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# Improving safe and efficient vessel downline operations around in-water assets:

Geomatics Committee Report 685:

*Survey and online positioning system recommendations  
for vessel downline operations within in-water assets*

IOGP Geomatics Committee webinar

24<sup>th</sup> March 2026

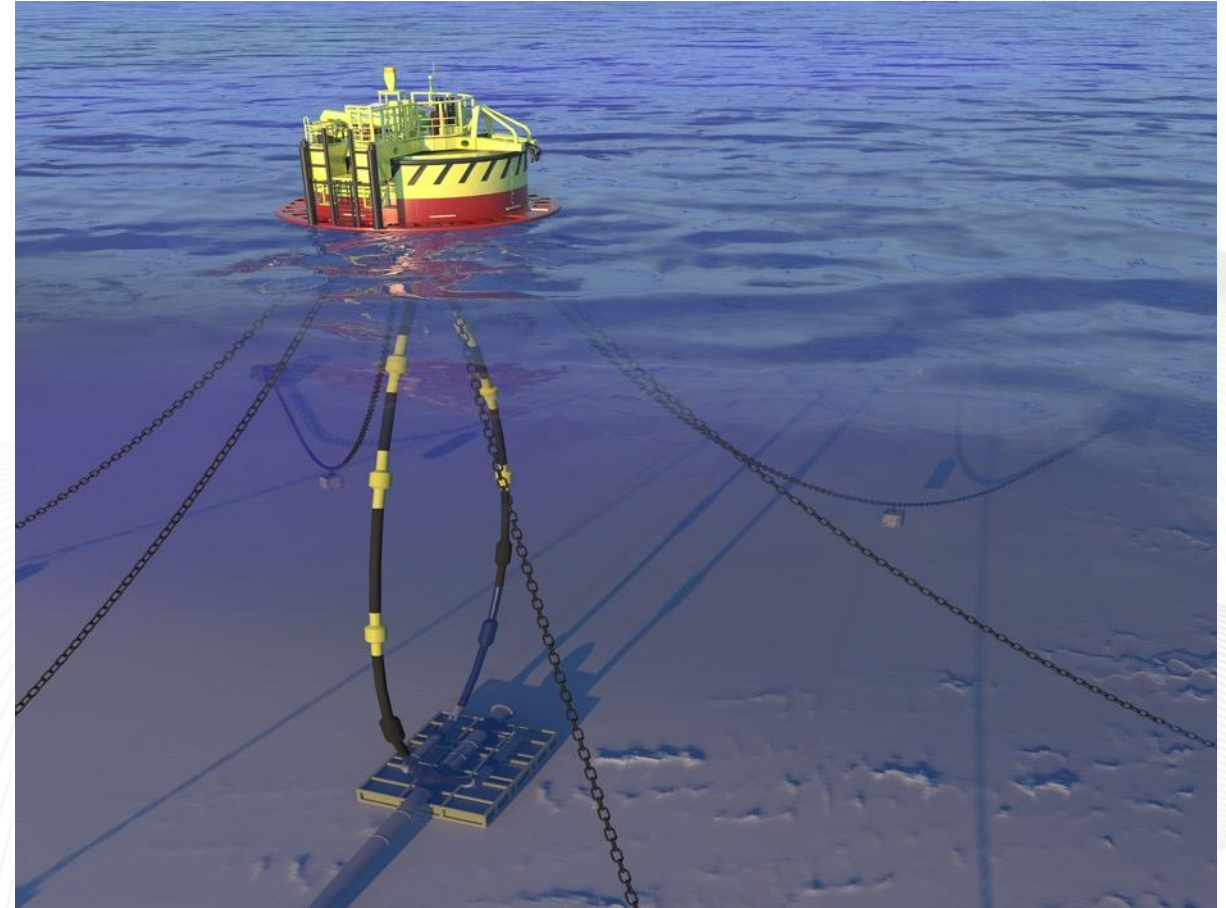
**Walter Jardine**, Vice Chair Geomatics Committee

**Matt Paloian**, Co-chair Survey & Positioning Sub-committee (Shell)



# Agenda

1. Introduction and definitions
2. Planning recommendations
3. Survey Execution recommendations
4. Downline Operations Checklist



# IOGP speaks on behalf of a global membership

IOGP has 97 Members (as of November 2025)

