



SAFETY MANAGEMENT MANUAL

ATL 7.9 DSV ALVIN OPERATIONS

Originator:	Approved By:
Christopher Morgan	Al Suchy

1. PURPOSE

The safe operation of the Deep Submergence Vehicle DSV Alvin requires careful planning and a high level of competence on the part of all persons involved in the operations. The purpose of this section is to define the safe launching and recovering procedures of the DSV Alvin on board the R/V ATLANTIS in normal and emergency situations.

2. SCOPE

This procedure applies to the operations involved during the launching and recovering of the DSV Alvin on board the R/V ATLANTIS.

3. RESPONSIBILITY

The **Master** of the R/V ATLANTIS is, by maritime custom and law, responsible for the safety of the vessel and all persons on board. The Masters' authority thus extends to all aspects of the vessel's operations. Operation of ALVIN from R/V ATLANTIS requires close cooperation among all parties involved. It is essential that the Master be able to rely on technical advice and assistance made readily available by the Alvin Group.

The **Expedition Leader** is responsible for all decisions regarding the safe operation of the DSV up to the time of launch, at which point responsibility for the safety of the DSV is divided into three separate spheres of influence governed by the Pilot-in-Command, the Launch Coordinator, and the Surface Controller. The overall responsibility returns to the Expedition Leader when the DSV is recovered. The Expedition Leader is also responsible for the assignment of Pilot-in-Command, Launch Coordinator, and Surface Controller for each dive.

The **Pilot-in-Command** is responsible for the complete knowledge of the status of the DSV, mission goals, safety regulations, and emergency procedures during a dive. The pilot in command is responsible for the safe operation of the DSV at all times during the dive and satisfactory performance of the mission. The pilot is responsible for aborting the dive if unsafe or potentially dangerous conditions arise.

The **Launch Coordinator**, in conjunction with the vessel Master, has the responsibility for the safe, coordinated launch and recovery of the DSV including consideration for obtaining the objectives of the dive.

The **Surface Controller** is responsible, during diving operations, for having a thorough knowledge of the mission, proposed dive track, weather and sea condition forecast, availability of nearest medical assistance (including search and rescue) and the readiness condition of the R/V ATLANTIS and equipment. The surface controller is responsible for communications, tracking and other assistance to the DSV. The surface controller is responsible for initiating and carrying out emergency procedures if required, and the termination of the dive when warranted due to safety considerations.



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The **LARS Operator** is responsible for operating the **LARS** during the launching and recovering of the DSV as directed by the Launch Coordinator. This includes reviewing the LARS hydraulic system for the proper warm-up period prior to the launch and recovery, and performing the required pre-testing to ensure that the **LARS** is in complete readiness.

The **Avon Operator** is responsible for operating the Rigid-Hull Inflatable Boat (RHIB) during the DSV launches and recoveries. The boat is used to transport the Alvin Swimmers, or any other necessary gear to and from R/V ATLANTIS during launch and recovery operations. The Operator is responsible for the preparedness of the boat including the warm-up of the outboard motor, and the readiness of all necessary and/or emergency equipment. The Operator is responsible for the well-being and safety of all personnel in the boat and shall be considered “in command” of the boat as if it were any other 16-foot vessel on the high seas.

Two **Alvin Swimmers** are required for DSV launch and recovery. The swimmers are responsible for casting off the main lift line and tail line during launches, hooking up the tow line, the tail line, and the main lift line during recoveries. Swimmers are also responsible for carrying out specific duties including: maintaining communications with the Alvin Pilot during launches and recoveries, checking that basket safeties are properly attached and fairlead, verifying that the manual vent valve is opened/closed, deploying the sea anchor during recovery, and reporting any abnormalities that are noticed which may affect the safety of the launch or recovery operation.

4. References

- a) R/V ATLANTIS Alvin **LARS** Operations and Maintenance Manual
- b) Management Plan for the Submersible Engineering & Operations Group
- c) Alvin Operations Manual
- d) R/V ATLANTIS Small Boat Operations (SMM ATL 06.4)
- e) R/V ATLANTIS LARS Operators (SMM ATL 06.5)
- f) R/V ATLANTIS Swimmer Qualifications (SMM ATL 06.6)

5. PROCEDURE

A. General

The launch and recovery of the DSV Alvin is a joint effort of the Master of R/V ATLANTIS, the Surface Controller, the Launch Coordinator, Pilot in Command and **LARS Operator**. Manning for the launch stations shall be assigned well in advance of the launch. Only qualified members of the DSV Alvin team and ship’s crew shall man these stations.



