JOHNSON-SEA-LINK CRUISE PLANNING MANUAL

Prepared by the Submersible Operating Crew
Marine Operations Division

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INTRODUCTION

In order to plan a successful cruise utilizing one of the two *Johnson-Sea-Link* submersibles, it is important to understand the capabilities and limitations of the system. The Marine Operations Division provides the information in this Planning Manual as a means for the user to become familiar with the submersibles and with the constraints put on them by the environment, geographic considerations and mechanical and/or electrical parameters.

Potential investigators are strongly urged to contact the Sub Crew after reading this manual in order to discuss plans and objectives and learn of possible changes to capabilities. Detailed discussions with members of the crew can often generate improved methods for accomplishing scientific objectives. Informal exchanges via mail or telephone are welcome, but organized and explicit written communications provide the safest and most reliable means for obtaining additional information and understanding.

Do not hesitate to request additional information from personnel listed in the Directory.

Don Liberatore
Manager of Under Sea Vehicles

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SECTION I – Chain of Command

1. Personnel Organization

a. Introduction and Summary of Shipboard Administration

The duty assignments which follow constitute the formal delegation of authority to persons assigned those duties. In addition, they provide a description of responsibilities and accountability for the management and operation of HBOI@FAU Research Vessels.

The HBOI@FAU Research Vessels unite two or more highly specialized groups into a team. The ship's crew, the submersible crew, and the science party are all equally essential groups, each having its own command structure. The Master, the Submersible Ops Coordinator, and the Chief Scientist are the respective heads of these groups. It is up to them to use their experience and expertise to coordinate the successful completion of the mission. Their duties are as follows:

Master

The Master manages the organization and operation of the vessel. He is responsible for all official communications and business transactions. He has full and final legal responsibility regarding operations and safety at sea and the conduct of all embarked personnel on board and ashore. His authority is absolute.

Submersible Operations Coordinator (SOC)

The SOC is responsible for the safe and efficient operation of the submersible and its associated systems. He is responsible for scheduling dives, interfacing mission related gear to the submersible and determining if conditions are favorable for a successful launch and recovery.

The SOC must know the capabilities and limitations of the ship, the submersible and their crews, and balance that against the needs of the Chief Scientist. He is the liaison between the Master of the vessel and the Chief Scientist. The SOC will be responsible for maintaining an overview of the entire operation to avoid conflicting demands and work closely with the Master in coordinating all efforts. In practice, the SOC informs the Master of what he desires and unless it is unsafe or illegal, it will be carried out.

Submersible Pilot

The submersible pilot is responsible to the SOC for ensuring that the submersible is ready and safe to dive and that all the checklist and log books are filled out. The pilot is completely in charge of the submersible from launch to recovery and ensures that all persons on the submersible are fully briefed on safety and emergency procedures. He will operate the submersible in accordance with the subs operations manual and procedures. While submerged the pilot may override a decision made by the SOC if he feels that the submersible or personnel are at risk.

Aft Observation Compartment (AOC) Operator

The AOC operator is a member of the submersible operating crew and is responsible to the sub pilot for the proper operation of all AOC life support, emergency systems, and mission specific equipment that may be operated from the AOC.

Submersible Technician

The submersible technician is a member of the submersible operating crew and is responsible to the submersible pilot to ensure that the proper repair and maintenance is carried out on all the subs systems and support equipment prior to diving operations.

The submersible technician may also be assigned as a communications tracking station operator where he will be responsible to the SOC for direct voice communications with the sub pilot and electronically tracking the submersible while submerged ensuring that the ships bridge is always aware of where the submersible is located.

The submersible technician may also be assigned as a swimmer during launch and recovery of the submersible where he is responsible to the SOC to ensure that the hatch is properly dogged and latched prior to the dive and is also required to enter the water for recovery operations and attach the towing rope to the subs tow bar.

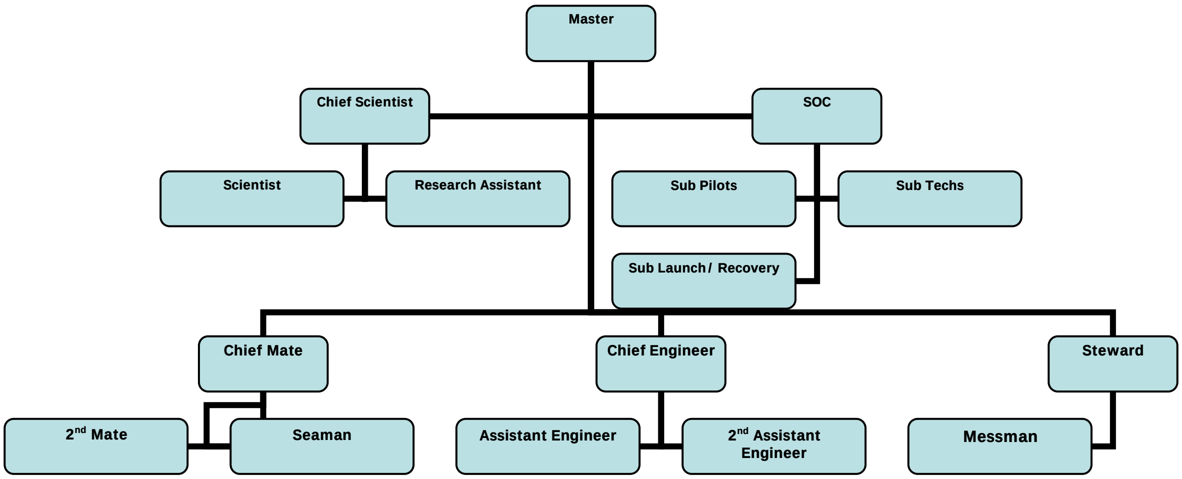
The Launch and Recovery System (LARS) Operator

Is a member of the ships engineering department and is responsible to the SOC for the mechanical and hydraulic integrity of the LARS and its safe operation during the launch and recovery phase of the operations.