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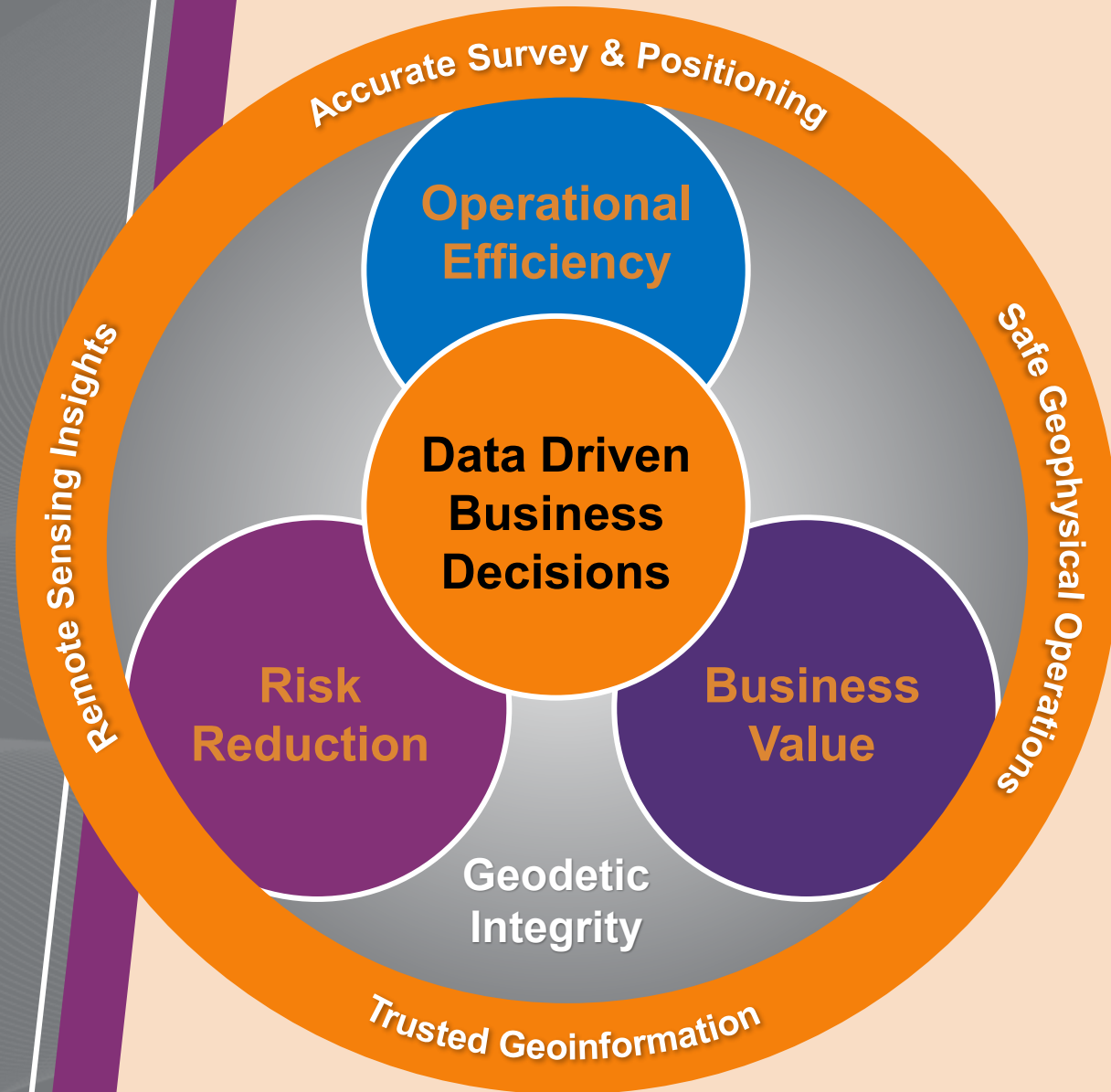