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Specific command and control assignments for all normal launch and recovery operations have evolved from practice and are set forth in the Alvin Operations Manual. Under unusual circumstances these assignments may be changed, but only with the concurrence of the Master, Expedition Leader, Surface Controller and Pilot-In-Command and LARS Operator.

During the actual launch and recovery operations, while Alvin is attached to the hoist equipment, the Master is responsible for the evolution as well as the control of the ship. When Alvin is unhooked from the towline and lift lines, the Pilot then takes control of Alvin, and the Pilot's actions are coordinated with those of the ship by the Surface Controller.

The Launch Coordinator's function is to provide a single point of control for the activities occurring on both the ship and the DSV, and coordinates launch and recovery operations. Therefore, all involved personnel receive commands directly from the Launch Coordinator who is in direct communication with the bridge, Surface Controller, Pilot, LARS Operator, Avon Operator and Alvin Swimmers. LARS operators control the LARS; reference e).

B. Pre-Launch

Approximately one hour before launch time, the LARS Operator shall begin system warm-up and checks. Engine Department is notified for redundant generators parallel on the electrical bus. Approximately a half hour before the scheduled launch time, swimmers will be called to begin suiting up, and the Avon boat will be moved to its launch position and checked.

The Mate on watch should determine the best launch heading considering wind, swell, set and drift. As close to the launch time as possible the ship should be at the desired launch point, on heading and dead in the water.

C. Launch

When the DSV Alvin pre-dive checklists (reference c) and the R/V ATLANTIS pre-launch checklist (reference a) have been completed and signed by the Expedition Leader, Pilot, Surface Controller, Master, LARS Operator, and Chief Scientist, the word is given to man launch stations. When all stations have been manned and agreement has been reached between the Master, Surface Controller, and Pilot that everything is in readiness, the order is given to board the submersible and launch the Avon Boat. When the boat is safely launched and standing by off the stern of the ship, and all personnel have embarked the submersible and the word is passed that the hatch is securely sealed, the order is given to launch the DSV by the Master. The LARS Operator and others involved take their directions from the Launch Coordinator. The launch proceeds as follows:



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The Launch Coordinator reports to the bridge, “All stations manned and ready; communications check complete.” The Launch Coordinator then assumes operational control of the launch and verifies the following:

- LARS hydraulic system warm-up period has elapsed and the LARS is ready
- LARS is vertical
- LARS telescopic leg is raised
- DSV is positioned under the LARS
- LARS is moved inboard with main lift line and tail lift line lowered and attached to the DSV’s lift points. Slack is removed from main and tail lift lines.
- LARS telescopic leg lowered and LARS latch engaged into the DSV lifting tee. Latch engagement must be visually verified.
- DSV access ladder removed, aft safety lines lowered and hatch is sealed.
- Two swimmers board the DSV.

Note: Stern propulsion is normally not used during launch and recovery operations. If the bridge feels that it is necessary to use stern propulsion, the Launch Coordinator must confirm that the swimmers are clear and provide the swimmers with adequate warning as appropriate.

- Ship begins to move slowly ahead if required.
- LARS telescopic leg is raised to ensure the latch fully engages the DSV lifting tee.
- LARS is boomed outboard to the “extend limit” mark.
- With the main and tail lift winches in full tension mode, the DSV load is taken up on the lift lines and the latch is disengaged. Latch disengagement must be visually verified.
- Lift lines are paid out until the DSV is afloat.
- Swimmers cast off lift lines. LARS Operator hauls in lift lines until clear of the DSV.
- If necessary to ensure adequate separation between DSV and the ship, the ship’s forward speed is increased by thrusting ahead for a short period until the ship is well clear of the DSV (>150 meters).
- Swimmers remove the sample basket safety lines when instructed by the Pilot.
- Swimmers open manual vent valves and energize “ID” light when instructed by the Pilot.
- Swimmers return to the Avon boat and wait until the DSV has submerged.
- LARS is boomed into the stowed position and the Avon boat returns to the ship to be recovered.
- Bridge is notified that launch operations are completed.



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D. Pre-Recovery

Recovery preparations begin approximately 1.5 hours before the DSV is expected to reach the surface. Preparations begin when the Surface Controller passes the word that the DSV has dropped its ascent weights. Engine Department is notified for redundant generators parallel on the electrical bus.

The Mate on watch shall determine the best recovery heading taking into account the wind, swell, set and drift. When this has been determined, the Surface Controller shall be informed and together they will maneuver the ship to be at a position no less than 500 meters and roughly downwind of the position where the DSV is expected to surface.

