Trial Protocol for the Validation of ROV Technology as an Equivalency to Manned Entries as Part of Internal Inspections On Floating Production, Storage and Offloading Systems

Recommended Document Retention: ADM220 Administrative, Policy, and Procedures; Policy, Directives, and Procedures.

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01	David Power *ConocoPhillips*	Peter White *Husky Energy*	ROV Task Force	(MM/DD/YY)	(Draft / Issued for Use)

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1.0 UNDERSTANDING AND DISCLAIMER

Each participant in this study shall incorporate this Protocol in its work and shall follow its own business and health safety and environment processes respecting work that each participant performs for this data collection effort and study. Each participant in this study shall bear its own costs and risks for its participation in this data collection effort and study.

2.0 PURPOSE

The purpose of this document is to detail the process in trialing ROV technology in the execution of internal asset integrity and Classification Society inspections as an alternative technique to human intervention in way of floating production, storage and offloading systems in an offshore environment.

Certain processes however will not be substituted to human entries into confined spaces and the trial program will determine the limitations and validate the technology's abilities as an equivalent method of inspecting clean and ballast water tanks in certain inspection criteria.

3.0 SCOPE

The primary objective of the campaign is to validate the application of ROV to perform GVI through the collection of data. Secondly, during the trials, another primary objective is to investigate the potential to extend the technology to CVI and certain NDT techniques.

The trial program is aimed at floating production, storage and offloading systems specifically that traditionally have "cleaner" water ballast tanks. By nominating this category of vessel it will provide a more objective determination of the capabilities and provide the Classification Societies an opportunity to evaluate the technology in the "ideal" environment before considering alternative applications.

The candidate vessels should have a Classification Society risk based or periodic inspection program in place. The objective is to have a Classification Society representative from validation task force in attendance to observe the process. It is also likely that each major Classification Society will be represented in the candidate vessel selection process.

