IMCA

Code of Practice for

The Safe & Efficient Operation of Remotely Operated Vehicles

International Marine Contractors Association

www.imca-int.com

IMCA R 004 Rev. 3

July 2009

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 two core activities that relate to all members:
- Competence & Training
- 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 & South America, Europe & Africa, Middle East & India and North America.

IMCA R 004 Rev. 3

The Remote Systems & ROV Division is concerned with all aspects of the equipment, operations and personnel involved with the remotely controlled systems (including ROVs) used in the support of offshore marine activities.

This code was originally published in 1997, with subsequent updates incorporated under the supervision of the IMCA Remote Systems & ROV Division Management Committee to reflect technical developments and operational experience.

The updates in this revised code of practice mainly provide additional guidance on crewing levels for tools with ROV systems.

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Foreword

This code of practice has been produced by IMCA (the International Marine Contractors Association) to provide a pertinent reference document for the safe and efficient offshore operation of remotely operated vehicles (ROVs). This document, which was revised in 2009, updates and replaces the earlier versions, published in 2003, 2001 and 1997.

Designed for use by both clients and contractors, the code purposely avoids subjects of minority interest. It contains guidelines and recommendations for the maintenance of a high level of safety and efficiency across the industry. However, it does not attempt to replace the need for contractors to maintain comprehensive operations manuals and procedures.

The advice given in the code is intended to apply anywhere in the world, but it is recognised that some countries will have regulations that require different standards or practices to be followed. Local or national regulations always take precedence over this code.

IMCA hopes that adoption of this code of practice and adherence to the guidance in it will lead to a safe and efficient industry that operates to common standards.

This code is a dynamic document and the advice given in it will change with the development of the industry. It is intended that this code be reviewed on a regular basis and any necessary improvements made. Any person with suggested improvements is invited to forward these to IMCA (e-mail imca@imca-int.com).

Code of Practice for the Safe and Efficient Operation of Remotely Operated Vehicles

IMCA R 004 Rev. 3 – July 2009

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Introduction

This document provides clients and contractors with guidance on the safe and efficient use of remotely operated vehicles (ROVs). Various types of ROV, tools commonly used, tasks performed, support locations and methods of operation are identified and briefly reviewed. This information provides an overview of the subject and an understanding of the relationship between various combinations of equipment and operational tasks.

Some of the information may seem obvious, but experience has shown that such 'obvious' points are the ones often overlooked.

The code highlights a wide range of technical and operational considerations, but ultimately it is the duty of individual contractors to satisfy themselves that ROV operations are conducted safely and efficiently.

The document is intended to assist:

- personnel involved in ROV operations;
- client staff who prepare bid documents and contracts;
- client and contractor representatives;
- vessel owners and marine crews involved with ROV operations;
- installation and rig managers;
- all personnel involved in quality assurance or safety, health and environmental management.

While it is recognised that safety must never be compromised, recommendations are made for areas where the balance between commercial considerations and safety implications is complex. In particular, clients and contractors need to recognise and accept the importance of providing sufficient qualified personnel to conduct safe operations at all times. This includes periods of routine preventative maintenance, breakdown or repairs when personnel may be exposed to the dangers of high-voltage, high-pressure machinery and other potential hazards.

Throughout this code, the term 'ROV project' is used to define a period of ROV work that involves several ROV dives. The term 'ROV operation' is defined as an individual ROV dive within an ROV project.

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Glossary of Terms

AUV	Autonomous underwater vehicle
CCD	Charged coupled device
CP	Cathodic protection
DP	Dynamic positioning
DSV	Diving support vessel
H_2S	Hydrogen sulphide
MSV	Multi-support vessel
NDT	Non-destructive testing
PLC	Programmable logic controller
ROV	Remotely operated vehicle
SIT	Silicon intensified target
SWL	Safe working load
TMS	Tether management system

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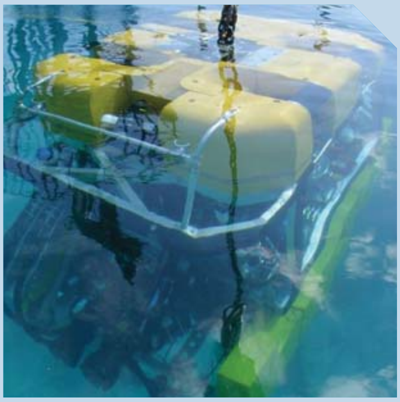

ROV Classifications

The term remotely operated vehicle (ROV) covers a wide range of equipment and no single vehicle can be described as 'typical'. Not only are there numerous ROV designs, but the same basic ROV can be modified to carry out different tasks. Within this code, however, ROVs are considered to be unmanned vehicles (rather than manned submersibles which are subject to separate requirements).

ROVs can be deployed either as free-swimming or via a tether management system (TMS). For a free-swimming ROV, the surface winch umbilical is directly connected to the vehicle. ROVs can also be deployed via a TMS where the surface winch umbilical is directly connected to the TMS. The TMS is a submersible winch with a tether connected to the ROV. The two main types commonly used are the side entry TMS (garage) or the 'top hat' TMS. Five vehicle classifications are identified which can be deployed either in free swimming or TMS modes:

3.1 Class I – Observation ROVs

These vehicles are small vehicles fitted with camera/lights and sonar only. They are primarily intended for pure observation, although they may be able to handle one additional sensor (such as cathodic protection (CP) equipment), as well as an additional video camera.

3.2 Class II – Observation ROVs with Payload Option

These vehicles are fitted with two simultaneously viewable cameras/sonar as standard and are capable of handling several additional sensors. They may also have a basic manipulative capability. They should be able to operate without loss of original function while carrying two additional sensors/manipulators.

3.3 Class III – Work-Class Vehicles

These vehicles are large enough to carry additional sensors and/or manipulators. Class III vehicles commonly have a multiplexing capability that allows additional sensors and tools to operate without being 'hard-wired' through the umbilical system. These vehicles are generally larger and more powerful than Classes I and II. Wide capability, depth and power variations are possible.

3.4 Class IV – Towed and Bottom-Crawling Vehicles

Towed vehicles are pulled through the water by a surface craft or winch. Some vehicles have limited propulsive power and are capable of limited manoeuvrability. Bottom-crawling vehicles use a wheel or track system to move across the seafloor, although some may be able to 'swim' limited distances. These vehicles are typically large and heavy, and are often designed for one specific task, such as cable burial.

3.5 Class V – Prototype or Development Vehicles

Vehicles in this class include those still being developed and those regarded as prototypes. Special-purpose vehicles that do not fit into one of the other classes are also assigned to Class V. This class includes autonomous underwater vehicles (AUVs).

