Guidance on
Module Outlines for ROV-Related Training Courses

International Marine Contractors Association

www.imca-int.com

IMCA R 010 Rev. 1
November 2016

The International Marine Contractors Association (IMCA) is the international trade association representing offshore, marine and underwater engineering companies.

IMCA promotes improvements in quality, health, safety, environmental and technical standards through the publication of information notes, codes of practice and by other appropriate means.

Members are self-regulating through the adoption of IMCA guidelines as appropriate. They commit to act as responsible members by following relevant guidelines and being willing to be audited against compliance with them by their clients.

There are three core activities that relate to all members:

- Competence & Training
- Lifting & Rigging
- Safety, Environment & Legislation

The Association is organised through four distinct divisions, each covering a specific area of members' interests: Diving, Marine, Offshore Survey, Remote Systems & ROV.

There are also five regional sections which facilitate work on issues affecting members in their local geographic area – Asia-Pacific, Central & North America, Europe & Africa, Middle East & India and South America.

IMCA R 010 Rev. 1

This guidance was prepared by the Training Steering Group of the IMCA Remote Systems & ROV Division Management Committee and the Competence & Training Core Committee.

www.imca-int.com/rov

If you have any comments on this document, please click the feedback button below:

feedback@imca-int.com

Date	Reason	Revision
November 2003	Initial publication	
November 2016	To reflect current practice and to align with IMCA R 002	Rev. 1

Guidance on Module Outlines for ROV-Related Training Courses

IMCA R 010 Rev. 1 – November 2016

1 Introduction

This document has been produced to present a modular approach to ROV training in order that training can be tailored to the level of previous experience of someone entering the industry.

It has been designed to follow IMCA R 002 – *Entry level requirements and introductory modular course outline for new remotely operated vehicle (ROV) personnel.*

Details of the competence requirements for ROV personnel are contained in the latest revision of IMCA C 005 – *Guidance on competence assurance and assessment: Remote Systems & ROV Division*. In the entry level requirements for ROV/pilot technician grade II, contained in that document; it specifies that such personnel should meet the requirements as set out in this document.

It shall be noted that the information contained within this publication is intended to set out the requirements for new personnel to receive an introductory course in ROV systems. This training should not be construed as achieving any level of competence defined in IMCA C 005.

Further, any party wishing to follow the guidance as provided in this publication shall not issue any qualification or certification that claims to be 'IMCA-approved' or recognised.

This document is not intended to be exhaustive in its description and outline of the technical background, typical qualifications and character traits that would apply to new personnel to the offshore ROV industry. Nor is the suggested content of the framework guaranteed to satisfy the demands of safety awareness in a constantly changing industry that can be challenging, exciting and rewarding to be a part of.

2 Glossary of Terms and Abbreviations

A	Amps
AC	Alternate current
API	American Petroleum Institute
CWDM	Coarse wavelength division multiplexing
dB	Decibel
DC	Direct current
DOL	Direct on line
DVD	Digital versatile disc
EPDU	Electrical power distribution unit
GFD	Ground fault defect
HD	High definition (video)
HP	High pressure
HPU	Hydraulic power unit
HV	High voltage
I/O	Input/output
IP	Ingress protection
ISO	International Organization for Standardization
IT	Information technology
LARS	Launch and recovery system – a lifting device that can be used to deploy the ROV, with or without a TMS, from the support vessel or installation overboard into the water and lower it to the working depth, or recover the ROV from depth and transfer it from the surface of the water back to the support vessel or installation. LARS may be a combination of winches, cranes, A-frames, etc. and may be hydraulically or electrically powered
LIM	Line insulation monitor
LP	Low pressure
LPF	Low-pass filter
LV	Low voltage
MMS	Maintenance management system
MUX	Multiplexer
NAS	National Aerospace Standard
OL	Overload
PCB	Printed circuit board
PDU	Power distribution unit
PID	Proportional, integral, differential