4.0 DEFINITIONS / ABBREVIATIONS

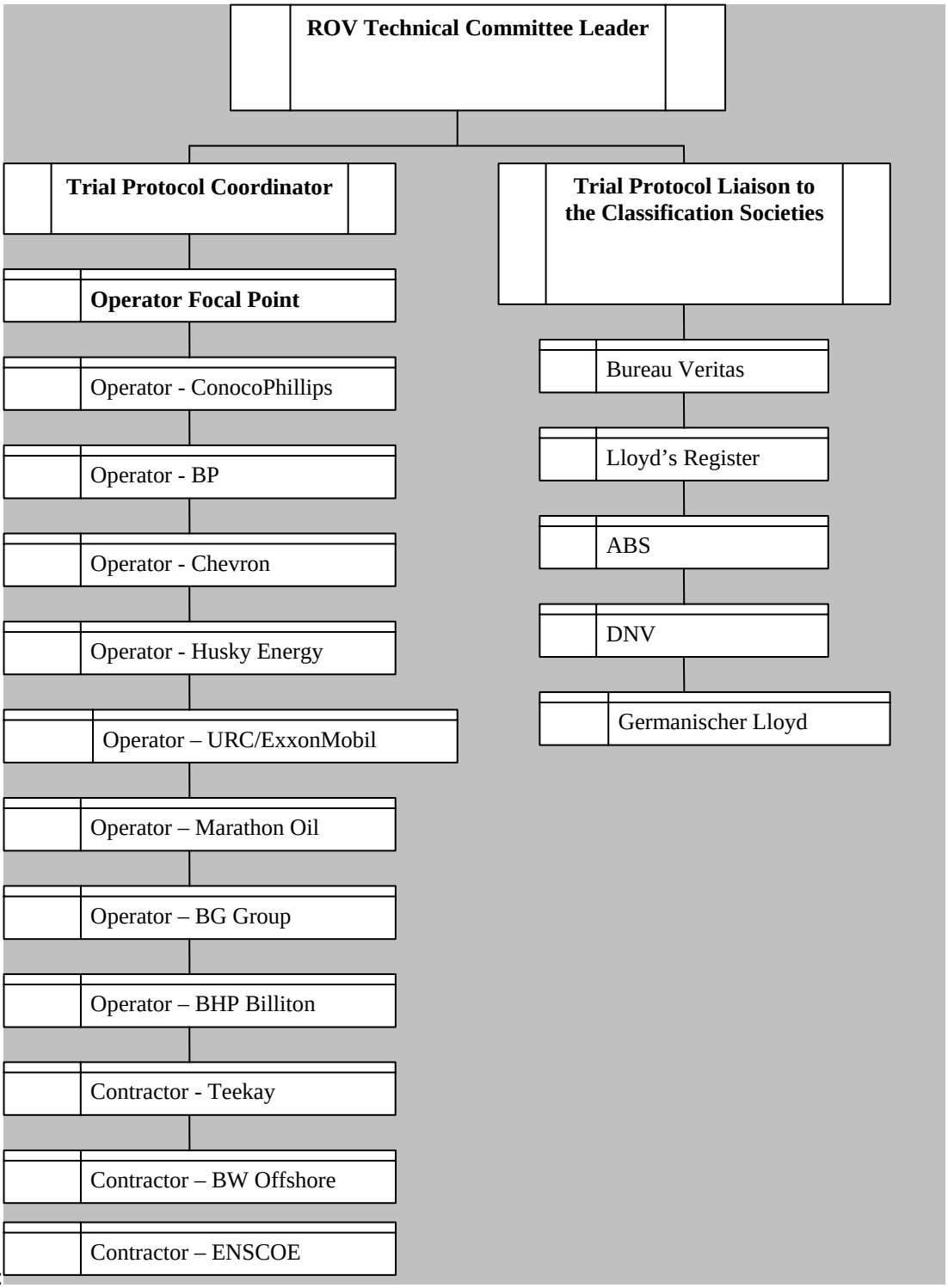
BOSIET	Basic Offshore Safety Induction & Emergency Training
CVI	Close Visual Inspection
F(P)SO	Floating (Production) Storage and Offloading facility
GA	General Arrangement
GVI	General Visual Inspection
IACS	International Association of Classification Societies
JIP	Joint Industry Project
JSA	Job Safety Analysis
MIST	Minimum Industry Safety Training (oil & gas sector)
NDT	Non Destructive Technique

Personnel	Individuals participating in the Trial Protocol, whether they are employees of participating companies, employees of contractors, agents, or representatives of participating companies and their contractors.
ROV	Remote Operating Vehicle
SMS	Safety Management System
TBOSIET	Tropical Basic Offshore Safety Induction & Emergency Training

5.0 PROCEDURE

5.1 Task Force

An industry task force will be appointed to coordinate the trial protocol and gather results or data. The function of the task force will be to keep the momentum such that the goals can be achieved as outlined in Phase 1 and 2 of the JIP. The structure of the task force is outlined below:


ROV Technical Committee Leader
Trial Protocol Coordinator
Trial Protocol Liaison to the Classification Societies
Operator Focal Point
Operator - ConocoPhillips
Operator - BP
Operator - Chevron
Operator - Husky Energy
Operator – URC/ExxonMobil
Operator – Marathon Oil
Operator – BG Group
Operator – BHP Billiton
Contractor - Teekay
Contractor – BW Offshore
Contractor – ENSCOE
Bureau Veritas
Lloyd's Register
ABS
DNV
Germanischer Lloyd

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5.1.1 Roles and Responsibilities

ROV Technical Committee Leader – is to apply to the peer group of operators and F(P)SO contractors to nominate candidate vessels suitable for the trials to be performed. In addition obtain basic information as to the structure and the details outlined in section 4.2. The Technical Committee Leader is also responsible for monitoring the program that was established as part of Phase 2 and to coordinate the meetings for follow-up and scheduling of Phase 3 and beyond.

Trial Protocol Coordinator – coordinates the trials by working with the Operator/Contractor *Focal Point* to appoint an appropriately qualified ROV Vendor for trial planning and execution on the candidate vessel. In the planning the coordinator will need to provide generic safety management process established by the task force to ensure that the Operators are confident that considerations for HSE have been addressed.

