Postgraduate Certificate in Marine Salvage Operations (Spain)

Marine Salvage Equipment and Techniques

Marine salvage refers to the complex set of operations undertaken to recover a vessel, cargo, or other maritime property after an incident such as grounding, collision, or sinking. The vocabulary associated with marine salvage equipment and techniques is extensive, reflecting the multidisciplinary nature of the field. The following explanation provides a detailed overview of the most important terms, definitions, practical applications, and typical challenges encountered by professionals in a postgraduate certificate program in Spain. The material is organized alphabetically by key term to facilitate quick reference during study and field work.

Air-lift pump – A device that uses compressed air injected at the base of a suction pipe to create a mixture of air bubbles and water, reducing the density of the fluid column and allowing debris or water to be lifted with less suction pressure. In practice, an air-lift pump is deployed when a submerged compartment must be dewatered but the available suction head is limited, such as in a partially flooded engine room. Challenges include controlling the air-to-water ratio to avoid excessive foaming and ensuring the pump does not become clogged with fine sediments.

Anchor handling tug supply (AHTS) – A specialized vessel equipped with high-capacity winches, powerful thrusters, and extensive deck space to support offshore oil-field operations, but also frequently employed in salvage to provide towing force, dynamic positioning, and heavy-lift capability. When a grounded vessel requires repositioning, an AHTS can supply both the necessary bollard pull and the precise maneuverability to avoid further hull damage. Limitations arise from the vessel's draft and maneuvering envelope in confined waters.

Ballast control system – The integrated arrangement of tanks, pumps, and valves that manages a ship's weight distribution and stability. In salvage, ballast control is used to adjust trim and list deliberately, facilitating refloat by shifting weight away from the damaged area. For example, filling forward ballast tanks while emptying aft tanks can raise a bow that is stuck on a sandbank. The main challenge is maintaining sufficient residual stability to prevent capsizing during rapid ballast changes.

Barge – A flat-bottomed, usually non-propelled vessel employed as a platform for equipment, as a transport vessel for cargo, or as a floating dry dock. In a salvage context, a barge may be used to receive cargo pumped from a sunken ship or to support a crane for lifting heavy sections. The primary difficulty is ensuring the barge's own stability when loaded unevenly, especially in rough seas.

Beaching – The intentional grounding of a vessel in shallow water to prevent sinking or to facilitate rescue operations. Beaching is sometimes chosen when a ship cannot be refloated in deeper water but can be safely run aground on a soft, gently sloping beach. The technique demands careful assessment of seabed composition, tidal range, and environmental impact. Improper beaching can cause hull rupture or severe pollution.

Bell buoy – A buoy equipped with a bell or acoustic signaling device used to mark the position of a submerged wreck or hazardous object. Bell buoys serve as reference points for divers, ROVs, and surface vessels during salvage. Deploying a bell buoy requires accurate GPS positioning and secure anchoring to avoid drift, which can be problematic in strong currents.

Belting – The application of high-strength synthetic or steel belting to secure cargo, equipment, or structural components during lifting or transport. In salvage, belting is used to fasten a crane hook to a ship's hull or to bundle sections of a broken superstructure before hoisting. Proper tensioning is critical; over-tightening can damage the material, while insufficient tension may lead to slippage.

Bilge pump – A pump installed in the lowest part of a vessel's hull to remove water that accumulates in the bilge. During salvage, portable bilge pumps are often added to augment the ship's existing pumps, especially when the main power is unavailable. Portable units may be powered by generators, diesel engines, or compressed air. The main challenge is ensuring the intake remains clear of debris that could cause blockage.

Blow-by – The flow of water or oil past the seals of a pump or pipe, resulting in reduced efficiency and possible contamination of surrounding areas. In salvage, blow-by is monitored when operating suction pumps on a wreck, as excessive blow-by can indicate seal wear or misalignment, requiring immediate maintenance to avoid loss of suction capacity.