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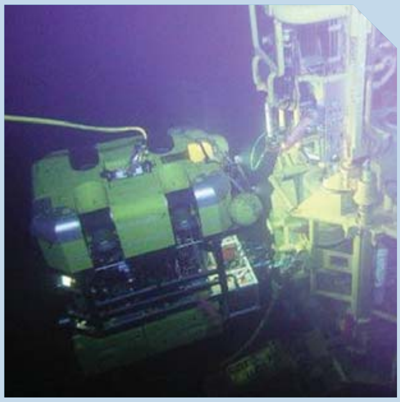

ROV Tasks

ROV capabilities are constantly expanding as technology improves. The introduction of higher specification vehicles and the upgrading of existing ones results in wider and more efficient utilisation of ROVs. It is therefore impossible to detail all the tasks that an ROV may be asked to carry out.

Within this code, ROV tasks are grouped into six categories relevant to the offshore oil, gas and cable industries. Highly specialised ROVs that have been designed for one specific task or location are not included.

For each operation, the ROV contractor should be satisfied that the vehicle and equipment provided are fit for the purpose to which they will be put in all foreseeable circumstances. Suitability can be assessed by the evaluation of a competent person, physical testing, or previous use in similar circumstances.

New or innovative equipment should be considered carefully, but should not be discounted simply because it is novel.

4.1 Observation

Observation is the simplest work mode. It can be undertaken by most ROVs by means of a video camera but without additional equipment and is generally carried out by Classes I and II. It includes tasks where the vehicle moves around an object and situations where the vehicle is effectively stationary, such as when monitoring divers.

4.2 Survey

Surveying generally consists of seabed observation, sometimes accompanied by acoustic mapping. Surveys are usually undertaken before and after pipeline, umbilical and cable installation. They may also be undertaken prior to or after seabed construction or equipment installation/removal. The purpose of the survey may be:

- fixing geographical co-ordinates;
- ensuring the target is within a permitted corridor or area;
- ensuring the target is adequately buried;
- identifying any unsupported areas or lengths of pipeline;
- examining the physical condition of the target;
- ensuring debris has been located, identified and, if necessary, removed.

Depending on the level of detail required, surveys can be performed by any class of ROV, but are generally carried out by Classes II, III or IV.

4.3 Inspection

It is often difficult to distinguish between inspection and survey tasks, particularly as an ROV may carry out both types of task in a single dive. Inspection tasks usually concentrate on specific, pre-defined areas of offshore structures and subsea equipment. These tasks often include detailed visual examination and other non-destructive tests that may require the ROV to be fitted with additional sensors, such as CP measurement probes.

Inspection tasks are normally carried out by Class II or III vehicles.

4.4 Construction

These tasks require a vehicle with two manipulators, i.e. normally Class III. Such vehicles can carry out a wide range of tasks involving physical intervention, including removal of debris, connection or disconnection of lifting strops and actuation of valves. Cameras held by manipulators can be used to obtain pictures in areas of restricted access or at difficult angles. Some construction projects, particularly those in deep water, use seabed equipment that can be operated by one ROV or by a number of ROVs simultaneously.

4.5 Intervention

Many ROVs have tool packages that are specifically designed for use with particular items of subsea equipment such as manifolds, wellheads and control pods. For example, an ROV may be capable of changing a failed well control valve and returning it to the surface for repair.

It is also common for ROVs to support drilling by undertaking tasks such as replacing AX/VX ring seals, connecting or disconnecting hydraulic and electrical lines, and operating valves.

4.6 Burial and Trenching

Some ROVs fitted with suitable trenching equipment are used where soil characteristics are favourable for burial or trenching operations. Performance of a burial/trenching vehicle is largely dependent on how accurately the prevailing soil conditions on the work location(s) have been established and how the actual conditions experienced correspond to the inherent as-designed trenching capability of the vehicle.

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ROV Tools

Tools fitted to ROVs are wide ranging and are being continually developed and upgraded. This section provides a brief introduction to some common tools.

All relevant industry safety practices should be complied with when fitting or testing ROV tools. Tools should not introduce a safety hazard to the ROV crew or exceed the ROV's capabilities. Tool manuals should be kept at the work site and be available to the ROV crew at all times.

Shallow water and surge zones present particular risks to ROVs and suitable forethought and planning should be given to the use of tools in these circumstances.

5.1 Video Cameras

Cameras can be mounted on a pan and tilt assembly, in a fixed position or held by a manipulator fitted onto the ROV, depending on the work being undertaken. The most common video package is a low light silicon intensified target (SIT) or charged coupled device (CCD) camera (for use in poor visibility and for long distance viewing) combined with a standard and zoom colour camera (for detailed work). High-resolution graphic documentation can be accomplished with video grabber techniques.

Variable lighting is used to assist with the effectiveness of the viewing system.

5.2 Non-Destructive Testing (NDT) Sensors

NDT sensors are normally used to verify structural integrity. The most common NDT sensors used on ROVs are CP probes, thickness measurement devices, current density and flooded member detectors.

5.3 Acoustic and Tracking Sensors

There are numerous acoustic systems suitable for ROVs. The simplest are tracking and measurement devices. Other devices include scanning sonars (used to detect and avoid obstacles), profiling sonars, bathymetric systems, and pipe trackers. Side scan sonars and sub-bottom profiling sonars are also in common use, particularly for survey work.

5.4 Cleaning Devices

There are several ways to clean offshore structures. The simplest uses rotating wire or nylon brushes that are attached to the ROV body or held/deployed by manipulators. Other methods include water-jetting with or without slurry or grit entrainment.

5.5 Vehicle Station Keeping and Attachment Devices

Many tasks require the ROV to be stable or immobile. This can be achieved in a number of ways. In fact, many vehicles have an automatic station-keeping capability as standard that allows them to maintain heading, depth and altitude.

Attachment devices may be used to hold the vehicle in a fixed position. Such devices include:

- docking cones and similar stabbing receptacles;
- suction pads and water pumps (for hydrostatic attachment on smooth surfaces);
- manipulator-mounted hydraulic claws that can grip platform legs or bracings;
- cup-shaped structures mounted on the ROV that are pressed against a platform leg or bracing to provide support. 'Autopilot' is then used to control pitch and roll.

All attachment devices should be fitted with 'fail safe' devices (i.e. it becomes free if the power fails) in case of any problems.

5.6 Work Tools

This category covers a vast range of tools from simple bars, hooks and knives to sophisticated single-purpose tools, such as anode installation packages, through to specially designed multi-mode tools.

The most common work tool is the manipulator which can be used alone or in association with other tools. Tools that can be operated by the manipulator without additional power are known as 'hand tools'. However, the majority of tools require either hydraulic or electrical power.

Specially designed work packages to conduct multi-mode tasks within a single dive can also be classed as 'work tools'. These should be considered on an individual basis.