Trial Protocol Liaison to the Classification Societies – tracks the approval process through contact with the representatives from the Classification Societies. Schedules routine conferences to obtain information with respect to how their respective technology and procedure departments are assessing the results. In addition coordinates the logistics with the representatives with respect to mobilizing to a trial site.

Operator Focal Point – is defined as the appointed representative within the Operator's organisation and forms part of the single point of contact to coordinate activities. Is responsible for ensuring contractor and task force representatives are inducted into the Operator's Safety Management System.

Operator – is defined as one of the peer group of energy producers that participated in the Phase 1 and 2 Workshops.

Contractor – is defined as one of the F(P)SO contractors that operate the facility on behalf of the Operator and participated in phase 1 and 2 of the workshop.

Classification Society Surveyor – is a representative from the appointed Classification Society that has been deemed competent and accredited in accordance with IACS Procedural Requirement No.7 - *Procedure for the Training and Qualification of Survey and Plan Approval Staff*

5.2 Vessel Selection

The vessel selection process is voluntary by the task force members however some guidance should be followed as close as possible to provide authenticity to real life applications. The mission is to provide trials that validate the technology application for an F(P)SO or equivalent. Shuttle tankers and trading tankers that frequently load and discharge ballast water from various origins should not be nominated as the clarity will be affected by mud and sediment. F(P)SOs that operate in an open ocean environment are preferred as candidate vessels.

Considerations in nominating a candidate vessel shall include:

- Age of hull – vessels that have not had their first special survey or equivalent are not recommended. Target age between 6 and 20 years to provide authentic results.
- Tank construction and complexity – to emphasize the ability for the vehicles to reach complex areas rather than limit to "box shaped" structures
- Geographic location with respect to mobilization of ROV contractor and Classification Society delegate
- Simultaneous operations and maintenance considerations during the trial protocol period
- Availability of the operator focal point and a representative from the Classification Society

- Provision of clear, legible GA and "As-built" documentation available for navigation.
- Access arrangement typical to tank and ship construction in accordance with BS ISO 5894: 1999.
- Adequate available bed space for the team who will perform the trails offshore

5.3 Health and Safety

5.3.1 Safety Management

Safety Management will be controlled through the vessel operator's SMS Processes. It is anticipated that in some aspects contractors and other task force representatives may require induction or training prior to mobilization. It is the responsibility of the Operator Focal Point to ensure Personnel are adequately prepared for mobilization to the offshore environment.

5.3.2 Formal Safety Assessments

All active Personnel participating in the trial protocol shall complete a formal safety assessment with the offshore facility teams to ensure all associated risk or hazards with the installation have been identified and controlled accordingly to minimise exposure to Personnel. It is encouraged that all parties contribute to convey understanding of the activities and that Personnel are aware of the controls.

A site specific JSA and pre-task toolbox talks should be conducted since the technology may not have been used in any other application or campaign form. A permit to work should be obtained as required by the vessel operator's SMS process. Localised hazard identification at these forums will enhance the safety further and reduce the likelihood of accidental damage to the ROV assets.

Specific consideration to operating in a potential gas hazardous environment shall be addressed in the control of the electrical equipment whilst utilizing the vehicle. Although the vehicle itself may have some sort of EX or IP hazardous area classification, the control units, visual equipment and the junctions may not be suitable for operation in the hazardous area zone. Control of this shall be managed through the facility safety management processes.

Cables and tethers shall as far as reasonably practicable be elevated or run such they do not pose a trip hazard. The control units and imaging equipment may in fact be situated in a remote location from where the vehicle is launched. Area responsible technicians may assist in the work site set up and preparation.