Bow thruster – A transversal propulsion device located near the bow, used to provide lateral thrust for precise maneuvering. When a grounded vessel must be repositioned, the bow thruster may be employed in conjunction with tug assistance to generate side forces that relieve pressure on the hull. The effectiveness of a bow thruster depends on the available water depth and the vessel's draft; shallow water can diminish thrust.

Breakwater – A structure, often constructed of rock or concrete, designed to protect a harbor or anchorage from wave action. In salvage operations, temporary breakwaters may be erected to create a calm working area for divers and equipment. Building a breakwater in a high-energy environment requires careful engineering to ensure stability against wave loading.

Buoyancy aid – Any device that provides additional lift to a submerged object, typically by displacing water with air or a lighter material. Common buoyancy aids include inflatable pontoons, foam blocks, and sealed drums. When refloating a sunken barge, a series of inflatable pontoons can be attached to the hull and inflated to generate sufficient upward force. The challenge lies in calculating the exact volume of air required to overcome the weight of the vessel and any attached cargo.

Capstan – A vertical-axle rotating machine used to apply a pulling force to a rope or cable, often powered by hydraulic, electric, or manual means. In salvage, a capstan may be used to winch a vessel off a shoal or to tension a towing hawser. Proper selection of capstan capacity is essential; an undersized capstan can overheat or stall under heavy loads.

Crane barge – A barge equipped with a large crane, typically with a lifting capacity ranging from a few hundred to several thousand tonnes. Crane barges are indispensable for heavy-lift salvage tasks such as

removing a broken ship's superstructure or extracting a large piece of cargo. The stability of a crane barge during lifting operations is managed by ballasting and sometimes by using spreader beams to distribute load. Weather constraints, especially wind and wave height, often limit the operational window.

Crane spreader – A structural component that distributes the load of a heavy object across multiple lifting points, reducing stress on any single point of the crane hook. In salvage, spreaders are used when lifting deck cargo containers, large engines, or sections of a ship's hull. Designing a spreader requires knowledge of the object's centre of gravity and the crane's load chart. Incorrect configuration can lead to uneven load distribution and possible crane failure.

Cutting torch – A portable oxy-fuel or plasma torch used to cut through steel plates, hull sections, or other metallic components. Cutting torches enable salvage crews to dismantle a damaged vessel into transportable sections, especially when the wreck cannot be moved whole. Safety considerations include proper ventilation to avoid accumulation of combustible gases, and the risk of igniting nearby flammable materials.

De-watering – The process of removing water from a flooded compartment, vessel, or structure. De-watering is a fundamental step in many salvage scenarios, as it reduces the overall weight and restores stability. Techniques include the use of high-capacity bilge pumps, submersible pumps, and air-lift pumps. The main challenge is achieving sufficient flow rates while preventing re-entrainment of sediments that could clog the pumps.

Deck cargo – Cargo that is stored on the deck of a vessel, often secured by lashings, chains, or dunnage. When a ship is grounded, deck cargo can shift, causing additional hull stress or obstructing access for salvage equipment. Proper assessment of deck cargo distribution is required to plan safe removal or re-securing. In some cases, deck cargo may be off-loaded onto a barge to lighten the vessel.

Diving bell – A sealed chamber that provides a dry environment for divers at depth, supplied with breathable air from the surface. Diving bells are used for deep salvage operations where surface-supplied diving would be impractical. They enable divers to work for extended periods without the fatigue associated with traditional scuba gear. Limitations include the need for a stable anchoring point and the risk of bell entrapment if currents shift.

Dynamic positioning (DP) – An automated system that uses thrusters and computer control to maintain a vessel's position and heading automatically, compensating for wind, wave, and current forces. DP is essential for salvage vessels that must hold a precise location while deploying subsea equipment, such as ROVs or suction dredges. The system's reliability depends on redundant power sources and accurate environmental sensors; failure of a DP system can result in loss of equipment or collision with the wreck.