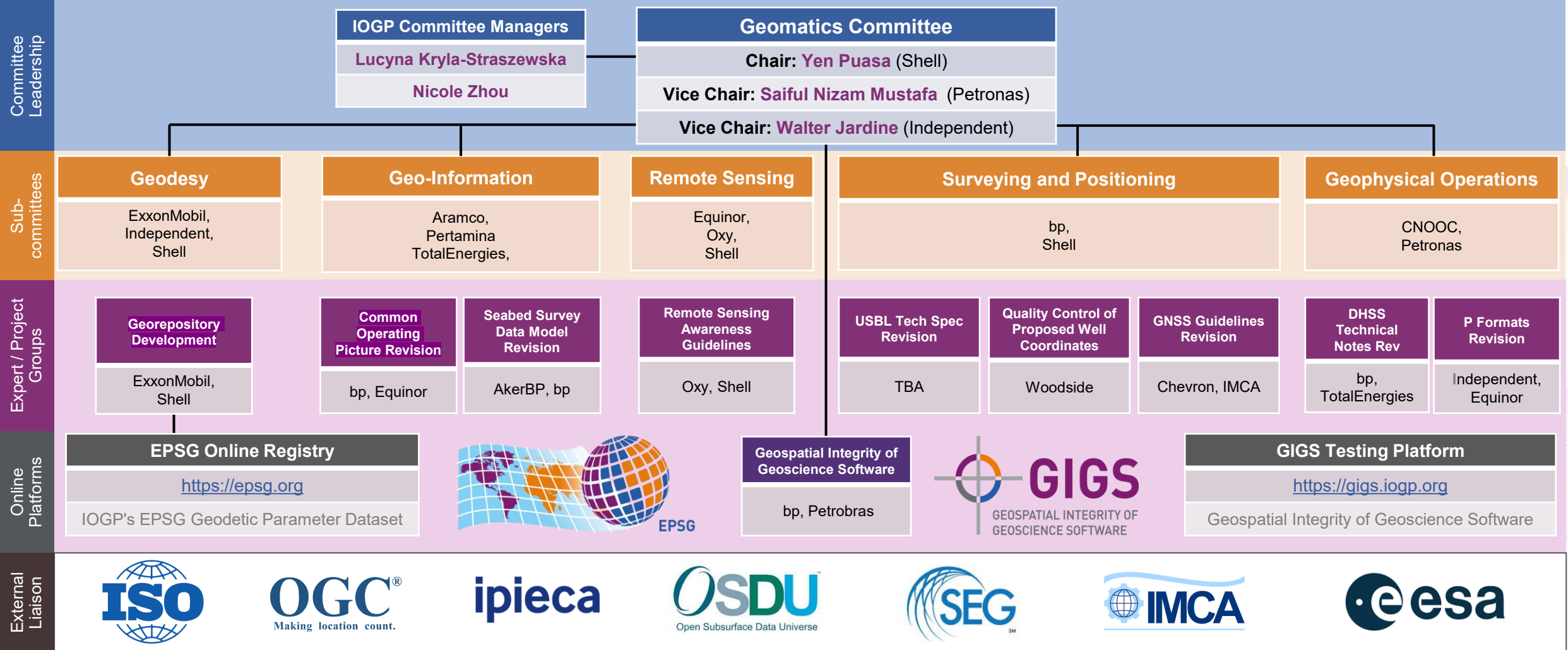
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## The Geomatics Committee:

- Established in 2005 by the absorption into IOGP of the European Petroleum Survey Group (EPSG)
- We promote knowledge exchange
- We develop and drive good practices and sound geomatics principles for an efficient industry
- We engage with relevant stakeholders to identify and collaborate to solve common challenges related to geomatics activities
- We advocate the industry's position to address regulatory changes with geomatics activity implications



# Geomatics Committee: Structure



# Introduction to IOGP report 685

## **IOGP report 685: Survey and online positioning system recommendations for vessel downline operations within in-water assets**

Operating vessel downlines within in-water asset areas can be high risk. This document recommends practices that reduce the risk of downline and in-water asset collision, entanglement and damage.

It provides only survey and online positioning system recommendations for surface vessels operating with downline(s). It does not duplicate existing industry standard offshore survey and positioning best practices, or cover vessel position reference systems or processes used by Dynamic Positioning (DP) systems, although much of the content is relevant to DP operations.

It assumes standard project processes, including project procedure review and approval, Risk Assessment and Management of Change are in place, and that they include relevant downline operations.