5.7 Future Tools

Considerable development work is being undertaken to improve tools and equipment available for use with ROVs. Several areas, such as underwater cleaning, are undergoing concentrated research, and improved packages are being developed to increase ROV efficiency.

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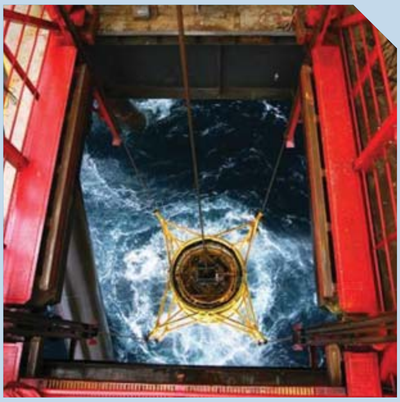

Environmental Considerations

The safe and efficient deployment and operation of ROVs depends on suitable environmental conditions. For any given situation, the combination of conditions can be dramatically different and it is the responsibility of the ROV supervisor to assess all available information before deciding to conduct ROV operations. The decision on conducting an ROV operation will rest with the ROV supervisor. Any query regarding the ROV supervisor's decision should be referred to the ROV contractor.

ROV contractors normally define clear environmental limits. ROV supervisors should ensure that they understand the implications of all limitations that apply to vehicles and deployment systems.

Environmental aspects that affect ROV operations are highlighted below. However, there is no substitute for practical experience.

6.1 Weather

While ROVs themselves are not normally sensitive to weather, the cost and efficiency of ROV operations can be affected in a number of ways:

- Wind speed and direction can make station keeping difficult for the support vessel and adversely affect ROV deployment;
- Rain and fog can reduce surface visibility and create a hazard for the support vessel;
- Adverse combinations of wind, rain and snow can make deck work extremely hazardous for the ROV crew;
- Hot weather and humidity can cause the ROV's electronics to overheat and/or be susceptible to moisture ingress/content during deck checks. Armoured/live boat umbilicals operationally in use or stored in open deck areas may also be susceptible.

Operations should, therefore, be carefully monitored with regard to the safety of both personnel and equipment.

6.2 Sea State and Swell

Sea state can affect every stage of an ROV operation.

Safety should always be considered carefully when launching or recovering an ROV and particularly from a support vessel in rough seas. ROV operators should understand the effect of a heaving support ship on a cable attached to a relatively motionless ROV and be aware that the ROV handling system can be overloaded or that personnel on deck may be exposed to the risk of an accident.

In rough conditions, personnel involved with launch and recovery must wear all necessary personal protective equipment and fully understand their own role as well as the roles of others involved in the operation, such as the master of the support vessel. Good communication is vital for avoiding accidents.

In certain situations, purpose-built deployment systems, such as motion compensation systems, can either reduce or better accommodate the effect of wave action, thereby enabling ROV operations to be conducted in higher than normal sea states while maintaining safety standards.

6.3 Currents

Currents can cause considerable problems in ROV operations but quantitative data on particular current profiles is rarely available.

Simulations and analysis can provide good current predictions, but currents do not remain constant for long, even close to the seabed. Currents also vary with location (for example between northern and southern regions of the North Sea) and surface currents can be quickly changed by the wind. Layered currents at different depths can also occur. Tide meters are useful indicators of current strength and direction at any particular depth.

Factors that affect ROV operations, including their manoeuvrability in currents, include:

- length and diameter of umbilical cable;
- propulsive power;
- depth and orientation to the current;
- non-uniformity of current profile;
- umbilical 'strumming' or 'spinning' in deep water (this may necessitate the use of specially designed umbilicals);
- vehicle hydrodynamics (i.e. surface area and profile).

6.4 Water Depth

Some ROVs can operate to depths of several thousand metres and research programmes are pushing the limits deeper. However, individual ROVs are designed for a particular maximum depth and should never be used below that limit. When operating vehicles at great depths, consideration should be given to:

- umbilical length and associated drag – these influence the specification of the topside handling system – see Sections 7.5 and 7.9;
- transit time – (Note: An ROV takes approximately 50 minutes to reach an operating depth of 1500 metres (approximately 5000 feet) at a descent speed of 1 knot). It is important that pre-dive and shallow water tests are carried out rigorously.

Variations in temperature, salinity, depth and acoustic noise should be considered because they can adversely affect acoustic tracking and positioning systems. Water characteristics may also have a significant effect and the following factors should be taken into account when assessing the use of a vehicle for a given task:

- Visibility – poor visibility can adversely affect an operation and may require the use of sophisticated equipment, such as acoustic imaging systems. Vehicle operation near the seabed may stir up fine-grained sediment that will reduce visibility in low or zero current situations;
- Temperature – extreme temperatures (both high and low) may affect the reliability of electronics and cause material fracture that leads to structural or mechanical damage (particularly in Arctic conditions). Hydraulics and lubricants that have stable properties over the intended temperature range should always be used;
- Salinity – this may vary substantially near river mouths, in tidal estuaries and near sewer outfalls. The resultant variation in water density may affect ROV buoyancy and trim;
- Pollutants – the presence of man-made or natural petroleum products can cloud optical lenses and damage plastic materials. Gas can affect visibility, block sound transmission and cause sudden loss of buoyancy. If pollutants are present, precautions should be taken to protect the in-water portions of vehicles and any personnel who handle the ROV during launch, recovery and maintenance;

- Water movement – ROVs are very sensitive to water movement and extra care should be taken in shallow water where water surge or vessel thrusters can have a major effect on vehicle control.

6.5 Seabed Characteristics

When planning an ROV operation, enquiries should be made about local seabed conditions and topography. Rocky outcrops or seabed equipment (manifolds, pipelines, etc.) make collisions more likely, add to the risk of abrasion to the vehicle's tether and affect operations by blocking video and sonar equipment.

Soft or silty seabed bottom conditions can make operations very difficult because particulate material can be stirred up by a heavy landing or thruster use close to the seabed.

6.6 Pilot Experience of Unfavourable Conditions

Pilot experience is an important factor in ROV operations, particularly in areas of strong current. Knowledge of the vehicle's capabilities and limitations is essential.

A good pilot will have developed a sense of spatial awareness and the ability to carry out operations under difficult conditions, such as strong currents or limited visibility.

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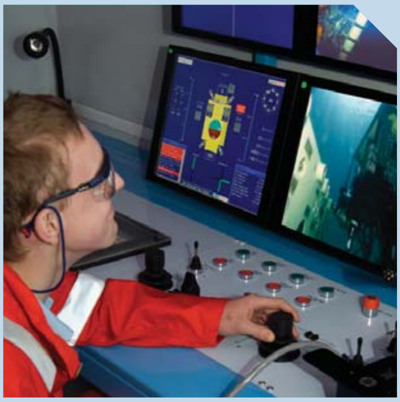

ROV Operations

It is necessary to take an overall look at ROV operations to ensure the safe and efficient use of ROVs in the demanding offshore environment. In particular, operators should ensure that the chosen ROV system has been satisfactorily tested prior to mobilisation and that it is capable of fulfilling all operational requirements. The ROV supervisor should only begin an ROV operation after carefully considering:

- the interaction of possible environmental criteria;
- factors related to deployment equipment;
- system and crew readiness; and
- the nature and urgency of the tasks.