Emergency tow vessel (ETV) – A ship specifically designated and equipped to provide immediate towing assistance to vessels in distress. ETVs are often stationed at strategic locations and equipped with high-strength towing gear, fire-fighting systems, and medical facilities. In a salvage context, an ETV may be the first response asset, securing a line and preventing a drifting vessel from grounding onto a protected coastline. Coordination with local authorities and rapid mobilization are critical challenges.

Engine room – The compartment where a ship's main propulsion machinery is located. During salvage, the engine room is often a focus of de-watering and inspection, as damage to propulsion systems can affect the vessel's ability to maneuver under its own power. Access to the engine room may be restricted by flooded conditions, requiring the use of entry chambers or de-watering pumps before inspection.

Environmental impact assessment (EIA) – A systematic process of evaluating the potential environmental consequences of a salvage operation, including effects on marine life, water quality, and coastal habitats. An EIA is typically required by Spanish maritime authorities before commencing major salvage work. The assessment must consider oil spill risks, noise from pile-driving, and the disposal of hazardous waste. Addressing EIA findings often adds time and cost to the salvage plan.

Fender – A protective device placed between a vessel and a dock, barge, or another ship to absorb impact forces. In salvage, fenders are used to safeguard both the damaged vessel and the assisting craft during close-quarter maneuvers. Types of fenders include pneumatic, rubber, and foam-filled varieties. Selecting the appropriate fender type depends on the expected impact energy and the surface condition of the hull.

Fire-fighting system – Integrated equipment for detecting and extinguishing fires aboard a vessel, often comprising water spray, foam, or CO_2 delivery systems. Salvage crews must be familiar with a ship's fire-fighting system to prevent accidental activation during cutting or welding operations, and to use it effectively if a fire erupts during salvage. Compatibility between the vessel's system and the salvage team's portable extinguishers must be verified.

Floatation device – Any apparatus that provides upward buoyant force, including inflatable pontoons, sealed drums, and foam blocks. Floatation devices are essential for refloating sunken vessels, raising submerged cargo, and stabilizing lifted loads. The selection process involves calculating the net displacement needed to overcome the vessel's weight, including cargo and water inside. Over-inflation can cause excessive stress on the hull, while under-inflation may be insufficient to achieve lift.

Force multiplier – A principle or piece of equipment that increases the effective output of a smaller power source, such as a hydraulic system that amplifies the force applied by a pump. In salvage, hydraulic shear rams act as force multipliers, allowing a relatively small hydraulic cylinder to cut through thick steel plating. Understanding the limits of force multipliers is critical to avoid over-loading the system and causing hydraulic failure.

Foul – The term used to describe marine growth, debris, or entanglement that obstructs the operation of equipment, such as propellers, thrusters, or suction intakes. Salvage teams often need to clean fouling before deploying pumps or thrusters, as fouling can reduce efficiency by up to 30 %. In some cases, specialized anti-foul coatings or mechanical cleaning tools are employed to mitigate the issue.

Freight container – A standardized, intermodal cargo unit used for transporting goods. When a cargo vessel is grounded, freight containers may become trapped or shift, complicating the salvage plan. Containers can be lifted using ship-board cranes, shore-based gantry cranes, or specialized container spreaders. The weight of a fully loaded container can exceed 30 tonnes, requiring careful load distribution during lifting.

Fuel oil transfer pump – A pump designed to move heavy fuel oil (HFO) from storage tanks to the engine

room or to bunkering facilities. In salvage, fuel oil transfer pumps are used to remove remaining fuel from a damaged vessel to prevent spillage. The pump must be compatible with the oil's viscosity and temperature; improper handling can lead to leaks or pump damage.

Gantry crane – A crane mounted on a system of rails, allowing it to move horizontally along a fixed track while lifting vertically. Gantry cranes are often installed on port facilities and can be brought to a salvage site on a barge. They are ideal for handling large, heavy cargoes such as steel girders or modular sections of a ship's hull. The primary challenge is ensuring the gantry's footing remains stable on uneven or soft ground.