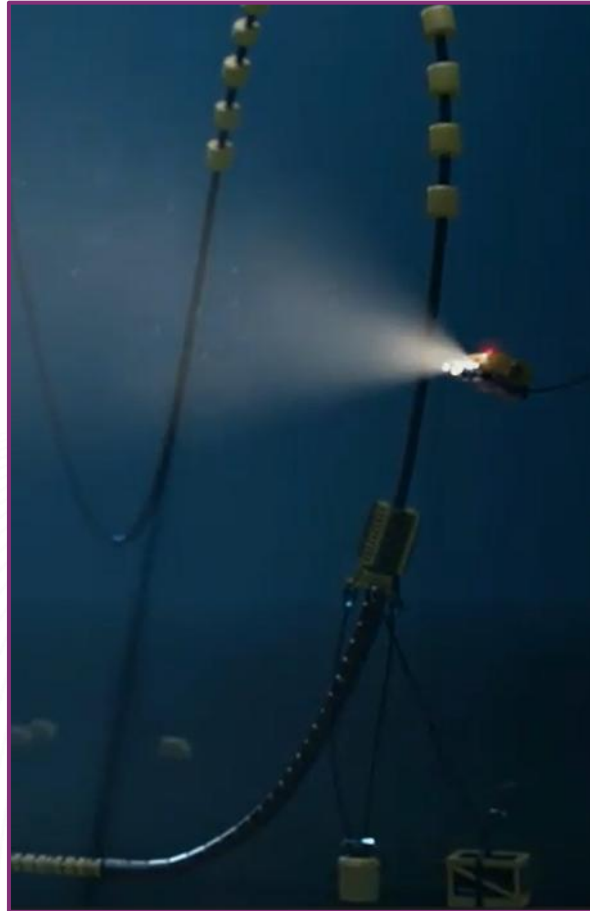
# Background and definitions

## Downline examples:

- dive bell wire & umbilicals
- ROV TMS wire and umbilical
- crane wire and load
- 'installation product' – e.g. rigid pipeline, flowline, umbilical, fibre optic or electrical cable
- mooring line while being installed

## Onshore role relevance:

- Construction Managers
- Transport and Installation Managers
- Vessel Managers
- Subsea Engineers
- managers and project personnel in the Geomatics, Survey and Geospatial domain



## In-water asset examples:

- FPSO and MODU moorings
- flexible risers
- TLP moorings
- metocean, communication system moorings
- Other temporary risers and moorings

## Offshore role relevance:

- Construction / Installation Manager
- Dive Superintendent, Party Chief
- Remotely Operated Vehicle personnel
- Dynamic Positioning Operator, online surveyor
- Installation / subsea engineer, vessel marine bridge crew

# Planning recommendations 1

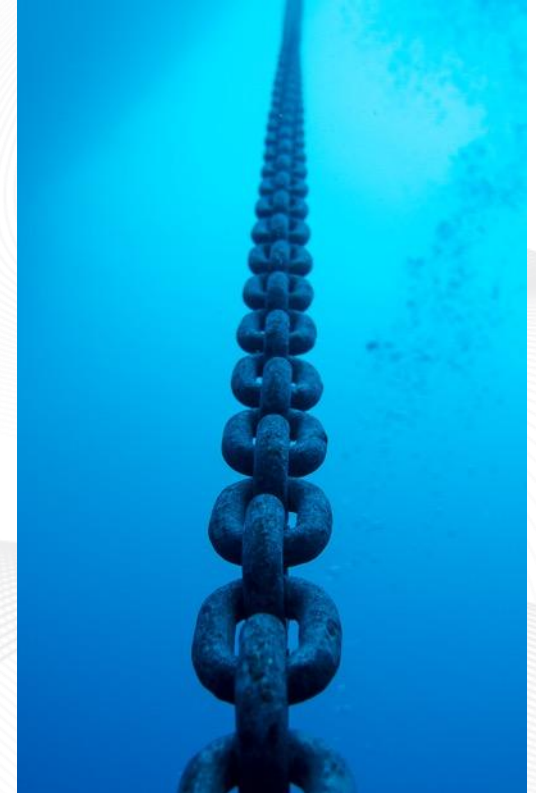
## Operational procedures should include:

- list of planned downlines with unique identifiers
- position uncertainties for subsea positioning components and frequency management plan
- roles and responsibilities, comms and move authorisation protocols
- execution plans and timing for any as-found / as-left surveys of existing assets

## Operational field charts and databases should include:

- all relevant infrastructure – surface, in-water, seabed, including maximum footprints
- exclusion and safety zones (3D), safe over-boarding and recovery locations (with IDs)
- vessel ingress, transit and egress routes (with IDs)
- risers and moorings, with expected touchdown points
- transit depths where relevant