This process will normally form part of the risk assessment (see section 7.1) carried out for that operation.

Contractual pressure should never be allowed to compromise the safety of personnel during ROV operations.

7.1 Risk Assessment

Many factors should be considered when preparing the procedures for a specific operation. In particular, a risk assessment should be carried out to identify site-specific hazards and assess their risks. Based on this information, the procedures should then state how these hazards can be mitigated. An exhaustive list of hazards is not possible, but some are highlighted below and those related to the environment are given in section 6.

7.2 Operating Procedures

The operating procedures should normally consist of both the ROV contractor's standard operating rules together with any site-specific requirements and procedures. Contingency procedures for any foreseeable emergency are also required.

The management of an ROV project should be clearly specified together with a defined chain of command.

7.3 Manuals and Documentation

A major factor in the safe and efficient operation of ROVs is the provision of a comprehensive set of manuals, check lists and log books. It is the contractor's responsibility to ensure that each ROV system is supplied with the necessary documentation, including:

- contractor's operations manual;

- contractor's quality, health, safety and environmental management system;
- technical manuals for system equipment;
- system daily log/report book/dive log;
- planned maintenance system;
- repair and maintenance record/spare parts inventory;
- pre- and post-dive checklists.

ROV contractors should be familiar with all relevant legislation for the operational area. They should also be familiar with advisory publications relevant to ROV operations, some examples of which are listed in the bibliography.

7.4 ROV System Location and Integrity

The location of equipment will be determined by the type of installation, i.e. fixed structure or marine vessel, and the integrity of the handling system with respect to lifting points, load-bearing welds, structures, etc. Valid test certificates should be included with the system documentation.

In some projects the ROV system may be located in a hazardous area, for example where ignition of gas, vapour or liquid could cause a fire or explosion. ROV systems located in such areas must comply with any relevant safety requirements for that area.

ROV operations should comply with any site-specific requirements. For example, an appropriate permit-to-work may be necessary before an operation can commence.

Onboard a ship, the equipment location may depend on available deck space. However, motion will be minimised by placing the deployment system as close as possible to the ship's centre of gravity. Due consideration should be given to the vessel thruster location and any other project equipment over-boarding requirements.

The power source for the ROV may be independent of the installation or vessel power supply. If a separate generator is used, its position should be governed by various factors including vibration, noise, exhaust, weather, length of cable required, possible shutdown phases, fire protection and ventilation.

Before welding any part of the ROV system to a vessel or installation, the position of fuel tanks and any other potential hazards should be ascertained.

A deck layout or plan should be prepared before mobilisation and agreed with all relevant parties to inform them of the equipment location and service connections.

7.5 Handling Systems

ROV handling systems can be complex and have been the cause of serious injuries to ROV personnel. Due care and attention is vital at all times during their operation. Section 7.11 contains more details on the physical hazards associated with handling systems.

A list of safe operating parameters for the handling system should be readily available. ROV operators should also be aware of the loads to which the system is subjected during normal operations. Standard welding procedures and NDT, for example dye penetrant, should be applied to all load bearing fastenings associated with tie down, both before and after load testing.

7.6 Launch and Recovery Operations

It is impossible to define every launch and recovery procedure in this code because of the variety of ROVs, support locations and deployment systems.

It is, however, the responsibility of the ROV supervisor to ensure that a safe launch and recovery procedure is adhered to and understood by all members of the ROV and support location crews. The procedure should progress in smooth, logical steps and be designed so that all personnel involved in the operation are fully aware of the situation at all times.

The decision to launch or recover the ROV will rest with the ROV supervisor. Numerous factors will affect this decision. However, the ROV supervisor has to be satisfied that the safe deployment or recovery of the ROV can be carried out. Factors which need to be taken into account when taking this decision will include the support location, deployment system, type of ROV, environmental conditions and crewing level.

Although the ROV contractor or manufacturer will have prepared appropriate design calculations to a recognised standard to determine the system capability, these should only be viewed as providing guidance in aiding operational decisions. These calculations may specify limits for launch and recovery based on weather, sea state, vessel motions and other parameters.

Any query regarding the ROV supervisor's decision on launch or recovery should be referred to the ROV contractor management team.

7.7 Communications

Effective communications are vital to the safety and success of any operation and include hard wire communication systems, word of mouth, toolbox talks and radio.

All personnel directly involved in the operation should be fully aware of the work being undertaken and the status of any unusual situation that may arise during operations.

Communications between the ROV operating crew and any other relevant personnel (such as the support vessel crew) are also vital.

If a diving operation is taking place in the vicinity, established communications should exist between:

- the diving supervisor and the ROV supervisor – when an ROV is used in a diving operation the diving supervisor has ultimate responsibility for the safety of the whole operation;
- the diver and the ROV operator – this communication is normally routed through the diving supervisor. If the ROV is monitoring a diver, back-up hand signals should be rehearsed.

More detailed guidance on this subject is given in AODC 032.

The ROV supervisor should have appropriate access to the communications service of the vessel or installation on which the operation is based, as and when required.

7.8 ROV Operating Sites

ROVs are required to operate from different locations with varying levels of support for the ROV system and crew. Due consideration should therefore be given to the effect of each location on safety and efficiency. Suitable deck strength, extra supports, external supplies and ease of launch and recovery should be considered.

Prior to mobilisation, the site should be inspected to consider the optimum location for the ROV system, taking into account the proposed location and the ROV launch and recovery system. The level of services should also be assessed.

It is not necessary for all the components of the ROV system to operate from a single location, but care should be taken when considering hose or cable runs that exceed standard system lengths. Hose and cable runs should be protected from physical damage and should not cause a hazard to personnel. Voltage or pressure drops may be caused by excessive length.

Basic types of support sites are described below.

7.8.1 Locations using Dynamic Positioning (DP)

Most support locations can be held in a fixed position by DP, although this can comprise anything from a supply boat captain using a joystick through to sophisticated systems involving several computers and external references.

DP has inherent limitations and hazards that can affect ROV operations:

- It is not possible to keep a vessel completely static. All DP systems allow the vessel to move in a pre-determined 'footprint', which can be quite large;
- Although many DP systems are very reliable, they are all capable of failing and leaving a vessel effectively out of control close to other vessels or fixed structures;
- Thrusters and propellers are in constant use. The ROV and its umbilical is therefore at continuous risk from these and their wash.