5.3.3 Personal Protective Equipment

All Personnel participating in the trial protocol shall comply with the minimum PPE requirements identified in the Operator's Safety Management System. In some applications there may be a requirement for additional protective equipment identified in the pre-job formal safety assessment or JSA:

- Fall protection equipment
- Respiratory protection
- Upgraded eye protection

All Personnel that will be working over open hatches or lids as part of the launching, retrieving or tether management process shall wear some form of fall protection equipment applicable to the standards in the region of operation or in accordance with the facility SMS.

5.3.4 Mobilisation of Personnel and Equipment

Vendors providing the ROV technology shall at their own expense have the minimum training requirements for heading offshore in the sector where the trials are proposed.

The mobilization of vehicle and equipment shall so far as practicable be compact and portable enough to be loaded onto a helicopter. No single piece of equipment should exceed 23 kilograms (50lbs) or packed in such a manner that the equipment is not able to be packed in the tail section of an AS332L Supa Puma. Equipment that is mobilized by crew boat or similar shall be packed in water tight cases and have adequate means of hand carry ability across the deck.

5.4 The ROV

As with any type of confined space inspection, there are two major concerns - getting in, and getting out. The small footprint of the suitcase ROV makes entry via small hatches and other types of opening possible. A detailed map of the tank is required such that the progress of the vehicle can be monitored. It is the responsibility of the Focal Point and responsible technicians to monitor the progress whilst satisfying the requests from the Classification Society Surveyor to target specific structures.

A major advantage of the suitcase ROV is the ability of the surveyor to interact with the ROV operator to view specific items/areas or return to an area for a second look.

5.5 Inspection Type – GVI

Establish the benchmark by conducting actual tank inspection trials with an ROV as a comparison to manned inspection results. Variables to consider during the execution include:

- Tank configuration,
- Number and type of pipes,
- Number and type of fittings,
- Access to tight spaces and difficulty of navigation
- Ability to track ROV position and perform visual coverage of the entire inspection area, ensuring that no locations are missed,
- Clarity of visual display,
- Anomaly identification ability (i.e. type, size, severity, etc.)

Attempt to obtain clear legible footage during the trial utilizing pre-identified datum points. Where ever possible zoom and focus on corners or complex structures. If the vehicle is installed with a manipulator or other accessory, then trial it to demonstrate the ability to remove debris, scale etc. Also demonstrate the light penetration and long range or zoomed views. The ability to take video footage of the under deck structures will also need validating by swimming the vehicle vertically and having the camera focus on the corners and other structures. Ensure all Classification Society GVI requirements are met.

Specific structures that will require validating footage are identified in document IACS Recommendation 96 *Double Hull Oil Tankers – Guidelines for Surveys, Assessments and Repair of Hull Structures*.

5.5.1 Data Collection

The data, footage and validation material will be reviewed by the Task Force delegates. Form 4.5.1 that forms part of Attachment 1 will need to be completed by the surveyor in attendance. Comments with respect to the benefits and limitations should be noted to better understand the vehicle capabilities. Data will be collected and presented at the review process.

To better understand the magnitude of the scope and achievements during the trial, copies of the progression dossier shall be submitted that includes:

1. Vehicle navigation plan
2. General arrangement or "as-built" drawings
3. Supporting reports identifying anomalies.

Please send completed forms and planning dossiers to the ROV Technical Committee Leader:

- HOLD – Appointment Detail

5.5.2 Feasibility Assessment Matrix

In addition to the data collection, the Feasibility Assessment Matrix will need to be updated with the results to collectively identify the limitations of the trial program and for the ROV Operators to better understand where there is opportunity for further development.

It will be the responsibility of the ROV Trial Protocol Coordinator to populate the Feasibility Assessment Matrix once the completed forms 4.5.1 are received. The image/footage and information with respect to accessories will need to be archived for future evaluation by the technical committee task force members identified in section 4.1.

The Feasibility Assessment Matrix is attached as part of Attachment 2 for reference.