**It is critical to ensure accuracy of field charts and online database: correct, complete, current, consistent**



# Planning recommendations 2



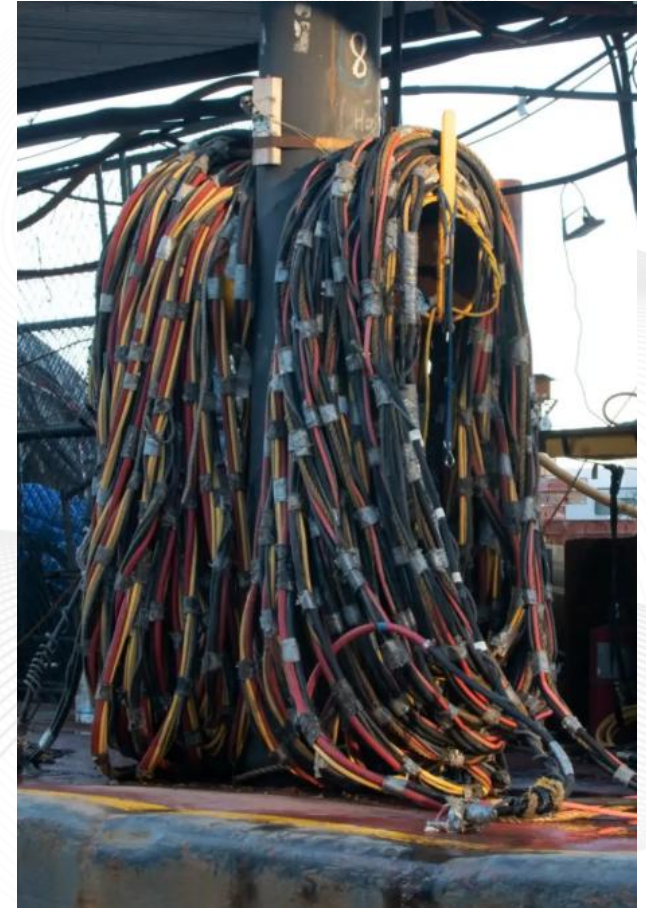
## Online system capabilities – standard survey functionality, but also consider:

- clearly visible pre-existing and project-specific exclusion zones, transit waypoints etc with ID
- survey alarm requirements – discussed and agreed with relevant parties
- balance between adequate and over-protection (alarm floods)
- project specific configurable alarms with geo-fencing to auto-trigger when navigated point enters / intersects agreed exclusion zone
- display any 3<sup>rd</sup> party mobile systems accurately and live – position, footprint, orientation, suitable update rate, depending on criticality. Typical options:
  - AIS, regular VHS/email position updates, project-specific GNSS / Fanbeam and telemetry system
- automated alarm for 3<sup>rd</sup> party mobile surface facilities that excurts more than the agreed distance
- 3D catenary modelling may be necessary for complex situations – eg double catenaries

# Survey execution – positioning recommendations 1

## Survey navigation setup and operations 1:

- surface and subsea positioning (including accuracies) delivered as per relevant scope of work
- completion of downline checklist (appendix A) by survey team, for sign off by operating authority
- briefing of navigation screen to all relevant parties. Display screens available in relevant locations – Survey, ROV, Dive, DP desk, client office etc.
- constant monitoring of all downline positions and online system integrity by online surveyor
- real-time position tracking of downline position (e.g. via USBL acoustic beacon) – unique labelling
- where live tracking is not possible – estimated position and touchdown provided from layback, heading, catenary etc.



# Survey execution – positioning recommendations 2



## Survey navigation setup and operations 2:

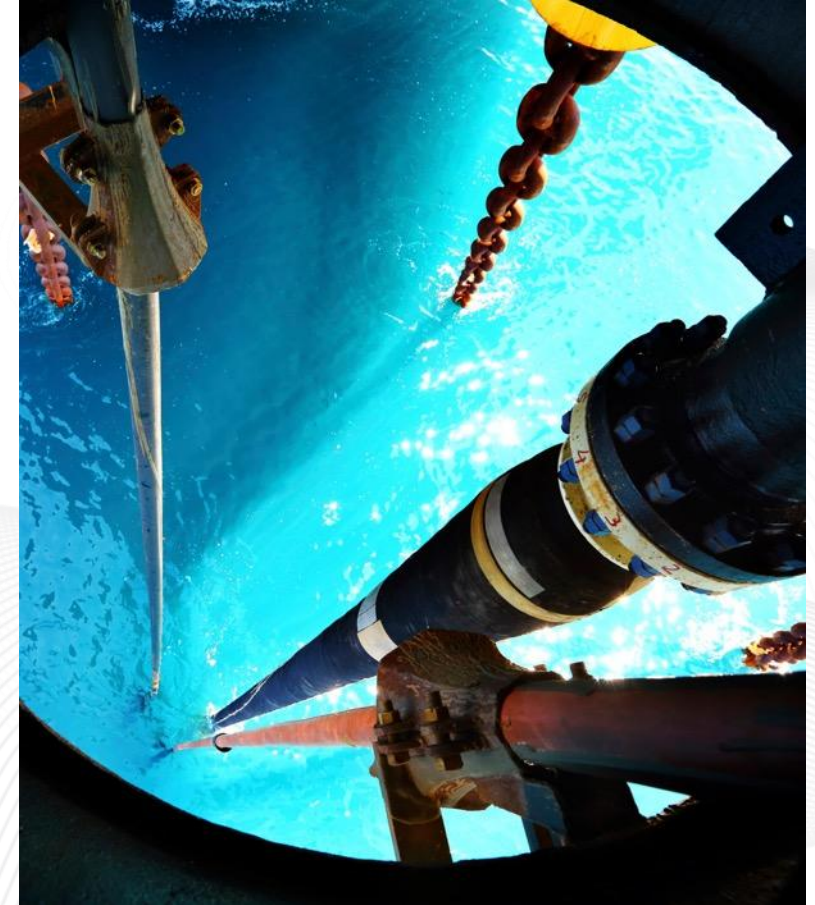
- display of access, egress, transit routes; safety, exclusion, safe work zones; alarm status etc
- live position, heading, footprint display of relevant 3<sup>rd</sup> party mobile assets
- in-water assets shown as part of the facility outline, and move with the live facility
- visible dynamic 'rubber band' connecting surface point to touchdown, seabed location, as-installed anchor position etc.
- as-found positions should be reflected in online system display as required