For these reasons it is important that the capabilities and limitations of a support vessel's DP system are thoroughly investigated prior to an ROV operation. The results of this investigation can then be compared with the ROV's work scope, and a decision made about suitability and any necessary operational restrictions.

DP vessels are subject to an agreed international classification system that will assist in any such consideration (see IMCA M 103).

7.8.2 Small Work Boat, Supply Boat or Standby Vessel

These are vessels of convenience on which ROVs may be temporarily installed. They offer relatively low day rates compared to other support vessels and may present operational limitations such as:

- lack of manoeuvrability;
- low-grade navigation systems;
- low specification or non-existent offshore mooring or position-keeping (DP) systems;
- minimal deck space;
- low electrical power reserves;
- unsuitable propeller guards;
- limited personnel accommodation;
- poor weather limitations for overside operations; or
- lack of crew familiarity with ROV operations.

Such vessels can be used successfully in a number of situations, but they need to be carefully assessed and/or audited (see IMCA M 189/S 004) prior to a project. Any limitations should be acceptable to the proposed scope of work and should be noted in the risk assessment.

7.8.3 Small Air-Range Diving Support Vessels and Larger Supply Boats

Such vessels may be appropriate for certain ROV operations, but may still have some of the limitations listed in Section 7.8.2. Anchor wires provide an additional hazard if these vessels are moored during operations.

These vessels can be used successfully in a number of situations, but they need to be carefully assessed and/or audited prior to a project. Any limitations should be acceptable to the proposed scope of work and should be noted in the risk assessment.

7.8.4 Dedicated ROV Support Vessels

These vessels are specifically designed or have been specifically modified to accommodate ROV operations. As such, they do not have most of the disadvantages associated with vessels of convenience. However, some of the smaller or earlier generation vessels may still have some limitations that require careful consideration.

The crew of these vessels should be familiar with ROV operations. This can be advantageous in difficult operating conditions and emergencies.

7.8.5 Monohull Diving Support Vessels (DSVs)

Monohull DSVs make good ROV support ships, but they are relatively expensive because they provide a range of capabilities. ROVs may operate from DSVs in a complementary role to a diving operation. In this case, diver safety takes precedence at all times. AODC 032 contains useful information on this subject.

ROV operations can be complicated by the number of lines deployed during operations: DP tautwire; equipment guide lines; clump weights and wires; diver and bell umbilicals; swim lines; etc. Detailed planning will help all parties to understand responsibilities and expectations.

7.8.6 Mobile Offshore Units

This category includes structures such as drilling rigs, crane barges and accommodation barges that may be mobile but which are held in one location for a period of time by moorings, DP systems or other fixing methods.

For ROV operations, they present similar hazards to fixed platforms, although zoning and hydrocarbon safety requirements will normally only apply to drilling rigs. These platforms may, however, present other hazards such as anchor wires and submerged pontoons.

7.8.7 Specialist Locations

These locations include multi-support vessels (MSVs), lay barges, trenching barges and specialised marine vessels. Each specialist location will present a different set of challenges or issues that should be carefully considered at the planning stage. From such vessels the primary task, such as pipelaying, cannot be interrupted without serious consequences.

It is important that all ROV operations conducted from a specialist location conform to a set of procedures agreed specifically for that location with the client.

7.8.8 Fixed Installations

Depending on the specific situation, there may be a number of problems associated with operating from a fixed installation compared to operating from a vessel or mobile offshore unit including:

- the need to comply with specific, often onerous, zoning requirements related to hydrocarbon safety;
- the need to comply with additional regulations;
- difficulties in installing surface support equipment;
- safety requirements, for example personnel training for hydrogen sulphide (H_2S) emergencies;
- potential power shutdown because of a preferential trip operation;
- relocation problems associated with tidal effects on the umbilical;
- deployment and recovery complications caused by the height difference between the platform and the sea;
- hazards related to work inside the jacket area;
- intakes and outfalls.

In addition, most platforms operate a permit-to-work system that governs ROV operations which may cause operational delays.

7.9 Navigation

The use of acoustic location beacons on ROVs allows accurate navigation, positioning and tracking. In some cases, an ROV can be placed beside a seabed object to establish an accurate position for that object.

There is the potential danger of acoustic interference, such as shadowing or noise, in several situations, for example if several vessels are operating in the same area or if large-scale construction or survey projects are underway. This can be a particular problem if the DP vessel relies on acoustic signals for positioning. Frequencies for acoustic beacons should be selected to avoid interference. In large projects, this matter may need to be co-ordinated by a central organisation.

In deep water, navigational range is a problem, while in shallow water the angles involved can pose difficulties unless a tracking head is used.

7.10 Umbilicals

Umbilicals can be broadly categorised by their weight and material composition, but vary widely in strength, power and signal transmissions. In general there are soft or armoured umbilicals.

When determining safety factors, soft (Kevlar-strengthened) umbilicals should be treated as fibre ropes while armoured umbilicals should be treated as wire ropes. The effect of additional mechanical or electrical loads on the umbilical should be considered before upgrading or modifying ROV systems.

ROV supervisors and operators should be aware that the umbilical's capabilities are limited by its breaking load, safe working load (SWL) and minimum bend radius.

ROV contractors should possess the manufacturer's test data for each umbilical, including physical and electrical properties, lay-up data, materials, letter of conformity and fitness for purpose.

Any retermination of umbilicals should be in accordance with the ROV contractor's procedures.

Where an umbilical is used for primary lifting, tests should be undertaken in accordance with IMCA R 011 to prove the SWL integrity of the termination when the umbilical is changed or reterminated. It is not recommended that tests be undertaken using an ROV as the test weight.

Routine inspection and maintenance of the umbilical cable is necessary to ensure the integrity of the system.

Some free-swimming vehicles use neutrally buoyant cables that allow the umbilical to stay clear of the vehicle and the object on which it is working. These umbilicals may float in shallow water depths, so care needs to be taken during launch and recovery in case the cable floats on the surface causing a hazard. Care also needs to be taken with such umbilicals when operating near to thrusters or propellers that might operate without warning.

7.11 Physical Hazards

In addition to the hazards already discussed, a number of other physical hazards may be encountered during ROV operations. These include the following.

7.11.1 Handling Systems

The use of ROV handling systems at sea, which are essentially mobile lifting operations, requires due care and attention at all times. Many winches or 'A' frames use programmable logic controllers (PLCs) or computer control systems in operation and care should be taken to assess the special risks these systems introduce such as unexpected movements without physical command or delays in movement after a command is given. In addition systems may have stored energy (for example, hydraulic accumulators) and, even when disconnected from the primary source of power, are still capable of movement that could cause injury to personnel. These specific hazards should be comprehensively risk-assessed in addition to standard handling system considerations. ROV operators should also be aware of the loads to which the system is subjected during normal operations.

