risk associated with vessel based surveys
Technology Urgency	Mid to Long Term (5-10, 10+ years(Ireland))
Information requirements	
Update frequency	Weekly-monthly
Temporal resolution	Weekly-monthly
Spatial resolution	<1m
Data quality	High
Data Coverage and extent	regional; include shipping routes (light)
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.7
Title	**Information on presence and abundance of deep water fauna** Includes deep-water coral and other vulnerable seabed habitat • Parameters of interest include bottom type and topography
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2011
General Description	
What data/products do you use?	ROV surveys and multibeam
When do you use this kind of dataset?	During environmental impact assessments (EIAs), oil spill response, environmental damage assessment
What are your actual limitations and do you have a work around?	ROV and multibeam surveys are expensive and time consuming
Needs and expectations on EO data	Not sure, EO capabilities can address this as it requires penetration to ocean floor and species and/or habitat identification
Challenge classification	
Pre license	4
Exp.	4
Dev.	4
Prod.	4
Decom.	3
Geographic context/ restrictions	- Eastern Mediterranean;
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years); short term, the sooner the better
Information requirements	
Update frequency	Yearly, for monitoring of change, but hourly during oil spills
Temporal resolution	Seasonal or yearly
Spatial resolution	1-10m

Data quality	High
Data Coverage and extent	; regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important, near real time for spill
Existing standards	

Challenge ID	OFF2.8
Title	**Scientific independence in environmental monitoring of pollution** Accidental spills, drill cuttings, atmospheric emissions, light and noise • Often no independent verification • Due diligence tool • Everybody having the same information would be good as quality check • Geographic context: regional bias, lack of transparency in environmental monitoring and reporting
Challenge originator: interviewed company	Galil B. and Herut B. 2011. *Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel.* IOLR Report H15/2014
General Description	
What data/products do you use?	Aerial surveillance, self-reporting
When do you use this kind of dataset?	Any time once exploratory drilling commences
What are your actual limitations and do you have a work around?	Public confidence in self-reporting is low, aerial surveillance or other types of independent monitoring are few, expensive or non-existent
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
Challenge classification	
Pre license	
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	- Eastern Mediterranean (lack of transparence in envt. Monitoring, reporting); regional bias
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Due diligence tool

Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily
Temporal resolution	Daily
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.9
Title	**Security and safety** • Operational rather than environmental requirement • Issues include piracy, unauthorized access to installations, encroachment • Geographic context: importance depends on geography and political context
Challenge originator: interviewed company	U.S. Energy Information Administration. Eastern Mediterranean Region. Overview of oil and natural gas in the Eastern Mediterranean region. Last updated August 12, 2013.
General Description	
What data/products do you use?	Aerial surveillance, coast guard, satellite imagery
When do you use this kind of dataset?	Any time once exploratory drilling commences
What are your actual limitations and do you have a work around?	Physical security of offshore operations due to political instability is a concern and could cause environmental damage in the area
Needs and expectations on EO data	High resolution imagery capable of detecting unauthorized shipping and other activity in the vicinity of offshore operations
Challenge classification	
Pre license	
Exp.	3
Dev.	3
Prod.	3
Decom.	3
Geographic context/ restrictions	- Eastern Mediterranean; importance depends on geography/political context
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Hourly to Daily
Temporal resolution	Hourly to Daily

Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	District area
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.10
Title	**Monitoring of chlorophyll-a** Productivity and harmful algal blooms (HAB) • Broad context is impact of ocean productivity on marine organisms • Satellite imagery is routinely used for ocean colour applications • Data from SEAWIFS (now defunct) has not been widely used by O/G industry • In-situ measurement sets context for timing of primary production; goal is understanding the integrated productivity throughout water column • Possible to correlate wastewater discharge with chlorophyll-a, interface different
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC. DanLing Tang, Hiroshi Kawamura, Tran Van Dien, MingAn Lee. 2004. *Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea.* Marine Ecology Progress Series. Vol. 268: 31-41. Jing Yu, Dan-Ling Tang, Im-Sang Oh, and Li-Jun Yao. 2007. *Response of Harmful Algal Blooms to Environmental Changes in Daya Bay, China*. Terr. Atmos. Ocean. Sci., Vol. 18, No. 5, 1011-1027.
General Description	
What data/products do you use?	Ship-based sampling (plankton tows), MODIS and SeaWifs ocean colour Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity and HABs in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	EEM data is generally collected around production platforms without a broader spatial or temporal environmental context. If changes in productivity or biota are detected around the site, it may not be clear whether it is a human induced effect or if it reflects an independent regional shift in ocean conditions. Data is sparse and SeaWifs is offline. To collect all these environmental data would require extensive ship