Gravitational anchor – An anchoring system that relies on the weight of the anchor itself, rather than embedment in the seabed, to provide holding power. Examples include heavy concrete blocks or large steel plates lowered to the seabed. Gravitational anchors are useful in soft sediments where traditional driven anchors would have poor penetration. The drawback is the need to retrieve or dispose of the heavy anchor after the operation.

Grounding – The event of a vessel making contact with the seabed, which may result in hull damage, flooding, or loss of maneuverability. Grounding can be intentional (beaching) or accidental (ship runs aground on a sandbank). The severity of grounding is assessed by examining hull breach, damage to propellers, and the extent of flooding. Salvage strategies differ based on whether the grounding is shallow and low-energy or deep and high-energy.

Gyrocompass – A navigation instrument that uses the Earth's rotation to maintain a true north reference, unaffected by magnetic anomalies. During salvage, a gyrocompass provides reliable heading information for vessels operating near wrecks where magnetic interference from the wreck's steel structure may render magnetic compasses unreliable. Calibration of the gyrocompass must be performed regularly to avoid drift.

Helicopter-supported salvage (H-salvage) – The use of heavy-lift helicopters to transport equipment, personnel, or buoyancy aids to a salvage site. Helicopters can deliver inflatable pontoons, fuel, and emergency medical supplies quickly, especially when sea conditions prevent vessel access. Limitations include payload capacity (typically 5–10 tonnes for medium-lift helicopters) and the need for safe landing zones or winch operations.

Hydraulic shear – A cutting device powered by hydraulic pressure, capable of severing thick steel plates, girders, or other structural members. Hydraulic shears are mounted on barges or crane trucks and are driven by a hydraulic pump that can deliver forces up to several thousand kilonewtons. In salvage, shears are employed to remove a damaged hull section to allow access to interior compartments. The main challenge is ensuring adequate hydraulic fluid flow and maintaining the shear's alignment with the cut line.

Hydro-blasting – The use of high-pressure water jets to remove marine growth, rust, or concrete from a wreck's surface. Hydro-blasting is often a preparatory step before welding or cutting, as it provides a clean surface for subsequent work. The equipment includes a high-pressure pump, a nozzle, and a water supply, sometimes supplemented with abrasive particles. The process can generate significant noise and may disturb sediment, impacting nearby marine habitats.

Inert gas system – A system that supplies nitrogen or other inert gases to cargo holds to reduce the risk of fire or explosion, particularly when carrying flammable cargoes. In salvage, the inert gas system may be used to purge a damaged hold of oxygen before entry, creating a safer environment for divers or personnel. Care must be taken to avoid asphyxiation hazards for workers, requiring continuous monitoring of oxygen levels.

J-hook – A metal hook shaped like the letter "J" used for lifting or securing objects. J-hooks are attached to crane hooks or winches and are commonly used to lift chain links, pipe sections, or other round objects. In salvage, a J-hook may be employed to retrieve a submerged anchor or to attach a lifting line to a damaged hull edge. The hook's load rating must be verified to prevent deformation under load.

Jack-up rig – A mobile offshore platform equipped with legs that can be lowered to the seabed, raising the working deck above the water surface. Though primarily used for drilling, jack-up rigs can serve as stable platforms for salvage equipment when operating in shallow water. Their legs provide a firm foundation for heavy crane installations or for positioning large suction dredges. The rig's leg penetration depth must be sufficient to ensure stability, especially in soft sediments.

Jetties – Fixed structures extending from the shoreline into the water, providing berthing for vessels. During salvage, jetties may be used as staging areas for equipment, as loading points for pumps, or as anchorage for tugs. The water depth alongside a jetty must be adequate for the draft of the assisting vessels; otherwise, temporary pontoons may be required.