7.11.2 Water Intakes and Discharges

ROVs are vulnerable to suction or turbulence caused by water intakes and discharges. The ROV contractor should establish with the client whether there are any underwater obstructions or hazards in the vicinity of the proposed operation. If there are any intakes or discharges which may create a hazard, suitable measures should be taken to either ensure that they cannot operate while the ROV is in the water or that the ROV is well clear of them. Such measures should be part of a work control system (such as a permit-to-work system) and could include mechanical isolation.

7.11.3 ROVs Near Diving Operations

Guidance is available on the safety considerations that should be taken into account when divers are working with, or in the vicinity of, ROVs (see AODC 032). These considerations include entanglement of umbilicals, physical contact and electrical hazards. Close liaison between the ROV and diving supervisors is needed to provide solutions to these hazards. For example, umbilicals can be restricted in length or a line insulation monitor can be used. For work-class ROVs, thruster guards should be employed.

The physical hazard to divers caused by the power, mass and possible inertia of large ROVs should not be underestimated.

Communications with the diving supervisor are most important. Refer to section 7.7 for further details.

7.11.4 Safe Use of Electricity

ROVs are fitted with equipment operated by or carrying electricity. Care must be taken to ensure that all personnel are protected from any electrical hazards and particularly from electric shock. Guidance on this subject is available in AODC 035 and IMCA R 005.

7.11.5 High-Pressure Water Jetting

Some ROVs carry high-pressure water-jetting attachments. Care should be taken on the surface when this equipment is being set up and tested, because even apparently 'minor' accidents with this equipment have the potential to cause a serious internal injury. The complete water jetting system, and in particular the hoses, should be rated to at least the system operating pressure.

8

Equipment Certification and Maintenance

Various codes are used to examine, test and certify offshore plant and equipment, while the requirements of those who are competent to carry out such examinations, tests and certifications have also been established (see IMCA R 011). Much of the equipment used in an ROV operation should comply with these requirements as a minimum. Relevant certificates (or copies) should be available for checking at the work site.

ROV equipment is used under offshore conditions and therefore requires regular inspection, maintenance and testing to ensure it is fit for use, i.e. that it is not damaged or suffering from deterioration. Regular maintenance is an important factor in ensuring the safe operation of an ROV system.

The frequency and extent of inspection and testing for all items of equipment used in an ROV operation, together with the levels of competence required of those carrying out the work, should be identified by the ROV contractor.

ROV contractors should give due consideration to recommendations given in manufacturers' maintenance manuals. In particular, the ROV operating system should be visually examined before and after every dive.

Many complex action sequences are required during an ROV operation and there is a risk that steps may be omitted or undertaken out of sequence. A suitable way to ensure the thoroughness of such sequences on each occasion is to use a checklist that requires relevant personnel to demonstrate correct completion by ticking a box.

ROV contractors should prepare and authorise the use of such checklists as part of the planning for operations. An outline for a typical system check is described below.

8.1 Pre- and Post-Dive Checks

8.1.1 Vehicle

A visual and physical inspection should indicate potential or existing problems prior to turning on electrical or hydraulic power. The vehicle should be examined for cracks, dents, loose parts, unsecured wires or hoses, oil spots, discolouration, dirty camera lenses and obstructions in the thrusters. If possible, vehicles should be washed with fresh water after a dive.

8.1.2 Electronic Control

All command controls should be briefly operated and the vehicle response, alarm status, data displays and indicators checked.

8.1.3 Vehicle 'Power-On' Checks

These should be carried out according to the particular vehicle pre-/post-dive checklists. All relevant safety precautions should be taken while exercising a live vehicle.

8.1.4 Ancillary Tools

These should have their own particular pre- and post-dive checklists.

8.1.5 Handling System

The handling system should be checked for structural damage. Electrical lines and connections should be examined and the hydraulic system inspected for abrasion and leaks. Fluid levels should be checked and functions tested in accordance with the system's pre-/post-dive checklist.

8.2 Planned and Periodic Maintenance

8.2.1 Equipment Register

An equipment register should be maintained at the work site together with copies of all relevant certificates of examination and test. It should contain any relevant additional information, such as details of design limitations, for example maximum weather conditions.

8.2.2 Planned Maintenance

It is important that the ROV contractor establishes a system of planned maintenance for plant and equipment. Such a system may be based on the passage of time, amount of use, manufacturers' recommendations or previous operational experience. Ideally it will be based on a combination of all of these. The ROV contractor should ensure that it has up-to-date supplier safety and information documents regarding all equipment supplied.

For each major unit, the planned maintenance system should identify the required frequency for each equipment item and under which discipline the work falls. Proper records should be kept.

8.2.3 Spare Parts

ROV operations are often undertaken in remote offshore areas. ROV contractors should therefore ensure that an adequate serviceable supply of spare parts is available, particularly for those items that are essential to continued operation and safety.

8.3 Handling System Testing and Periodic Examination

Although ROV handling systems are not specifically covered by classification society rules, guidance note IMCA R 011 provides information that helps to avoid confusion over testing and periodic examination requirements.

All lifting equipment should be examined by a competent person:

- before the equipment is used for the first time;
- after installation at another site;
- after major alteration or repair which may affect its integrity.

Regular examination every six months is also recommended. Any additional testing specified should be at the discretion of the competent person.

ROV lifting cables should be provided with test certificates confirming the safe working load. Details of the required SWL for lifting cables are given in IMCA R 011. The SWL should not be exceeded during operations and should include the ROV and any components that hang from the lifting cable. The condition and integrity of the cable should be checked at six-monthly intervals, or more frequently if circumstances require it.

A dedicated lift cable, or an umbilical which is used for lifting a ROV, should be reterminated at intervals of 12 months, examined and retested by a competent person.

All lifting gear, such as sheaves, rings, shackles and pins, should have test certificates when supplied and be examined at six-monthly intervals thereafter. The certificates should show the SWL and the results of load tests undertaken on the components to 2 x SWL.

9

Personnel

9.1 Qualifications and Competence

All ROV personnel should be competent to carry out the tasks required of them. Competence can normally be demonstrated by the possession of suitable qualifications or experience, but most commonly by a combination of both.

IMCA has developed guidance on competence assurance and assessment, which is designed to facilitate improved safety in the offshore industry by setting out a framework for IMCA's contractor members to assess and demonstrate to others the competence of their safety critical personnel.

This guidance sets out minimum requirements, in terms of applicable qualifications and minimum experience, to ensure that personnel are competent to fulfil their safety-critical responsibilities. The guidance also sets out how proficiency can be developed, demonstrated and maintained. The guidance covers various positions, including ROV Supervisor, ROV Senior Pilot Technician and ROV Pilot Technician Grades I and II (see IMCA C 005).