Approximately 30 minutes before the expected surfacing time, the Avon boat is prepared for launch and the swimmers are called. The LARS is warmed up as required, the recovery checklist completed, and all personnel are notified of the DSV's expected surface time.

E. Recovery

Prior to the DSV's arrival on the surface, the word is given to man recovery stations.

The ship maneuvers to take station well clear a minimum of 500 meters, of Alvin's predicted surfacing position, generally downwind.

When the DSV ascends to a depth of about 500 meters from the surface, the Avon boat is launched with the Avon Operator and two Alvin Swimmers. In rough sea conditions, an additional person to handle a safety line as bow hook shall also be aboard.

When the DSV surfaces, a radio check is conducted, the Avon maneuvers along side and the swimmers go aboard. While one swimmer establishes contact with the Pilot via sound powered phone, the other swimmer begins to attach the basket safety lines and sea anchor. The second swimmer provides assistance with the safety lines after determining if the Pilot has any special instructions or information.

When the Avon Operator reports to the ship that all is ready, the DSV recovery proceeds as follows:

- Launch Coordinator reports to the bridge, "All stations manned and ready; communications check complete".
- LARS is boomed out to the recovery position with aft safety lines lowered.
- Ship maneuvers so Alvin passes down one side; approximately 15-25 meters. The maximum speed should be 1.5 knots.
- As Alvin approaches the vessels mid-ship, the bridge passes the word to the Launch Coordinator to pass the towline to the Avon boat. The swimmer will then attach the tow bridle to the DSV stern tow point.



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- Launch Coordinator assumes operational control of the DSV recovery.

Note: The Pilot of the DSV will maneuver Alvin in accordance with instructions received from the Launch Coordinator except when, in the Pilot's judgement, emergency maneuvering is required to avoid collision or other mishap. Normally, the DSV will be instructed to maneuver such that the tow point faces the support ship as it passes along side.

- Ship maintains speed of approximately 1.5 knots, generally upwind with ALVIN in tow, while the LARS Operator hauls in on the tow winch until the DSV is positioned at the transom for the lift.
- Main and tail lift lines are lowered and swimmers attach them to the DSV lift points.
- When conditions are optimum, the lift lines are retrieved in full tension mode and the DSV is lifted clear of the water. At the same time the swimmers disembark.
- Swimmers return to the Avon boat, which take station astern.
- Lift continues until the DSV makes contact with the LARS telescopic leg.
- DSV Latch is engaged. Latch engagement must be visually verified.
- The DSV is lowered onto the latch with the main lift line, leaving sufficient slack to release the load.
- LARS is boomed to the inboard position. Tow line is detached as the DSV passes over the tow winch.
- If required, the telescopic leg is lowered until the DSV is placed on its cradle.

Note: Positioning of the cradle and telescopic leg prior to swinging the DSV inboard frequently allows placing the DSV on its cradle without additional telescopic leg extension. This is an acceptable procedure and usually results in a shorter period of time during which the DSV is suspended from the LARS. Caution must be exercised however, since in rough sea conditions, the telescopic leg should be partially retracted while the swimmers are attaching the lift lines.

- DSV Latch is disengaged, aft safety lines are raised and the sea anchor is brought aboard.
- LARS lift lines are disconnected and the telescopic leg raised.
- Avon boat is recovered; Pilot and observers debark; bridge is notified that DSV recovery operations are complete.
- LARS system is returned to the stowed position.

F. Recovery in Rough Seas



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Although Alvin will not be launched for a dive if rough weather is imminent, weather and sea conditions are not predictable enough to preclude the possibility of a recovery in rough weather. In the event that a rough weather recovery becomes necessary, the following steps will be taken in addition to normal recovery procedures:

- At the first indication of a rough weather recovery, the Pilot should be notified in order that he may conserve power. If the Surface Controller deems it necessary, the order to the pilot to surface as soon as possible may occur.
- Senior experienced personnel may be substituted for recovery duties for all aspects of the DSV recovery.
- Extra Alvin swimmers may be utilized in the Avon boat.
- Tag lines may be used to pass the tail line.
- All unnecessary personnel are kept clear of deck operations.
- All disposable weights aboard the submersible are dropped and the variable ballast system is pumped down if necessary to establish additional freeboard.
- If it is safe for the swimmers to do so, samples and tools are removed from the sample tray and placed in the Avon boat.

When all the above steps have been taken, the DSV recovery then proceeds in the normal fashion. During the lift line attachment phase, the LARS Operator must ensure that the telescopic leg is in the partially retracted position in order to provide the Alvin swimmers with the maximum possible clearance.