Jib crane – A crane with a horizontal arm (jib) that can rotate around a vertical axis, allowing it to lift loads over a relatively wide area. Jib cranes are often mounted on salvage vessels or barges to handle smaller items such as tools, ropes, or lifting slings. Their load capacity is limited compared to large deck cranes, but they provide flexibility for precise positioning. Stability during operation must be managed by proper ballast or outriggers.

Kinetic energy absorber – A device designed to dissipate the kinetic energy of moving masses, such as a winch drum or a towing line under load. In salvage, kinetic energy absorbers protect equipment from sudden load spikes that can occur when a grounded vessel breaks free during a pull. These devices often consist of hydraulic cylinders or friction plates that convert kinetic energy into heat. Proper sizing is essential to avoid premature failure.

Lift bag – An inflatable device made of high-strength fabric, used to provide buoyancy when filled with air. Lift bags are attached to a submerged object and then inflated, generating an upward force that can raise the object toward the surface. They are commonly used for lifting small sections of a wreck, such as a broken bow or a cargo crate. The main limitation is the bag's maximum pressure rating, which must not be exceeded during inflation.

Line handling – The practice of managing ropes, cables, and hawsers used to secure, tow, or lift vessels. Proper line handling includes selecting the appropriate line material (synthetic vs. Steel), calculating the correct breaking strength, and employing proper splicing techniques. In salvage, line handling is critical when securing a tug to a grounded ship, as incorrect tension can cause line rupture or hull damage.

Live-load monitoring – The continuous measurement of forces and tensions on lifting equipment during operation, often using load cells or strain gauges. Live-load monitoring provides real-time feedback to operators, allowing them to adjust lifting speed or reposition loads to avoid over-loading. In salvage, this monitoring is vital when lifting heavy ship sections, where sudden load shifts can occur due to uneven weight distribution.

Longitudinal stability – The ship's ability to resist pitching motions around a transverse axis. In salvage, longitudinal stability is assessed when ballast is transferred fore-to-aft, or when cargo is removed from one end of the vessel. An imbalance can cause the ship to trim excessively, potentially leading to further grounding. Stability calculations must account for the weight of remaining cargo, fuel, and water.

Low-freeboard vessel – A ship whose deck is close to the waterline, resulting in a small vertical distance between the water surface and the deck. Low-freeboard vessels are more susceptible to flooding and may require additional de-watering measures during salvage. Their design also limits the clearance for equipment such as winches or cranes, necessitating careful planning of lifting points.

Marine diesel engine – The primary propulsion engine used in many commercial vessels. Understanding the layout and operation of the marine diesel engine is essential for salvage teams, as damage to the engine may affect the vessel's ability to generate power for pumps or winches. In some salvage scenarios, the engine is used as a source of hydraulic pressure for onboard equipment.

Marine pollution response equipment (MPRE) – Specialized gear used to contain, recover, and treat pollutants such as oil, chemicals, or hazardous cargo. MPRE includes booms, skimmers, sorbent pads, and containment vessels. When a wreck leaks fuel, MPRE is deployed immediately to minimize environmental damage. Selecting the appropriate type of boom (e.G., Floating vs. Anchored) depends on sea state and current direction.

Marine salvage contract– The legal agreement that outlines the responsibilities, compensation, and liabilities of the salvage operator, the shipowner, and any insurers. Contracts often reference the "Lloyd's Open Form" (LOF) or other standard forms, specifying the "no cure-no pay" principle. Understanding the contractual terms is crucial for students, as it influences decision-making on the selection of equipment and techniques.

Marine salvage law – The body of international and national regulations governing salvage operations, including the International Convention on Salvage (1976) and the United Nations Convention on the Law of the Sea (UNCLOS). Salvage law establishes the rights to remuneration, the duty to protect the marine environment, and the hierarchy of claims in case of competing interests. Legal considerations can affect the choice of techniques, especially when environmental protection clauses impose strict limits on certain methods.