For new entrants into the ROV industry, IMCA R 002 sets out entry level requirements and a basic introductory course outline for new ROV personnel and is regarded as the industry-accepted standard for new personnel.

The medical fitness of personnel should meet any relevant local or national requirements for offshore topsides personnel. A medical examination is normally undertaken on a regular, periodic basis.

9.2 Team Size

With ever-increasing complexity and dependence on the ROV in the offshore workplace, the competence of the individuals operating the equipment needs to be carefully scrutinised to ensure a safe and efficient operation. The ROV system is perhaps the single most sophisticated system on an offshore operation and its availability, reliability and effectiveness have become critical. An ROV operation embodies many sophisticated technologies and a team must have the capability to maintain and repair electrical, electronic, fibre optic, hydraulic and mechanical systems as well as having the operational knowledge to safely operate and maintain the equipment.

The variance in vehicle type and tasks, together with advances in technology, make it difficult to offer anything more than general advice in this code. Furthermore, it is not the aim of this document to remove the responsibility for safe operations from the contractor. Actual team sizes should be decided after the completion of a risk assessment.

Safety of personnel is paramount during operations and maintenance and it is the responsibility of the contractor to provide a well-balanced, competent team of sufficient numbers to ensure safety at all times. When selecting the team size the contractor should consider:

- the nature of the work being undertaken;
- the deployment method;
- the location;
- the vehicle classification;
- the operational period (12 or 24 hours per day);
- how any foreseeable emergency situations will be handled.

9.2.1 Support Functions

The contractor should provide a sufficient number of competent and qualified personnel to operate all the equipment and to provide support functions to the ROV team. For safe operation, the team may also need to include additional deck support personnel and other management or technical support personnel, such as project engineers or tooling/maintenance technicians.

9.2.2 Safe Working Practice

Safe working practice dictates that personnel should not work alone when dealing with:

- high voltage (guidance on which is contained in IMCA R 005);
- heavy lifts;
- high-pressure machinery;
- umbilical testing;
- potential fire hazards – welding, burning, etc.;
- epoxy fumes, etc.

Individuals in an ROV team may carry out more than one duty provided they are qualified and competent to do so and that their different duties do not interfere with each other. Overlapping functions should be clearly identified in operational procedures.

9.2.3 Minimum Crewing Levels for Work-Class ROVs

The skill sets of the ROV team must be carefully chosen to ensure a safe efficient operation and meet the demands of the type of equipment. For a work-class ROV, a minimum crewing level of three per shift is necessary in order to:

- have proper complementary skill sets to operate safely and efficiently;
- have sufficient competent personnel available at critical times to launch and recover the ROV;
- have sufficient (hydraulic and electronic) expertise available to safely maintain the ROV and repair it promptly following breakdown;
- ensure operability over both normal operational periods and in exceptional circumstances;
- prevent an individual being alone with a powered-up and operational system.

The use of three-man crews permits the introduction of technicians who, although having core competences, lack operational experience. It also permits the introduction of new crew members in a manner that does not prejudice safety.

Such technicians may form part of the team, but should not normally be allowed to take over the functions of the person training them unless that person remains in control, is present to oversee their actions and the handover does not affect the safety of the operation.

9.2.4 Crewing Levels for Bottom-Crawling Class IV Systems

Since bottom-crawling Class IV systems are much larger and heavier than Class III (work-class) ROVs, a minimum crewing level of four per shift is required.

9.2.5 Tooling with ROV Systems

Increasingly, work-class ROV systems are required to operate with a range of intervention/specialist tooling, many of which are relatively complex, often with their own mechanical, hydraulic and control system components. Similarly, work-class ROV systems can be outfitted with a range of instrumentation/sensors when conducting inspection and/or survey tasks.

The crewing level for any specific project should take into account the tooling manufacturer's recommendations, the nature of the work and an appropriate task-specific risk assessment.

However, in the above situations, it is recommended that consideration be given to increasing the crewing level for the ROV systems by a minimum of one specialist tooling/sensor technician per shift. In the event that the task involving the specialist tooling or specialist sensors is particularly intensive, such as where a tooling module is required to be changed during the shift pattern, then the numbers of specialist technicians/engineers should be increased in line with the forecast workload. The final number of personnel should be subject to an appropriate risk assessment.

9.3 Working Periods

Accidents are more likely when personnel work long hours because their concentration and efficiency deteriorate and their safety awareness is reduced. Therefore, while long hours are sometimes required, such circumstances should be exceptional.

Work should be planned so that each person is normally asked to work for a maximum of 12 continuous hours and is then given a 12 hour unbroken rest period between shifts. The maximum number of hours that a member of the ROV team pilots an ROV should not exceed six hours in every 24 hour period under normal circumstances. However, additional non-piloting work may be included in a shift, up to the 12 hour maximum.

Members of the ROV team should not be asked to work or be on standby for more than 12 hours without having at least 8 hours of unbroken rest during the previous 24 hours. However, in some circumstances an ROV team may have been on standby for a number of hours before an operation begins and, in such circumstances, this can be taken in to account in extending the hours worked. In such cases, extreme care should be taken and allowance should be made for the effects of fatigue.

No person should be expected to work a 12 hour shift without a meal break taken away from their place of work. Personnel also need toilet and refreshment breaks during their shifts. To allow for these breaks, the ROV contractor should ensure that planned work either has natural breaks (for example during periods of strong tide) or that qualified and experienced personnel are available to act as reliefs during breaks.

For operations where a two person crew is used on a pure observation ROV system, operations need not be suspended during periods when only one man is at the control station, provided the second man is not absent for more than one hour and that a responsible person contacts the first team member at regular intervals during that absence. This is only appropriate for routine observation operations and not during launch and recovery activities.

9.4 Training

ROV contractors should ensure that their personnel have received necessary safety and technical training in line with any relevant legislation or, where appropriate, to meet specific contractual conditions or requirements.

9.4.1 Safety Training

Safety training should include:

- courses on survival, first aid and fire fighting;
- installation- or vessel-specific safety induction covering possible hazards at work and while responding to emergencies;
- task-specific safety outlining the hazards associated with tasks such as working overside;
- refresher training at regular intervals.

9.4.2 Technical Training

ROV personnel should attend technical training courses, as appropriate, in order to gain a sound knowledge of the operation and maintenance of ROVs and associated equipment. Details of courses attended should be recorded in the individual's personal logbook and in the contractor's personnel records.

9.5 Communications

Personnel tend to revert to their own language in emergencies. If team members do not speak the same language this can be hazardous. All team members should be able to speak fluently and clearly to each other at all times, particularly during emergencies.

9.6 ROV Personnel Logbooks

It is important that ROV personnel maintain records of their ROV operations. An IMCA logbook has been designed for this purpose and is recommended.