Pilot	A person who has been specifically trained and assessed/verified as competent to operate and maintain the ROV System, including the 'flying' of the ROV in water to accomplish its tasks/operations
PLC	Programmable logic controller
PMS	Planned maintenance schedule
PPE	Personal protective equipment
PTFE	Polytetrafluoroethylene is a synthetic fluoropolymer of tetrafluoroethylene that has numerous applications
PTW	Permit to work
RC	Resistor-capacitor
ROV System	The collection of equipment that comprises, but is not limited to, the ROV, the handling system, the surface control system and all associated peripheral equipment
ROV	Remotely operated vehicle – the common term for an unmanned, underwater vehicle that is controlled from the surface by a pilot via a cable and is, in itself, a collection of equipment used in water with an ability to observe the surroundings and, in certain circumstances, intervene/interact with underwater infrastructure
RP	Recommended practice
RS	Recommended standard
SD	Standard definition (video)
SWL	Safe working load
SWR	Steel wire rope
TMS	Tether management system – may be described as a 'cage' or a 'top hat', but both types essentially house a submersible winch which controls the deployment of a neutrally buoyant cable, or tether, connected to the ROV
V	Volts
WDM	Wavelength division multiplexing
WLL	Working load limit

3 Application and Delivery

This guidance is intended to apply internationally, but it is recognised that some countries will have regulations that require different standards or practices to be followed. Where local or national regulations are more stringent than those contained herein, they will always take precedence over this guidance.

The modules contained in this document are aimed at personnel with an appropriate technical background as set out in IMCA R 002. They have been developed to lead on from the introductory course modules 1-3. However, it is the company's responsibility to determine if an introductory course is required and if the company deems it unnecessary an individual could, with acceptable experience and qualifications, commence training at module 4.

It is suggested that the modules contained in IMCA R 010 can be undertaken in sequence or in isolation (depending on the training need of the individual or company), but it shall be a requirement that all modules be completed or otherwise evidence provided, to the company's satisfaction, for a new entrant to be granted exemption from completing the same.

4 IMCA R 002 – *Entry Level Requirements and Introductory Modular Course Outline for new Remotely Operated Vehicle (ROV) Personnel*

This document sets out the basic entry-level requirements for personnel new to the industry with no prior relevant offshore experience. It also set out an ROV familiarisation course. It is recommended that these new personnel attend an introductory course before the first offshore trip. However, it also notes that it was not a prerequisite for personnel to attend such a course.

IMCA R 002 sets out the initial familiarisation course modules which are based on the topics listed below, but can be further adapted or developed by ROV contractors and/or training establishments to suit specific company needs.

It is highly recommended that personnel new to the ROV industry meet the minimum requirements described in IMCA R 002 and receive an initial ROV familiarisation before their first trip offshore. This can be provided by an ROV contractor, or alternatively by an appropriate training establishment.

ROV familiarisation course modules for people new to the industry should cover three areas as a minimum:

1. Health, safety, environmental and quality;
2. ROV industry;
3. Background and introduction to ROV systems.

The aim of these familiarisation course modules is to give new entrants to the offshore ROV industry an understanding of the safety awareness implications of the industry, provide them with an overview of the industry and offer basic information on the background to the ROV systems they may encounter.

Further information on the content of these modules can be found in IMCA R 002.

5 IMCA R 010 Outline Syllabus

The modules contained in this document are aimed at personnel with an appropriate technical background as set out in IMCA R 002. They have been developed to lead on from the introductory course modules 1-3. However, it is the company's responsibility to determine if an introductory course is required and if the company deems it unnecessary an individual could, with acceptable experience and qualifications, commence training at module 4.

It is suggested that the modules contained in this document can be undertaken in sequence or in isolation (depending on the training need of the individual or company), but for a new entrant to be granted exemptions from completing same, evidence should be provided to the company's satisfaction.

Module:

4. ROV electrical systems;
5. ROV electronic and control systems;
6. ROV mechanical and hydraulic systems;
7. ROV system/equipment maintenance;
8. ROV system/equipment operations;
9. ROV tooling and ancillary sensors;
10. Lifting operations.