Marine salvage vessel – A ship specifically equipped for salvage tasks, featuring towing winches, fire-fighting systems, deck cranes, and often a dynamic positioning system. Examples include dedicated salvage tugs, multi-purpose offshore support vessels, and converted oil-platform supply ships. The vessel's classification (e.G., Class-A versus class-B) determines the maximum pulling force it can exert and the range

of equipment it can carry.

Marine salvage register – A database maintained by maritime authorities that records vessels, equipment, and personnel certified for salvage work. In Spain, the Registro de Buques de Salvamento lists approved salvage vessels and their capabilities. Consulting the register ensures that the selected assets meet regulatory standards and are authorized for operation in Spanish waters.

Marine salvage insurance – A specialized insurance policy that covers the costs associated with salvage operations, including equipment deployment, crew wages, and environmental remediation. Coverage may be arranged by the shipowner, the charterer, or a third-party salvage insurer. Insurance terms often dictate the maximum allowable expenditure, influencing the selection of cost-effective techniques.

Marine tow line – A heavy-duty rope or cable used to tow a vessel. Tow lines are typically made from steel wire rope, synthetic fibers such as HMPE (high-modulus polyethylene), or a combination of both. The choice depends on required breaking strength, flexibility, and resistance to abrasion. Proper splicing and termination are essential to prevent line failure during high-tension towing.

Marine winch – A mechanical device that hoists, pulls, or pays out rope or cable, powered by hydraulic, electric, or diesel engines. Winches on salvage vessels are rated in terms of pulling capacity (tonnage) and line speed. Selecting the appropriate winch involves matching the expected load, the required speed of operation, and the available power supply. Over-loading a winch can cause gear damage and loss of control.

Marking buoy – A buoy used to indicate the position of a hazard, wreck, or salvage operation area. Marking buoys are often equipped with lights, dayboards, and sometimes acoustic signals. They serve as reference points for navigation and for coordinating the positions of tugs, divers, and support vessels. The buoy's anchoring system must be robust enough to withstand currents and wave action.

Material handling crane – A crane designed for moving bulk materials, such as sand, gravel, or aggregates, often featuring a bucket or grapple attachment. In salvage, material handling cranes may be used to remove sediment from around a grounded hull, creating a channel for refloating. The crane's reach and lift capacity must be sufficient to handle the volume of material without overloading the deck.

Mechanical advantage – The factor by which a simple machine multiplies the input force to produce a greater output force. In salvage, mechanical advantage is achieved through the use of pulleys, gear reductions, or hydraulic cylinders. Understanding mechanical advantage allows operators to calculate the required input force for a given load, ensuring that equipment is not overstressed.

Mid-ship deck – The central portion of a vessel's deck, often housing cargo holds, machinery, or superstructure elements. Damage to the mid-ship deck can affect the vessel's longitudinal stability and may require the removal of cargo or equipment before refloating. Access to the mid-ship deck is frequently achieved via side openings or by cutting through the hull.

Mine counter-measure vessel (MCMV) – A ship equipped to detect and neutralize naval mines. Although primarily a defense asset, MCMVs can assist in salvage when a wreck is suspected of containing unexploded

ordnance. Their sonar and remotely operated vehicles (ROVs) provide valuable information on the presence of mines, allowing salvage teams to plan safe removal routes.

Mobile crane – A crane mounted on a truck chassis, capable of traveling on roads and providing lifting capability at various locations. Mobile cranes are often used in salvage when a fixed crane barge is unavailable or when the operation takes place on land, such as when a vessel is beached and cargo must be off-loaded. The crane's stabilizers must be properly deployed to prevent tipping on uneven ground.

Modular salvage system – A set of interchangeable components, such as pumps, hoses, and power units, that can be assembled to meet specific salvage requirements. Modular systems allow rapid deployment and customization, enabling teams to adapt to varying depths, cargo types, and environmental conditions. The challenge lies in ensuring compatibility among modules and maintaining a stock of spare parts.