# Downline operations checklist - utilisation

**Checklist should be used with existing industry and contractor processes e.g.:**

- Risk Assessment and related sign-off process
- Management of Change procedures
- IMCA S 016 mobilisation checklist (or contractor equivalent)
- contractor survey and positioning procedures
- contractor installation procedures
- project charts and drawings
- contractor survey mobilization and calibration report
- DP 500m entry checklist
- pre-dive checklist (ROV and/or diving operations)
- go/no-go operational decision checklist

**Site-specific planning is recommended to facilitate effectiveness of hazard identification and risk assessment when working downline(s) are within in-water assets.**



# Downlines checklist section 1 – Project details

1A. Project name/Phase
1B. Asset/Field/Location name and lease block/concession
1C. Facility name with in-water asset/s
1D. Project Coordinate Reference System, Transformation, and EPSG codes
1E. Primary Surface and Subsea Positioning Systems and accuracy/uncertainty (from agreed Survey Procedures) (see relevant project-specific survey mobilization and calibration Report for positioning results)
1F. Vessel and Primary Contractor Name

1G. Survey Company name
1H. Lead Surveyor/Party Chief
1I. Online Navigation System, model, and version number
1J. Date form submitted
1K. Name of person completing form
1L. Role of person completing form
1M. Approver's name
1N. Approver's role
1O. Date reviewed and approved

# Checklist sections 2 & 3: pre-mobilisation and survey readiness

2A. Document name, revision number, and date with approved minimum clearances and exclusion zones (e.g. distances, hazards, moored weathervane vessel's swing circle etc.) and safe over-boarding/recovery location(s) with detailed maps, coordinates of the work areas.

2B. Document/chart names, revision number, and date with approved ingress/egress routes for each operational phase of the project and any vessel transit paths with downlines within in-water assets.

2C. Document name, revision number, and date with detailed Survey and Positioning procedures and requirements (including accuracy requirements, equipment calibrations, verifications, survey charts, deliverables, etc).

3A. Does the vessel have suitable survey equipment, including spares (each as per contract/scope of work) and is it ready for work? Confirm suitable survey equipment to track all agreed downlines.

Are survey display monitors located at all relevant workstations (including, e.g., Bridge Control, DPO station, Dive Control, and ROV pilot station)  
Confirm setup is compliant with Safe Work Plan and/or Acoustic Frequency Management Plan (if applicable).

3B. Survey navigation display briefing: list all navigation display locations roles that use the display. List all briefing participants (e.g. master, Dynamic Positioning Operator/bridge crew, Offshore Construction Manager, Dive/installation Superintendent, ROV Team, Subsea Engineer etc.

Briefing should ensure that all parties can clearly identify hazards or encroachment on potential hazards and fully understand the display.

3C. IMCA Document 300 S 016 'Mobilisation Requirements for Offshore Survey Operations', including Survey Mobilisation Checklist - completed and approved (Yes/No, with report name and reference number) and/or Contractor Survey Mobilisation and Calibration Report Number as relevant

# Checklist section 4 – exclusion zones, access routes

4A. In-water asset alarms. List each in-water asset (mooring line number, riser number, etc.) and any agreed as-found survey elements

4B. Exclusion distances: approved minimum clearances and alarm elements recommendations

4C. Touch Down Point asset alarms: List each set of TDP coordinates for in-water asset (mooring line, riser, etc).  
Can attach or refer to drawing with details as long as drawing has all relevant info.