Each module provides an outline of the topics that are recommended to be covered in such training, rather than providing detailed information on the contents. It is envisaged that training establishments and/or ROV contractors might wish to develop courses based on the topics outlined, but tailored to suit specific personnel/ company requirements. The suggested courses are intended to provide an overview of the proposed topics, rather than detailed information.

It should be noted that none of the courses suggested in this document are mandatory or a prerequisite under IMCA's Competence Assurance & Assessment guidance or schemes based thereon. The outline course syllabus has been developed to aid members in setting up appropriate courses, where they feel that their personnel would benefit from formalised training. It is not intended that personnel need to have attended a formalised training course to demonstrate the appropriate knowledge during a competence assessment.

The elements of each module should be delivered in a properly structured format and preferably in accordance with a set of coherent instructional specifications detailing each training objective and their associated enabling objectives. In this way courses can be delivered to an assured standard by different instructors and thereby all key training objectives can be met. If a trainee is absent for an element of the course, the training provider will be able to state exactly which training objectives have not been completed by the individual and thereby enable any gap in training competency to be addressed. Some of these will be delivered through practical, 'hands on' sessions and others through theoretical tutoring, especially where these relate to hazardous activities and emergency procedures. The maximum use should be made of appropriate training tools such as simulators, static displays and training vehicles. Instructors should always ensure that trainees understand that the ROV systems they end up working on in industry will almost inevitably be different to the equipment used in training.

6 Content of Training Course Modules

The content of the course modules detailed in section 5 are provided below. Every module should always commence with a system safety awareness brief to cover any aspect of occupational health and safety involved in the completion of the module. Any PPE requirements or permit to work procedures should always be adhered to by both instructor and trainee.

Module 4 ROV Electrical Systems

Training Objectives

Trainees should be able to:

- Interpret an electrical schematic diagram for a typical ROV including, identifying the major units and the types of signals on the interconnecting wiring on surface and subsea systems;
- Be able to use the following test equipment:
  - digital multimeter
  - insulation resistance tester;
- Conduct the following tests, using an umbilical chart and understand what constitutes an acceptable reading for:
  - continuity/resistance
  - insulation resistance;
- Identify simple long line faults using diagrams (SI units) and test equipment.

Enabling Knowledge Training

Electrical Principles

Enabling Objectives:

a) Trainees should understand the basic concepts of electrical engineering including, resistance (Ohm's law); power and apparent power; inductance; capacitance and 3 phase supplies;

b) Understand and describe the function of the main units in an ROV electrical power distribution block diagram to include the AC/DC power supplies and the following elements or component parts:

- 3 phase/single phase
- Surface electrical
- Subsea electrical (including HPU and EPDU)
- Electrical payload and typical option configuration
- Vehicle setup and configuration (circuit diagrams)
- HV familiarisation and awareness (refer to IMCA R 005)
- Fault finding exercises
- Voltage, current, resistance
- Series, parallel circuits
- Ohm's law
- Electric power
- Common electrical symbols
- Reading electrical schematics
- Motor starter DOL (OL protection, control interlocks)
- Motor starter star-delta (OL protection, control interlocks)
- Troubleshooting electrical automated systems
- AC parameters (frequency, period)
- PDU
- Step up and step down transformers
- LIMs/GFDs

- Rectification
- Filters (RC, LPF low/high pass)
- Construction of umbilical and tethers.

Electrical High Voltage Safety Systems

Enabling Objective:

Trainees should be able to describe the principles of the following elements:

- Effects of electric current on the human body
- How burns of electric origin can result
- First-aid actions and treatment of electric shock
- Generic company HV safety policies
- Risk assessment
- Advantages of high voltage in generation and transport
- HV hazards
- ROV HV system including approach and workflow (TBT, JRA, IC, LOTO, PTW, SFT)
- Personnel competence and responsibilities – Limitation of access
- Isolated and dead circuits
- Earthing and bonding

Safe Systems of Work

Enabling Objective:

Trainees should be able to describe the principles of the following elements:

- Safe electrical working practices
- Assessment procedure for working dead
- Labelling HV equipment
- Discharging cables and umbilicals
- Attachment of additional earths
- Selection of testing equipment, correct use and storage
- Selection of PPE, correct use and storage
- Fire extinguishing equipment
- PTW systems
- IP ratings
- Thermal overload