Multibeam echo-sounder – A sonar system that emits multiple acoustic beams to create a detailed three-dimensional map of the seabed. Multibeam surveys are essential for assessing the position and orientation of a wreck, identifying hazards, and planning the placement of suction dredges or anchor points. Data processing requires specialized software and trained personnel.

Multipurpose salvage vessel (MPSV) – A ship equipped with a broad range of salvage equipment, allowing it to perform towing, firefighting, diving support, and heavy-lift operations. MPSVs are valuable assets in regions with limited specialized vessels, providing flexibility for various scenarios. Their design often includes multiple winches, a sizable deck crane, and a DP system.

Natural buoyancy – The inherent upward force exerted by a body immersed in a fluid, equal to the weight of the displaced fluid. In salvage calculations, natural buoyancy is considered when determining the net lifting force required to raise a submerged object. For example, a steel hull section may have a natural buoyancy of 10 tonnes, reducing the amount of additional buoyancy needed from lift bags.

Naval architecture – The discipline concerned with the design and construction of ships and marine structures. Knowledge of naval architecture is crucial for salvage engineers, as it provides insight into hull form, structural strength, and stability criteria. Salvage plans often reference the vessel's lines plan and structural drawings to locate critical load-bearing members.

Neoprene diving suit – A wet suit made of neoprene material, providing thermal protection for divers operating in cold water. While dry suits are preferred for deep salvage work, neoprene suits are frequently used for shallow dives where the risk of contamination is low. The suit's thickness must be selected based on water temperature and expected exposure time.

Oil spill containment boom – A floating barrier designed to encircle and contain oil on the water surface, preventing spread. Booms are made from flexible PVC or rubberized fabric, and may be equipped with skirts to improve oil capture. In a salvage scenario involving fuel leakage, booms are deployed around the wreck to limit environmental impact while pumps remove the oil.

Oil-water separator – A device that separates oil from water using gravity, coalescing plates, or centrifugal forces. Salvage teams use separators to treat recovered bilge water before discharge, ensuring compliance

with environmental regulations. The separator's capacity must match the anticipated volume of contaminated water to avoid bottlenecks.

On-board power generation – The suite of generators, engines, and distribution panels that supply electricity to a vessel's systems. During salvage, on-board power may be compromised; portable generators are then brought aboard to operate pumps, lighting, and communication equipment. Matching generator output to load demand is essential to avoid overloading and to maintain safe operation.

Operational depth – The maximum depth at which a piece of equipment, such as a diving bell or ROV, can function effectively. Operational depth is limited by pressure ratings, cable length, and communication bandwidth. For example, a standard air-line diving system may be limited to 30 metres, whereas an ROV with a fiber-optic tether can operate beyond 1 000 metres.

Outrigger – A lateral support extension used to increase the stability footprint of a vessel or crane. Outriggers are deployed on salvage barges when operating a crane to lift heavy loads, preventing excessive roll. Proper placement and anchoring of outriggers are critical, especially on soft or uneven seabeds where they may sink.

Over-board discharge – The release of water, fuel, or other liquids directly into the sea from a vessel's pumps. In salvage, over-board discharge is generally prohibited unless the discharged material is proven to be non-hazardous, due to strict environmental regulations. Alternative methods, such as pumping into containment tanks, are preferred.

Paraview – A software tool used for visualizing complex data sets, including three-dimensional models of wrecks generated from sonar surveys. Paraview assists salvage planners in assessing the geometry of a wreck, identifying weak points, and simulating lifting scenarios. The software requires a capable workstation and trained personnel to interpret the results accurately.

Passive acoustic monitoring – The use of hydrophones to listen for sounds generated by a wreck, such as gas release, structural collapse, or marine life activity. Passive monitoring can provide early warning of hazardous events, such as the sudden release of pressurized cargo. Installing hydrophones around a salvage site adds an extra layer of safety for divers and crew.

Pedestal crane – A crane mounted on a fixed pedestal, offering 360-degree rotation and a high lifting capacity. Pedestal cranes are often installed on salvage vessels to provide a stable lifting platform for heavy objects. Their design allows for quick repositioning of the load without moving the vessel, which is advantageous when space is limited.