4D. Approved safe over-boarding/recovery locations. List all unique names/identifiers.

4E. Alarms (vehicle names): List each downline name (e.g., ROV, dive bell, crane hook, flowline TDP) or vessel offset point (ROV launch, cable chute, moon pool, Over-Boarding Device (OBD) etc.) that would trigger the automated alarm.

4F. Other critical waypoints or vessel transit plan (e.g., vessel-to-vessel transfer points) or transit plan with downlines in the water? List all unique names/identifiers.

4G. Mobile surface facility positioning. List each mobile facility and position update system being used that would trigger an alarm  
Note: Moored surface facilities that weathervane (e.g., FPSO) may require enhanced positioning references or increased update rates. Confirm positioning and orientation requirements with relevant company authority (e.g. survey lead, OIM, etc.)

4H. Approved ingress/egress route names. List all unique names/identifiers

# Checklist section 4 – example layout for data entry



## Section 4: Exclusion Zones, Access Routes Checklist

(examples in red text to be replaced with project-specific details as required)

Instruction	Response		
4A. In-water asset alarms. List each in-water asset (mooring line number, riser number, etc.) and any agreed as-found survey elements	List in-water asset names. Alarm required Y/N?		
	Name, colour scheme, as-found survey Required (Y/N). Alarm required Y/N	Name, colour scheme, as-found survey Required (Y/N). Alarm required Y/N	
	1. e.g., FPSO Mooring line 1. Yellow, Y, Y	2. e.g., FPSO Mooring Line 2. Yellow Y, Y	
	3. e.g., FPSO Mooring line 3. Yellow, N, N	4. e.g., FPSO Mooring Line 4. Yellow N, N	
4B. Exclusion distances: approved minimum clearances and alarm elements recommendations	In-water feature name and minimum separation (m/ft). Alarm required Y/N?		In-water feature name and minimum separation (m/ft). Alarm required Y/N?
	1. e.g., FPSO Riser Prod1, 100m, Y		2. e.g., FPSO Riser Prod2, 100m, Y
	3. e.g., FSO Riser W Inj1, 100m, Y		4. e.g., FSO Riser W Inj 2, 100m
	List TDP coordinates of in-water assets. Alarm required Y/N?		
4C. Touch Down Point asset alarms: List each set of TDP coordinates for in-water asset (mooring line, riser, etc).  Can attach of refer to drawing with details as long as drawing has all relevant info.	Name:	Easting / X ED 50, UTM Z30N (EPSG 20303)	Northing / Y: ED50, UTM Z30N, (EPSG 23030)
	1. e.g., MODU Rig A ML1, N	123,456.0mE	7,234,567.0mN
	2. e.g., MODU Rig A ML2, N	etc.	etc.
	3. e.g., FPSO Riser Prod 1, Y	etc.	etc.

# Checklist section 5 – navigation alarm settings

5A. Screenshots of in-water asset TDPs. Confirm navigation system using dynamic ('rubber-band') connections between TDP and hang-off/fairlead on facility.

5B. Screenshots of enabled alarms within the navigation system.

5C. Screenshots of avoidance/exclusion zones. Visible geo-fencing/buffers setup in navigation map for work area.

5D. Screenshots of alarm tests (1) "Surface Vessel": verified alarm for surface vessel entering an avoidance/exclusion zone? Image showing required intervention from the monitoring operators (DPO/Survey) to acknowledge and correct the issue.