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Responsibilites

10.1 ROV Contractor

The ROV contractor is responsible for defining the management structure for an ROV operation and this should be defined in writing. In addition, there should be a clear handover of supervisory responsibilities at an appropriate stage of operation, again recorded in writing.

The ROV contractor should arrange for every member of the ROV team to have at least one meal break during a 12 hour shift and to ensure that opportunities are available for toilet and snack breaks. This will mean either having other qualified personnel available or planning the work so that breaks are available when a person is not required for the operation.

The ROV contractor is responsible for ensuring that:

- a risk assessment has been carried out and necessary resulting actions taken;
- the support location is suitable and safe;
- there are sufficient competent personnel in the ROV team;
- suitable plant and equipment is supplied, correctly certified and properly maintained;
- a suitable plan is prepared and is available that includes emergency and contingency plans;
- records of all relevant project details are kept;
- adequate arrangements exist for first aid and medical treatment of personnel;
- there is a clear reporting and responsibility structure in writing;
- all relevant regulations are complied with.

The level of detail or involvement required of the ROV contractor and information on how to meet the responsibilities are given in the relevant sections of this code.

10.2 ROV Supervisor

Supervisors are responsible for the operation that they have been appointed to supervise, and they should only hand over control to another suitably qualified person. Such a handover should be entered in the relevant operations logbook.

The supervisor with overall responsibility for the operation is the only person who can order the start of an ROV operation, subject to appropriate work permits, etc. Other relevant parties, such as the ship's master or the installation manager, can, however, tell the ROV supervisor to terminate work for safety or operational reasons.

The ROV supervisor will sometimes need to liaise closely with the master of a DP vessel. In such circumstances, the supervisor must recognise that the vessel master has responsibility for the overall safety of the vessel and its occupants.

The supervisor can give direct orders relating to health and safety to any person taking part in the ROV operation, including a representative of the client. For example, the supervisor may order personnel to leave the control area or to operate equipment. These orders take precedence over any company hierarchy.

To ensure that the ROV operation is carried out safely, the supervisor should adhere to the following points:

- They should satisfy themselves that they are competent to carry out the work and that they understand their own areas and levels of responsibility and who is responsible for any other relevant areas. Such responsibilities should be included in relevant documentation;
- They should be satisfied that the personnel they are to supervise are competent to carry out the work required of them;
- They should check that the equipment they propose to use for any particular operation is adequate, safe, properly certified and maintained. They should ensure that the equipment is adequately checked by themselves or another competent person prior to use. These checks should be documented, for example on an operation checklist, and recorded in the operations log;
- When the operation uses, or plans to use, complex or potentially hazardous equipment, they should ensure that the possible hazards are evaluated and fully understood by all parties and that training is given if required. This will be carried out as part of the risk assessment during the planning of the operation and should be documented. If the situation changes, further risk assessment should be considered. Supervisors will meet their responsibilities by ensuring that this documentation exists and following any guidance contained in it, for example manufacturers' instructions;
- They should establish that all relevant parties are aware that an ROV operation is going to start or continue. They will also need to obtain any necessary permission before starting or continuing the operation, normally via a permit-to-work system;
- The supervisor should have clear audible and, if possible, visual communications with any personnel under their supervision. For example, a supervisor will be able to control the raising and lowering of an ROV adequately if there is a direct audio link with the winch operator, even though the winch may be physically located where the supervisor cannot see it or have easy access to it.

10.3 Other ROV Personnel

Other ROV personnel should act in a responsible manner, follow the ROV supervisor's instructions and adhere to all applicable company procedures. Should any of the ROV personnel identify that any aspect of the job is unsafe, then it is their responsibility to request that the work is stopped.

10.4 Other Personnel

The actions of other personnel can have a bearing on the safety of the ROV operation even though they are not members of the team. These other personnel include:

- The client who has placed a contract with an ROV company for an operation. The client will usually be the operator or owner of a proposed or existing installation or pipeline, or a contractor acting on behalf of the operator or owner. If the operator or owner appoints an on-site representative then this person should have the necessary experience and knowledge and be competent for this task;
- The main contractor carrying out work for the client and overseeing the work of the ROV company according to the contract;
- The installation manager responsible for the zone inside which ROV work is to take place;
- The master of a vessel or floating structure from which ROV work is to take place. The master controls the vessel and has overall responsibility for its safety and all personnel.

These personnel should consider the following actions required of them:

- They should provide facilities and extend all reasonable support to the ROV supervisor or contractor in the event of an emergency;
- They should consider whether any items of plant or equipment (either underwater or topside) under their control may cause a hazard to the ROV team. Such items include water intakes or discharge points causing suction or turbulence, gas flare mechanisms that may activate without warning, or equipment capable of operating automatically. The ROV contractor should be informed of the location and exact operational details of such items in writing and in sufficient time to account for them in the risk assessments;
- They should ensure that other activities in the vicinity do not affect the safety of the ROV operation. They may, for example, need to arrange for the suspension of supply boat unloading, overhead scaffolding work, etc.;
- They should ensure that a formal control system, for example, a permit-to-work system, exists between the ROV team, the installation manager and/or the vessel master;
- They should provide the ROV contractor with details of any possible substance likely to be encountered by the ROV, and therefore the ROV team, that would be a hazard to health, such as drill cuttings on the seabed. They will also need to provide relevant risk assessments for these substances. This information should be provided in writing and in sufficient time to allow the ROV contractor to carry out their relevant risk assessments;
- They should keep the ROV supervisor informed of any changes that may affect the ROV operation, such as vessel movements.

The following personnel have additional responsibilities:

- The client should ensure, as far as it is reasonable, that the plant and equipment, personnel and operating procedures requested of an ROV contractor are appropriate and meet the requirements of relevant regulations;
- When operating from a DP vessel, the DP operator must inform the ROV supervisor of any possible change in position-keeping ability as soon as it is known. A duplicate set of DP alarms, and clear instructions as to their meaning, in the ROV control centre would be of value.

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References

The following is a list of documents which give more detailed information on subjects covered in this code.

Further details on all IMCA publications (including those published previously by AODC) and their latest revisions are available from IMCA (www.imca-int.com).

AODC 032	*ROV intervention during diving operations*
AODC 035	*Code of practice for the safe use of electricity under water*
IMCA C 005	*IMCA guidance on competence assurance & assessment – Guidance document and competence tables – Remote Systems & ROV Division*
IMCA M 103	*Guidelines for the design and operation of dynamically positioned vessels*
IMCA M 189/S 004	*Marine inspection checklist for small workboats*
IMCA R 002	*Entry level requirements and basic introductory course outline for new remotely operated vehicle (ROV) personnel*
IMCA R 005	*High voltage equipment – safety procedures for working on ROVs*
IMCA R 011	*The initial and periodic examination, testing and certification of ROV handling systems*