Test Equipment

Enabling Objective:

Trainees should be able to describe the function and uses of the following components:

- HV probes and testers safely including proving/checking HV probes and testers
- LV test probe
- Electrical equipment and methods
- Multimeter (V, A, Ohm, diode meter)

- Transformer
- Relays
- Fuses
- Circuit breakers
- AC and DC motors (properties, parameters)
- AC motor capacitors (run, start)
- AC motor soft starter
- DC motor drive
- ROV electrical thruster

Worksite Safety

Enabling Objective:

Trainees should be able to describe the function and uses of the following components:

- Protection systems
- Insulation resistance meter (characteristics, hazards)
- Ground fault monitors/interrupt (line insulation monitor)
- ROV low voltage and high voltage protective systems
- Residual current devices
- Hazardous areas and flame proof equipment
- Explosive hazard areas and equipment rating
- Flameproof enclosures and characteristics
- Cable glanding and transit devices

Module 5 ROV Electronic and Control Systems

Training Objectives

Trainees should be able to understand the following:

- Basic concepts of data transmission including RS232, 485, Ethernet and fibre optics
- Methods by which components on the ROV are controlled, e.g. thrusters, lights, tools etc.
- Typical control sensors on the ROV e.g. temperature, pressure, oil level indicators
- Basic method for setting up a control system
- Basic principles of optical fibre data transmission including capabilities and limitations

Enabling Knowledge Training

The trainee requires knowledge of a typical ROV control system including:

- Functions of a control system
- Key components
- Overview of the set up and diagnostic pages
- Basic maintenance activities
- Basic cyber/IT security precautions

Basic principles of optical fibre data transmission including capabilities and limitations

Enabling Objective:

Trainees should be able to describe the principles of optical fibre data transmission including the following elements:

- Electronic control systems (principles)
  - Basic requirements of an ROV electronic control systems
  - Introduction to control systems, power management and data protocols
  - Handling PCBs
  - Introduction to regulated and unregulated power supplies
  - Types of electrical and electronic connectors
  - Types of semiconductors
  - Introduction to PLC systems as used on ROVs
  - Digital communication basics
  - Binary system including bits and bytes
  - Transmit–receive termination/clock and digital coding
  - Communication link parameters (baud, management bits)
  - Protocol RS232 (hardware characteristics)
  - Protocol RS485/422 (hardware characteristics)
  - Multiplexer, demultiplexer
  - ROV communication (via copper) long line architecture (telemetry, auxiliary channels, multiplexing)
  - Vehicle setup and configuration (electronic system drawings)
  - Basic electronic fault finding techniques
- Fibre optics (principles)
  - Introduction to fibre optic systems
  - Single-mode/multi-mode systems
  - How losses are incurred on a system
  - Bandwidth
  - Baud rate

- Capabilities and limitations of a fibre system
- Fibre optics safety and operations
- Light characteristics (wave length, colour spectrum)
- Fibre optic characteristics
- Optical communication advantages over electrical systems
- Fibre optic types (cable types, single-mode, multi-mode, sizes)
- Fibre optic media parameters
- Introduction to the 'dB' and methods
- Fibre optics termination connectors
- Termination and line integrity analysis (microscope, visual light, optical power meter, optical time domain reflectometer)
- Specific losses/loss budget/optical meter correct use
- Correct maintenance of terminations and hazards
- ROV fibre optic equipment
- Optic MUX (common configurations)
- CWDM (common configurations and wavelengths)
- Redundant optical link systems
- ROV communication (via fibre optic) long line architecture and specific loss budget
- Working with fibre optic hazards

Key components of a typical ROV control system

Enabling Objective:

Trainees should be able to describe the function of the following components:

- Electrical connections
- Multiplexer systems
- Fibre multiplexers (video MUX and WDM)
- Interface cards
- Analogue and digital I/O cards
- Power supplies
- Input devices (joysticks, switches)
- Output devices (valves, lights, cameras)
- ROV propulsion and control (PIDs, auto-functions etc.)
- Vehicle set-up and configuration (circuit diagrams)
- Fault-finding (exercises)