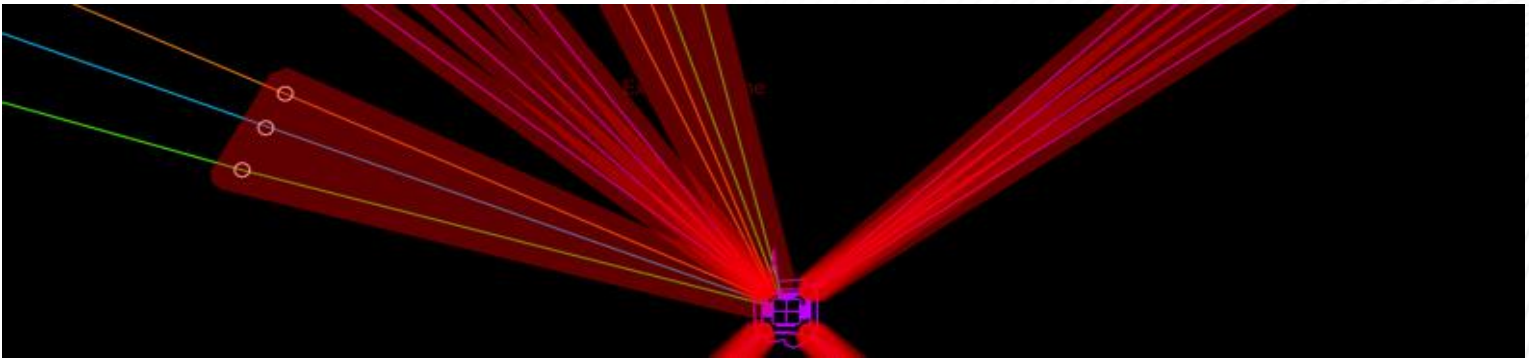
5E. Screenshots of alarm tests (2) "Vessel Transit Route": verified alarm for surface vessel proposed transit route ('boat-to-go') intersecting an avoidance/exclusion zone (e.g., route intersects mooring line).

5F. Screenshots of alarm tests (3) "Downline": verified alarm for a downline (e.g., subsea vehicle/crane wire, cable TDP dynamic position) or vessel fixed offset point (e.g., ROV launch, moon pool, vessel crane block, cable overboard point, A&R wire hang off, etc.) entering an avoidance/exclusion zone.

# Online positioning system displays – example exclusion zones and alarms

The screenshot displays a map with a red 500m exclusion zone around a vessel. A red error dialog box is open, stating "Vessel To Go is inside of Mooring Line". An "Alerts" window is also visible, listing various events.

Event	Time cleared	Time Acknowledged	State	Module
Port Tether is inside of Mooring Line	7/25/2024 12:26:08.6	7/25/2024 12:26:18.5	Cleared, Acknowledged	Exclusion Zone
PORT ROV is inside of Mooring Line	7/25/2024 12:22:18.1	7/25/2024 12:26:20.4	Cleared, Acknowledged	Exclusion Zone
PORT ROV is inside of Mooring Line	7/25/2024 12:21:13.7	7/25/2024 12:26:19.0	Cleared, Acknowledged	Exclusion Zone
PORT ROV is inside of Mooring Line	7/25/2024 12:18:55.3	7/25/2024 12:26:20.1	Cleared, Acknowledged	Exclusion Zone
Origin is inside of Mooring Line	7/25/2024 12:18:30.5	7/25/2024 12:18:37.3	Cleared, Acknowledged	Exclusion Zone
Port Tether is inside of Mooring Line	7/25/2024 12:27:44.6	--	Cleared	Exclusion Zone
Vessel To Go is inside of 500m Zone	7/25/2024 12:29:09.6	--	Cleared	Exclusion Zone
Vessel To Go is inside of Mooring Line	--	--	Triggered	Exclusion Zone



The screenshot shows a vessel's position on a map with various data points. A red error dialog box is open, stating "PORT ROV is inside of Mooring Line".

PORT ROV D:199.526 ft  
H:45.000°  
Spd:2.108 knot

Stbd ROV D:150.000 ft  
H:340.000°  
Spd:0.000 knot

STBD TMS 100.000 ft

PORT TMS D:50.000 ft

# Key recommendations

**These cover Survey & Positioning recommendations only – they do not include Marine, Dynamic Positioning, Diving, Engineering elements etc.**

- Clear understanding of downline clash risks during project
- Clearly defined roles and responsibilities for 'authority to move' process, alarm cancelling, critical asset location data review & approval
- Suitable positioning system for project vessel/s and all downlines, with constant monitoring of positioning and system integrity
- Complete, accurate and current database of all relevant surface, in-water and seabed assets, including mobile systems – correctly and fully transferred to online positioning system
- Appropriate level of automated positioning alarms for unplanned incursions / proximity alerts
- Appropriate supply of live positions of mobile assets to positioning system
- Checklist utilised to manage downline operations and clear identification of downlines, transit routes, exclusion zones etc
- Briefing of online positioning graphics display for all relevant vessel personnel



# Discussion and Q&A

A PDF version of this presentation will be made available to all attendees shortly after the event

IOGP Report 685 can be downloaded from the IOGP Geomatics publications bookstore at:

<https://www.iogp.org/bookstore/portfolio-item/geomatics/>





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