Petroleum, Oil, and Lubricant (POL) contamination – The presence of hydrocarbons in water or soil resulting from a spill. Salvage teams must assess the extent of POL contamination and implement remediation measures, such as using absorbent pads, skimmers, or bioremediation agents. Accurate measurement of contamination levels is required for compliance with Spanish environmental statutes.

Pile driving – The process of installing large timber, steel, or concrete piles into the seabed to provide anchorage or to create a foundation for structures. In salvage, pile driving may be used to secure a

temporary mooring point for a tug or to create a barrier that prevents a wreck from drifting. The operation generates high acoustic noise, which can affect marine mammals; mitigation measures include using bubble curtains.

Pipe handling – The techniques and equipment used to maneuver large-diameter pipes during salvage, such as those forming part of a ship's ballast system or cargo. Pipe handling may involve hydraulic spreaders, chain slings, and specialized lifting clamps. Proper alignment is vital to avoid bending or buckling the pipe during lift, which could compromise its integrity.

Platform supply vessel (PSV) – A vessel used to transport supplies to offshore platforms, often equipped with deck cranes, dynamic positioning, and large fuel tanks. PSVs can be repurposed for salvage tasks, especially when a large deck area is needed for staging equipment. Their versatility makes them valuable assets in regions where dedicated salvage vessels are scarce.

Plumb line – A simple weighted line used to measure depth or to verify the vertical alignment of equipment. In salvage, a plumb line may be used to confirm the straightness of a lifting rig before hoisting a heavy load. Modern alternatives include laser rangefinders, but the plumb line remains a reliable backup.

Portable de-watering pump – A compact pump that can be quickly moved to different locations on a vessel to remove water. Portable pumps are often powered by gasoline or diesel engines and may include a suction hose and discharge hose. Their flexibility is crucial when multiple compartments need to be de-watered simultaneously.

Power-towing – The use of a high-capacity tug to apply a continuous pulling force on a grounded vessel, often combined with ballast adjustments and de-watering. Power-towing is most effective when the vessel's hull integrity is intact and the seabed condition permits movement. The tug's bollard pull must exceed the estimated resistance of the grounding, which is calculated based on soil type, hull contact area, and vessel weight.

Pressure-testing hose – A hose equipped with a pressure gauge used to verify the integrity of pipelines, pumps, or suction lines before operation. Pressure testing ensures that no leaks will occur during salvage, which could lead to loss of suction or environmental contamination. The test pressure is typically set at 1.5 Times the normal operating pressure.

Propulsion system – The combination of engines, shafts, propellers, and associated control equipment that moves a vessel through water. In salvage, a damaged propulsion system may be repaired on-site to provide auxiliary power for pumps or winches. When the propulsion system is beyond repair, external power sources such as generators or shore power must be arranged.

Public liability insurance – Coverage that protects the salvage operator against claims arising from third-party injuries or property damage caused by the salvage operation. The policy limits may influence the selection of equipment, as higher-risk techniques (e.G., Explosive demolition) may require additional coverage.

Pull-through rate – The speed at which a grounded vessel moves during a towing operation, measured in

metres per minute. The pull-through rate is influenced by the tug's power, the resistance of the grounding, and the vessel's mass. Monitoring the rate helps operators adjust towline tension to avoid excessive stress on the hull.

Purser – The officer responsible for ship's administration, including cargo manifests and passenger lists. During salvage, the purser may be consulted to locate hazardous cargo, verify cargo weight, and provide documentation required for customs clearance. Accurate cargo data is essential for stability calculations.

Quay – A solid structure built along a shoreline for loading and unloading vessels. In salvage, a quay can serve as a staging area for equipment, a mooring point for tugs, and a location for de-watering pumps to discharge water onto land. The quay's load-bearing capacity must be sufficient to support heavy salvage gear.