Overview of the set up and diagnostic pages on a control system

Enabling Objective:

Trainees should be able to describe the set-up procedure and meaning of the diagnostics messages/read out of the following elements:

- Thruster diagnostics
- Valve pack diagnostics
- Alarms and sensors
- Alarms pages
- Calibration pages
- Signal status page

Basic maintenance activities required in a control system

Enabling Objective:

Trainees should be able to describe the basic maintenance requirements including the following:

- Board replacement
- Control card set-up requirements
- Testing voltages
- Using the system diagnostics
- Testing a telemetry system
- Interfacing sensors to control systems
- Basic understanding of security requirements for control system computers

Module 6 ROV Mechanical and hydraulic systems

Training Objectives

Trainees should be able to understand the following:

- Basic concepts of hydraulics including, pressure; flow; viscosity and types of hydraulic fluid
- Purpose and operation of hydraulic valves (directional, solenoid, pressure control, check and servo/ proportional valves).
- Main types of hydraulic pump and the construction and operation of an axial piston pump
- Soft start systems
- Types and applications of hydraulic seals
- Function of compensators and accumulators
- Function of linear and rotary actuators

Enabling Knowledge Training

Hydraulic Engineering Principles

Enabling Objective:

Trainees should be able to describe the principles used in hydraulic circuits on ROV systems and understand routine instructions, circuit diagrams, the control of pressure, direction and flow with respect to actuators. The following topics constitute the recommended minimum level of detail required:

- Pascal's law
- Storage of energy
- Hydraulic definitions and oil characteristics
- Advantages over electric power
- ROV compensator (electrical and hydraulic power circuits)
- Check valve (simple, adjustable threshold)
- Hydraulic piston, gear, vane, variable displacement pumps
- Filter (solids, water)
- Heat exchanger
- Cavitation/aeration
- Positive pressure inlet loading
- Pressure, flow, restriction
- Parallel and series paths
- Linear actuators (types, work, speed, forces)
- Adjustable flow control restrictor
- Hydraulics lines (steel pipe, steel tube, flexible hose)
- Hydraulic, pilot, case/drain lines
- Pressure relief, release/pressure reducing valve
- Hydraulic motors and thrusters
- Directional control valve
- Valve configuration and application (sequence, counterbalance, reducing, brake, cross port, etc.)

- Fittings (common ROV types and characteristics)

Equipment Hydraulic Systems

Enabling Objective:

Trainees should be able to describe the functions of the component parts of the hydraulic system on ROV systems and identify them on a hydraulic circuit diagram to including the following key components:

- Hydraulic power unit
- Valve packs
- Pressure relief valves
- Pressure reducers/regulators
- Flow control valves
- Compensators (or accumulators if applicable)
- HP/LP manifolds
- Filters
- Actuators

Safe working practice

Enabling Objectives:

a) Trainees should be able to describe the key elements of safe working practices used during the maintenance of ROV hydraulic systems.

b) Under supervision, trainees should be able to remove, inspect and replace hydraulic valves, actuators and select appropriate hydraulic hose, for pressure or suction as indicated in system documentation.

c) Trainees should be able to identify common hydraulic faults and the actions needed to repair them from a given set of symptoms.

To achieve the enabling objectives instruction in the following topics is required:

- Sources of contamination; equipment failure due to contamination and contamination control
- Procedures for conducting an oil and filter change on specific marine equipment
- Reasons for conducting oil/filter changes
- Hydraulic safety and the hazards associated with system pressure testing
- Control valve maintenance
- Hydraulic pumps failures and maintenance
- Linear actuator maintenance
- Maintenance of compensators and accumulators
- Types and use of hydraulic fittings and seals
- Selecting appropriate hydraulic hoses/tubing
- System set up procedures
- Fault finding processes

Module 7 ROV system/equipment maintenance

Training Objectives

Trainees should be able to understand the following:

- Types of ROV system maintenance
- Electrical, mechanical and hydraulic equipment maintenance management systems (MMS)
- Fault diagnosis and rectification

Enabling Knowledge Training

ROV system/equipment maintenance concepts, protocols and procedures

Enabling Objectives:

a) Trainees should be able to describe the principles, procedures and requirements of MMS for ROV equipment.

b) Trainees should be able to understand routine instructions, maintenance checklists, record keeping, scheduling and procedures for fault diagnosis and rectification.