5.6 Inspection Type – CVI

This type of inspection does pose some recognized challenges as typically it requires the Classification Society Surveyor to be at "arms length" or reach by hand. Document IACS Recommendation 96 *Double Hull Oil Tankers – Guidelines for Surveys, Assessments and Repair of Hull Structures* details the specific process that would be adopted in performing CVI. To perform it correctly the surveyor would remove scale, debris and mud to access the surface intended to be inspected. ROV contractors that have accessories that are adaptable for tool operation or manipulation to effectively perform basic debris removal or surface preparation should trial this during the GVI campaign. This will enable further research and development into what accessory enhancements would be required to perform equivalent inspections to manned entries.

CVI inspections that are scheduled during the trial program may prove to be difficult to plan and coordinate without incurring significant interruptions to operations. Largely that the facility Personnel would have performed large scale preparation for confined space entry that includes, comprehensive isolations,

adjusting cargo and other ballast for list, trim and stress as well as the segregation of the rundown to maximize the inspection window of opportunity.

It is for this reason as part of the Trial Protocol that it is not recommended to prove equivalence for manned entry to perform CVI at this stage. If however operators are willing to manage the disruption then the CVI trial may proceed.

6.0 REFERENCES

- IACS Recommendation 96 *Double Hull Oil Tankers – Guidelines for Surveys, Assessments and Repair of Hull Structures*
- BS ISO 5894: 1999
- IACS Procedural Requirement No.7 - *Procedure for the Training and Qualification of Survey and Plan Approval Staff*
- *Using Suitcase ROVs for Internal Asset Integrity Inspections on Floating Drilling, Production Storage and Offloading Systems* – presentation from Will Boytim, PE and Steve Van Meter
- Form 4.5.1 – *Trial Protocol Validation Form*

7.0 ATTACHMENT 1 – FORM 4.5.1

Submit by Email | Print Form

Form 4.5.1 - ROV Trial Validation Form

ConocoPhillips

Name:	
Title:	
Classification Society:	
Phone:	

ConocoPhillips
600N Dairy Ashford
Houston, Texas
USA
77041
Phone: +1-281-293-3148
Fax: +1-281-293-4424
www.conocophillips.com

Facility Name:

Facility Type: ☐ FPSO ☐ FSO ☐ TLP ☐ Semi-sub ☐ FPU ☐ FSRU ☐ Other

Age of Hull: Yrs Weather: ☐ Good ☐ Fair ☐ Adverse

Date	Tank No.	Structures Observed	ROV Footage Viewed	Gap Observed

Gap Descriptions:

Surveyors Comments:

Operations Focal Point :

Surveyor:

Limitations During Trial:
☐ Poor Visibility
☐ Facility Movement
☐ Technical Difficulty
☐ Time Constraints
☐ SIMOPS
Other: _____

Special Instructions: Please e-mail or scan and send the completed form to the Trial Protocol Coordinator as soon as possible after completion of the campaign. Copies can be retained by the surveyor.

8.0 ATTACHMENT 2 – FEASABILITY MATRIX

Feasibility Assessment Matrix Data Collection

Facility Name:
Facility Type:
Classification Society:
Facility Age:

Type of Inspection	Current Practice	ROV-Assisted	Gaps or Limitations	Surveyor's Comments	Equivelancy to Manned Entry	Technical Challenges for Equipment
GVI	Visual, walk around, human intervention, company and class personnel, looking for significant defects and coating breakdown, foreign objects	YES				
CVI	"Arms-length" visual, walk around, human intervention, company personnel and class surveyor, looking for localized defects, suspected damages, typically requires more effort (rope access or scaffolding), needs manual dexterity (chipping scale, measuring pits)	YES				
Crack Verification & Measurement	MPI, UT, ET, PT, all techniques require a high dexterity and training, high level of skill, cleaning required, dryness	LIMITED				
Coating & Corrosion Survey	Visual, estimate areas, types of breakdown (e.g. blistering or peeling), coating thickness; Check anodes	YES				
Leak Detection (Piping)	Vision inspection and/or using your senses (smell) , use of dye injection, soap test, turbulence, gas alarms	YES				
Thickness	Use of UTM teams, difficult access	LIMITED				
Tank Pressure Test	*Not achievable - no further consideration during the trial period*					