	surveys which are time consuming and expensive
Needs and expectations on EO data	Ocean colour imagery Satellite imagery to detect features such a productivity (colour), SSH, temperature, winds, waves, fronts, etc.
Challenge classification	
Pre license	3
Exp.	3 4 under spill even
Dev.	3 (4 under spill event)
Prod.	3 4 under spill even
Decom.	3
Geographic context/ restrictions	– Falklands, South China Sea, Myanmar, Morocco / Western Sahara; probably all reas
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily-weekly Daily-seasonal (Morocco / Western Sahara)
Temporal resolution	Daily-weekly; during spill event, more frequently, monitor effect of spill or application of dispersant Daily-seasonal (Morocco / Western Sahara)
Spatial resolution	100m (important in some areas, coastal); open ocean 1km 1-100m (Morocco / Western Sahara)
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month As close to real-time as possible
Existing standards	

Challenge ID	OFF2.11
Title	**Monitoring of waste management practices**
Challenge originator: interviewed company	RPS Energy. 2009. *Environmental Impact Assessment for Offshore Drilling The Falkland Islands.* Report prepared for Rockhopper Exploration PLC. General requirement • Plumes/slicks due to discharge of regular waste (kitchen waste, grey water, black water, etc.) • All operations have waste management protocol • Waste protocols cover different products in different jurisdictions
General Description	
What data/products do you use?	Self-reporting, ship-based water sampling, aerial surveys, ship to shore waste transfer
When do you use this kind of dataset?	Environmental and compliance monitoring
What are your actual limitations and do you have a work around?	Self-reporting is not trusted, other sampling is infrequent and expensive
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking plumes of discharged materials
Challenge classification	
Pre license	
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	All regions
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Public trust, compliance, environmental liability

Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	District area, vessel route and onshore site
Example format	Mid-high resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.12
Title	**Coastal resource mapping of mangroves, coral reefs, wetlands, and sandbanks**
Challenge originator: interviewed company	Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002. UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden. BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-14
General Description	
What data/products do you use?	Data currently collected through shoreline, small boat, and dive surveys but satellite imagery has been used to help with broad classification
When do you use this kind of dataset?	When offshore production transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
What are your actual limitations and do you have a work around?	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily be repeated on a seasonal basis.
Needs and expectations on EO data	High resolution maps that will allow characterization/ classification of inter and sub-tidal and nearshore environment High resolution maps that will allow characterization/ classification of coral reefs
Challenge classification	
Pre license	1
Exp.	1
Dev.	1
Prod.	1
Decom.	1
Geographic context/ restrictions	- South China Sea, Falklands, Myanmar

Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Strategic decision enabler
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	One-off, perhaps every few years might be helpful One-off for initial assessment and monthly for monitoring purposes
Temporal resolution	Seasonal
Spatial resolution	1m
Data quality	High
Data Coverage and extent	District area, vessel route and onshore site
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.13
Title	**Coastal sediment dynamics, estuarine fronts, and land–ocean interactions.** • More important/necessary if coastal infrastructure is involved: equipment, terminal • Does not include bottom; discharges from land, siltation, coastal erosion (link with water quality/turbidity) • Currently achieved using modelling • Satellite images used to identify fronts, especially off-shore
Challenge originator: interviewed company	Huang, Weigen, Fu, Bin. 2002. *Remote Sensing for Coastal Area Management.* Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People's Republic of China in China. *Coastal Management,* 30:271–276, 2002.
General Description	
What data/products do you use?	Models, aerial surveillance, satellite imagery
When do you use this kind of dataset?	To monitor coastal erosion, freshwater run-off and other dynamics that can influence currents and sedimentation in the nearshore environment
What are your actual limitations and do you have a work around?	Acquiring data of this type is difficult and expensive, requires modeling and in-situ data validation
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking plumes and oceanic fronts
Challenge classification	
Pre license	2
Exp.	2
Dev.	2
Prod.	2
Decom.	
Geographic context/ restrictions	- South China Sea
Topographic classification / Offshore classification	Shallow Water
Activity impacted/concerned	Operational, response capability enhancement

Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	1-6 h during time of discharge (hourly to daily)
Temporal resolution	1-6 h during time of discharge
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.14
Title	**Coastal upwelling** Includes index of seasonal and inter-annual variations of summer upwelling • Indicates high productivity • Provides context • Can be achieved via SSH or SST or ocean colour • EO can provide context, time series, help explain what is observed • EO not really widely used, but if something happens, people would come looking for EO-derived information
Challenge originator: interviewed company	Xie, S.-P., Q. Xie, D. Wang, and W. T. Liu. 2003. *Summer upwelling in the South China Sea and its role in regional climate variations.* J. Geophys. Res., Vol. 108(3261), doi:10.1029/2003JC001867, C8. Pelegrí, J.L. et al. 2005. *Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter*. Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: http://www.sciencedirect.com/science/article/pii/S0924796304002027
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
What are your actual limitations and do you have a work around?	To detect timing and extent of upwelling would require extensive ship surveys which are time consuming and expensive
Needs and expectations on EO data	Satellite imagery to detect upwelling features such a productivity, SSH, temperature
Challenge classification	
Pre license	2
Exp.	1
Dev.	1

Prod.	1
Decom.	1
Geographic context/ restrictions	- South China Sea, Morocco / Western Sahara
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Weekly-seasonal South China Sea Daily-seasonal (Morocco / Western Sahara)
Temporal resolution	Weekly-seasonal South China Sea Daily-seasonal (Morocco / Western Sahara)
Spatial resolution	100m – > 1km
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	Ocean colour imagery
Timeliness	Within a month South China Sea As close to real-time as possible (Morocco / Western Sahara)
Existing standards	

Challenge ID	OFF2.15
Title	**Fish and fish habitat**
Challenge originator: interviewed company	General requirement • Habitat includes bottom type for shallow areas • Need to have reference area(s) to estimate uniqueness/significance • Looking for any change in fish habitat • EO can be used to map bottom type in clear, shallow water (not applicable to deep water) • Seasonal changes of habitat parameters can be important (e.g. temperature) • Importance should be 4 in all life cycle stages
General Description	
What data/products do you use?	Sidescan and multibeam survey data for habitat, stock-assessment and fishing effort data for fish distribution and abundance
When do you use this kind of dataset?	During impact assessment, environmental monitoring, spill response and damage assessment
What are your actual limitations and do you have a work around?	Data is highly seasonal and expensive to collect through dedicated surveys
Needs and expectations on EO data	High resolution imagery capable of detecting fish habitat features
Challenge classification	
Pre license	4
Exp.	4
Dev.	4
Prod.	4
Decom.	4
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler

Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
Temporal resolution	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
Spatial resolution	1-10m
Data quality	high
Data Coverage and extent	District area, vessel route and onshore site
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.16
Title	**Commercial shipping** (not including shipping activity related to offshore oil operations) • Includes container vessels etc. (i.e. does not include O/G-related shipping) • Accurate shipping data is difficult to get • Most useful at pre-licensing stage (e.g. verify if AOI is located on shipping route) • Shipping/transit is a category in environmental impact assessments (EIA) • Knowledge of ship traffic especially relevant for confined areas • In international waters, knowledge of fishing vessel locations is also important (e.g. in case of claim against O/G development, use of regional areas) o Fishing is captured as a separate category in this analysis
Challenge originator: interviewed company	General requirement
General Description	
What data/products do you use?	Aerial surveillance, satellite imagery, AIS, logbook port-inspections
When do you use this kind of dataset?	During initial assessment to determine placement of offshore installation in context of commercial shipping lanes
What are your actual limitations and do you have a work around?	AIS is not available everywhere, other shipping data is hard to get or confidential
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking ship traffic
Challenge classification	
Pre license	2
Exp.	
Dev.	
Prod.	
Decom.	
Geographic context/ restrictions	Everywhere

Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Data accessibility and logistic feasibility
Technology Urgency	Mid-Term (5-10 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.17
Title	**Natural and other existing oil seeps**
Challenge originator: interviewed company	General requirement • Also includes newly appearing seeps • Key issue is differentiating between natural and man-made seeps o Seeps from old ship wrecks would be considered "natural" in this context • Being able to visualize water column from bottom to surface is very important
General Description	
What data/products do you use?	Any visual detection of oil seeps from unknown sources (through aerial surveillance, sat imagery, oiled wildlife, ship based reports)
When do you use this kind of dataset?	During initial environmental assessment and during environmental monitoring
What are your actual limitations and do you have a work around?	Observations are by chance, not due to dedicated surveys. Operators may be charged for pollution in cases where they are not the cause
Needs and expectations on EO data	High resolution imagery capable of detecting slicks
Challenge classification	
Pre license	3
Exp.	3
Dev.	3
Prod.	4
Decom.	3
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Operational, environmental monitoring, spill response
Technology Urgency	Short term (2-5 years)

Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	10-100m
Data quality	High
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Reference data - timeliness not important
Existing standards	

Challenge ID	OFF2.18
Title	**Commercial and recreational fisheries**
Challenge originator: interviewed company	General requirement • Detection and monitoring of fishing vessels to safeguard against liability claims • Identifying small boats is a challenge
General Description	
What data/products do you use?	Data from resource management agency responsible for fisheries
When do you use this kind of dataset?	During initial environmental assessment and during oil spills
What are your actual limitations and do you have a work around?	Exact location of fisheries effort and not always easy to come by and in case of a spill real-time information is needed to determine economic impact
Needs and expectations on EO data	High resolution imagery capable of detecting and tracking fishing activity
Challenge classification	
Pre license	3
Exp.	3
Dev.	2
Prod.	2
Decom.	2
Geographic context/ restrictions	Everywhere
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Strategic decision enabler and spill response
Technology Urgency	Short term (2-5 years)
Information requirements	
Update frequency	Weekly
Temporal resolution	Weekly
Spatial resolution	10-100m
Data quality	High

Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	As close to real-time as possible
Existing standards	

Challenge ID	OFF2.19
Title	Monitoring of Sea Surface Height (SSH) • Parameter used to assess primary productivity, which affects species abundance • Primary productivity is also assessed using sea surface temperature, chlorophyll concentration • Effects on offshore structures (e.g. vibrations near risers)
Challenge originator: interviewed company	DanLing Tang, Hiroshi Kawamura, Tran Van Dien, MingAn Lee. 2004. *Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea.* Marine Ecology Progress Series. Vol. 268: 31-41. Patidar, B. 2006. *Application of remote sensing and GIS in the analysis of environment of Bay of Bengal*. MSc., Dissertation, Barkatullah University, Bhopal(MP)- National Institute of Oceanography, Goa, India Pelegrí, J.L. et al. 2005. *Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter*. Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: http://www.sciencedirect.com/science/article/pii/S0924796304002027
General Description	
What data/products do you use?	Ship-based measurements; satellite images
When do you use this kind of dataset?	Environmental assessment and effects monitoring, characterizations of currents (eddies) and possible foraging hotspots for birds and mammals
What are your actual limitations and do you have a work around?	Ship-based surveys are expensive and there are always safety concern when putting people in the field. Data is often seasonally limited due to weather conditions
Needs and expectations on EO data	Satellite imagery to monitor eddy activity and impacts on productivity and species distribution
Challenge classification	
Pre license	3
Exp.	3
Dev.	3

Prod.	3
Decom.	3
Geographic context/ restrictions	OFF.REG.12 - South China Sea
Topographic classification / Offshore classification	Ocean
Activity impacted/concerned	Possible reduction of environmental liability, reduction of HSE risks
Technology Urgency	Immediately (0-2 years)
Information requirements	
Update frequency	Daily-weekly
Temporal resolution	Daily-weekly
Spatial resolution	100m
Data quality	Medium to high
Data Coverage and extent	Regional
Example format	High resolution image
Timeliness	Within a month
Existing standards	

Other Parameters of Interest

- Ice is key operational parameter for O/G industry
    - EO4OG precursor activity addresses the generation of ice charting guidelines for the O/G sector
        - Phase 1 has been completed under ESA funding
        - Phase 2 is being considered for funding by OGP
    - Ice edge is information is important from environmental perspective
        - Primary productivity
        - Mammal activity

- Asset integrity
    - Pipeline to shore, annual survey would be helpful to assess stress on near-shore pipelines
    - Pipelines in subtidal areas can be subjected to high current; would be helpful to monitor more than every few years
    - **ACTION:** T. McKeever to verify importance for all life cycle stages
    - Estimating fouling rates on structures would be heloful (e.g. via growth in girth)

- Bottom type
    - Proportion of organic matter
    - Assessment of benthic health
    - Redox potential

- Methane in sediment
    - Current approaches use box core over sediment, capture water directly above to analyze for methane

- Invasive species
    - Monitor ballast water discharges (e.g. via temperature as main difference to surrounding waters)