The following topics constitute the recommended minimum level of detail required:

- Type of maintenance – planned, unplanned, predictive/condition based
- Maintenance management – data, accuracy, reliability, vehicle setup and configuration (circuit diagrams)
- Adherence to a general management model for maintenance and to be capable of identifying the correct use of forms and corporate document control and retention, for example:
  - Equipment failure report (opened/closed status) – inventory of ongoing or closed faults, to be repaired as per standard system design
  - Modification logs (opened/closed status) – inventory of in-use modifications and reverted to standard modifications, as for repairs or improvements outside of the standard system design; mandatory updating documentation and diagrams
  - Planned maintenance schedule (PMS) (daily, weekly, monthly, 6-monthly, yearly, etc.) – rationale of undertaking tasks within time-windows; personal initiative and improvement of maintenance schedule in relation to corporate document control
  - Material procurement and inventory responsibility concerning all ROV team members
- Fault diagnosis techniques (ROV centric)
- Electrical maintenance/fault diagnosis
  - Power distribution – Faults, maintenance tasks, earthing connections, conductor crimping trouble-shooting
  - Harnesses – faults, maintenance tasks, trouble-shooting
  - Lighting systems – faults, maintenance tasks, trouble-shooting
  - Motor DOL
  - Subsea connectors (types, characteristics, correct use and maintenance)
  - Subsea ROV cables
  - Continuity and insulation resistance verification
  - Splicing with resin and self-amalgamating rubber and liquid epoxy
  - Electrical thruster maintenance and repair
  - Long line segmentation for troubleshooting (lights, tooling, camera, ground faults)
  - Tether re-termination (soft)
  - Cathodic protection/anodes and ground fault monitors
  - Electrical enclosures maintenance (water ingress, sealing issues, air/gas atmosphere/humidity/liquid contaminants)

- Mechanical maintenance/fault diagnosis
  - Inspection of typical components
  - Cleaning and repair
  - Mating of dissimilar metal components
  - Umbilical re-termination (mechanical)
- Hydraulic maintenance/fault diagnosis
  - System inspection visual/oil testing NAS standards
  - Hydraulic system troubleshooting
  - Hydraulic thruster maintenance and repair
  - Cleaning and repair, flushing use of deck packs, circuit bleeding, purging, flushing, fluid recovery
  - Correct charge/discharge of compensators
  - Correct use of hydraulic seals (including PTFE, liquid sealant)
  - Hydraulic connection/hose degradation (changes in flexibility)
- Data Communications
  - Fibre optic systems – safety, testing, repair, loss budget
  - Serial communication – protocols, testing/fault diagnosis
  - Ethernet communications – protocols, testing/fault diagnosis
  - Ethernet network cables and crimps (UTP/STP, RJ45)
  - Video signal cables and crimps (RG59)
  - Signal termination blocks
- System Level testing/repair
  - Umbilical re-termination
  - Load tests (onshore/offshore)
  - Calibration, burial depth etc.

Module 8 ROV Systems/Equipment Operations

Training Objectives

Trainees should be able to understand the following:

- Generic ROV systems, equipment fit and operational procedures
- Functionality, limitations, use and risks of ROV systems and equipment
- Risk assessment and safety procedures used in ROV operations

Enabling Knowledge Training

ROV Operations and Equipment

Ballast and trim

Enabling Objective:

Trainees should understand the procedures required to adjust and change ballast and trim. This should include:

- Understanding hydrodynamic drag and buoyancy
- Fitting/adjusting ballast and buoyancy ancillaries

Environmental factors

Enabling Objective:

Trainees should understand and be able to describe the affect and impact of environmental conditions on ROV operations. This should include:

- Sea state – wave height/swell
- Surface visibility – low vis/sun glare/precipitation
- Day into/out of night operations
- Wind
- Temperature – high/low – air and water
- Weather forecasting
- Tidal stream assessment/calculation
- Currents (effect on ROV components including ROV, TMS, tether, umbilical)
- Sub-surface visibility – water turbidity
- Seabed types

Launch and Recovery Systems

Enabling Objective:

Trainees should understand and be able to describe the procedures and instructions for the operation of launch and recovery systems. This should include:

- Toolbox talk, launch/recovery procedure, job/task brief
- Description of methodologies for launch and recovery systems
- Principles of heave compensation
- Environmental conditions (see above)
- Permit to work/authorisation

Communications

Enabling Objective:

Trainees should be able to operate and use generic communication equipment used by ROV operators. This should include the correct procedures for communicating via radio or hardwire communication systems. This should include the following topics:

- Correct radio protocol
- Emergency/safety instruction/alerts
- Emergency numbers/safety response procedures
- Back-up systems

Video and Underwater Cameras

Enabling Objective:

Trainees should understand the types of video cameras available and be able to operate and use generic video equipment used on ROVs. This should include the following subjects:

- Visual inspection of camera(s)
- Camera types
- Camera installation
- Video recording systems
- Video equipment documentation
- Video system configuration – DVD, monitor control, overlay

Sonar

Enabling Objective:

Trainees should understand the types of sonars available and be able to operate and use generic sonar equipment used on ROVs. This should include the following subjects:

- Types of sonar
- Basic use of sonar
- Sonar system interconnection
- Interpretation of sonar display screen

ROV navigation and piloting

Enabling Objective:

Trainees should understand the principles of ROV piloting and navigation and be able to control/pilot an ROV under supervision or by using an ROV simulator and demonstrate basic piloting ability. This should include the following subjects:

- Visual navigation
- Compass navigation
- Sonar navigation
- Correct use of automatic functions
- Safe side awareness
- Tether management system:
- Entanglement prevention
- Vessel co-ordination and TMS positioning

- Un/docking from TMS in rough seas

Manipulators

Enabling Objective:

Trainees should understand the principles of using manipulators, the types of manipulators available and limitations/precautions to be taken in use. This should include the following subjects:

- Retrieving, releasing
- Subsea rigging (shackle, hook)
- Un/park hot stab
- Handles and tools manipulation
- Protection/damage avoidance

Operational Preparations

Enabling Objective:

Trainees should understand the procedures required to prepare an ROV for operational use and be able to carry out these preparations on a generic ROV simulator or live ROV under supervision. This should include the following operational preparations:

- Mission/task/dive planning
- Risk assessment
- Pre-deployment set-up including buoyancy and trim
- Navigation and positioning systems
- Dynamic positioning systems
- Safety procedures for pre/post dive checks
- ROV dive/operation logbook recording
- Safety procedures during dive checks
- Simultaneous operations and strategy

Operational procedures/scope of work implementation

Enabling Objective:

Trainees should be able to describe the principles and procedures for operating an ROV system and its equipment. The following operating procedures constitute the recommended minimum level of detail required:

- Operating safely including standard safety briefing procedure and hazard identification and mitigation
- Demonstrate the necessary skills required to pilot ROV systems
- Understanding of mobilising/demobilising ROV systems
- Vessel/platform limitations
- Concurrent activities

Module 9 ROV Tooling and Ancillary Sensors

Training Objectives

Trainees should be able to understand the following:

- Basic concepts of tooling and ancillary sensors
- ROV tooling capacities, types and integration of ROV tooling including survey sensors
- ROV tooling – importance of standard interfaces e.g. API, ISO
- Operation and maintenance of tooling and ancillary sensors

Enabling Knowledge Training

Introduction to ROV tooling

Enabling Objective:

Trainees should understand the principles of ROV tooling and limitations/precautions to be taken in use. This should include the following subjects:

- Integration of ROV tooling to ROV system
  - Hydraulic interface
  - Mechanical interface (including weight in air vs weight in water)
  - Effects on trim and buoyancy
  - Power and signal interface, data standards and bandwidth limitations
  - Use of different fluids, flow rates and pressures
  - Management of cables and hoses (allowing for movement in tool operation)
- Operation and maintenance of ROV tooling
  - Buoyancy requirements
  - Calibration/testing and verification
  - Operating techniques ROV tooling subsea
  - Deliverables
  - ROV tooling maintenance

Introduction of ROV work package sensors

Enabling Objective:

Trainees should understand the principles of ROV sensors. This should include the following subjects:

- Overview of ROV survey sensor capacities, and types of ROV work package sensor
- Overview of data recording and storage
- Integration of ROV work package sensors to ROV system
  - Mechanical interface
  - Power and signal interface, data standards and bandwidth limitations
  - Management of cables
- Operation and maintenance of ROV work package sensors
  - Buoyancy requirements
  - Calibration/testing and verification
  - Operating techniques ROV work package sensors subsea.
  - Deliverables
  - ROV work package sensor maintenance

Module 10 Lifting Operations

Training Objectives

Trainees should understand the following subjects:

- Types of lifting equipment, lifting procedures, and testing requirements used in ROV operations
- Use, limitations and risks of launch and recovery systems (LARS)
- Risk assessment and safety processes for LARS used in ROV operations
- Roles and responsibilities of personnel involved in lifting operations

Enabling Knowledge Training

Crane operation, lifting equipment/accessories and winches

Enabling Objective:

Trainees should be able to describe the principles and procedures for lifting procedures, equipment and testing requirements used in ROV operations. The following subjects are the recommended minimum level of detail required:

- Movement of loads
- Types of lifting equipment both fixed and mobile.
- Cranes and A-frames
  - Types
  - Installation
  - Inspection
  - Operation and safety function testing requirements
  - Maintenance requirements (daily/weekly/monthly)
- Umbilical Winches
  - Types
  - Installation
  - Inspection (winch and umbilical)
  - Operation and safety function testing requirements
  - Umbilical types (armoured)
  - Load testing (armoured)
  - Maintenance requirements (daily/weekly/monthly) for winch and umbilical
  - Umbilical re-termination
- Tether Management Systems

Use, limitations and risks of launch and recovery systems (LARS)

Enabling Objective:

Trainees should be able to describe the general functions and limitations of generic LARS used in ROV operations. The following subjects are the recommended minimum level of detail required:

- Identification and use of lifting equipment and accessories
- Lifting equipment and accessories selection criteria
- Use of lifting equipment and accessories
- Types of equipment and accessories:
  - Lifting equipment
  - Cranes
  - Winches

- Chain blocks
- Lever hoists
- Wire rope hoists
- Lifting accessories
- SWR
- Chain slings
- Webbing slings
- Shackles
- Eye bolts

Risk assessment and safety processes for lifting operations used in ROV operations

Enabling Objective:

Trainees should be able to understand and follow a risk assessment process used in lifting operations. The following subjects are the recommended minimum level of detail required:

- Pre use inspection
  - Markings
  - SWL/WLL
  - Damage (and how it may occur)
  - Quarantine process
- Certification and recertification requirements
- Limitations of use
  - System/equipment limitations
  - Limitations caused by environmental conditions
- Weight identification and estimation of the load
- Principles of sling angles and tensions
- Sling attachment – safe and even weight distribution
- Route planning
- Operation and safety function testing requirements

Roles and responsibilities of personnel involved in lifting operations

Enabling Objective:

Trainees should be able to describe the job, roles and responsibilities of trained lifting operation personnel (riggers, banksmen, slingers (load handlers)) in ROV operations. The following subjects are the recommended minimum level of detail required:

Lifting operations and procedures:

- Steps/phases of lifting operations
- Lift plans
- Risk assessments
- Toolbox talks/job or task brief
- Methods of communication (radio/hand singles)
- Deck awareness (correct positioning of personnel involved in lifting operations)
- Roles and responsibilities:
  - Rigger
  - Banksman
  - Slinger (load handler)