Chief Scientist

One member of the scientific party will be designated Chief Scientist. When two or more Co-Chief Scientists are designated, one shall clearly be identified as spokesman. He or she will be responsible for the coordination and execution of the entire scientific mission and is accountable, to the Master, for the conduct of all scientific personnel on board and ashore. The Chief Scientist will work closely with the SOC to develop an acceptable mission plan to include location, depth, tasks, equipment and/or personnel required. In matters of operational safety, he/she must always defer to the SOC, the Master of the vessel, or the pilot of the vehicle. In practice, the Chief Scientist informs the SOC of what he/she desires and unless it is unsafe, illegal, or against accepted procedure it will be carried out.

In addition, the Chief Scientist is responsible for the assignment of scientific staterooms and berths, the safe and secure storage of all scientific equipment and the cleanliness of the scientific work areas.



Shipboard Organization Chart

SECTION II - Vessel Characteristics

1. Johnson-Sea-Link I & II

a. General Capabilities

- Operate at any depth from the surface to 3000 fsw (not to exceed 3300 fsw actual bottom depth) at a speed of 0 - 1.0 knots, and remain submerged for periods of up to approximately 4 hours (120 hours under emergency conditions).
- Carry one observer in the acrylic pilot sphere, one observer in the aft observation chamber (AOC), and various internal and/or external instrumentation and tools.
- Maneuver within close proximity of slopes or other bottom topography.
- Hover at neutral buoyancy and/or rest on the bottom to perform scientific and engineering tasks, including still and video photography.
- Use its manipulator and specialized tools to deploy various scientific instruments and to collect samples.
- Provide a limited amount of electric and hydraulic power for instruments and equipment not normally part of the submersible.
- Offer data logging and display capabilities with standard sensors including temperature, conductivity, and depth.

Each of these capabilities and limitations will be discussed in this manual. Additionally, the capabilities of the support ship R/V *Seward Johnson* beyond those of supporting the submersibles should be considered in order to maximize the value of the cruise and to minimize the effect of dive time lost due to unforeseen problems. Further information pertaining to the support vessels is available in the **Research Vessel's Cruise Planning Manual.**

Submersibles have proven most effective when used in a well planned, coordinated program, where their abilities to observe directly, photograph selectively, and sample in situ are complemented by other research techniques.

b. Specifications

Johnson-Sea-Link I & II (JSLs) were commissioned by Harbor Branch Oceanographic Institution in 1971 and 1975 respectively. They are virtually identical. These untethered vehicles have together logged over 8500 dives. The submersibles remain state-of-the-art due to numerous improvements made over the years.

A side view of a JSL is shown in Figure 1. The submersibles' general characteristics are as follows:

Certification	American Bureau of Shipping
Length	27' (8.2 m)
Beam	8'4" (2.5 m)
Height	10'11" (3 m)
Draft	7'7" (2.3 m)

Gross Weight	28,000 lbs (12,727 kg)	
Operating Depth	3,000 ft. (914.4 m)	
Pilot Sphere	OD	68.3"
	ID	57.80"
	Wall	5.25"
	Materials	Acrylic, annealed
	Hatch	17.5" opening
	Weight	2,920 lbs in air
		3,110 lbs. Positive in water
Aft Observation Compartment (AOC)	Length	98"
	ID	44"
	Side Wall	3.3" thick
	Heads	2.3" thick
	Material	5456 Aluminum
	Lock	4" dia x 12"
	Viewports	Two 8" side ports
	Hatch	20" opening
Payload		1000 lbs. approx.
Total Power	49.3 kWh (28 VDC x1760 Ah)	
Speed	0-1 knot approx.	
Max. Cruising Range	2 miles	
Normal Dive Duration	3-4 hours	
Life Support Duration	480 man hours	
	(120 hrs x 4 persons)	
Complement	Forward	1 HBOI@FAU pilot, 1 observer
	Aft	1 HBOI@FAU technician,1 observer

Both compartments have been hydrostatically tested to conform to American Society of Mechanical Engineers (ASME) and Pressure Vessels for Human Occupancy (PVHO) codes.

The 1000 lb payload listed above includes four passengers. Any remaining payload is available for user equipment and samples taken during the dive. This load includes internal and external equipment, subject to some restrictions. Internal equipment must pass through 17.5" (sphere) or 20" (AOC) hatch openings with adequate clearance. The sample load limit on the Lower Work Platform is 150 lbs (in air).

Normal dive duration varies from 3 to 4 hours, but this time may be reduced by excessive power usage. The primary power consumers are thrusters, hydraulics and lights. High speed or current-fighting transits and excessive use of the lights represent loads that might be avoidable with proper dive planning.

During any given dive, the percentage of time actually spent on the bottom or at desired depth depends upon the amount of time it takes to travel to and from that depth.

Dive duration may also be affected by the need to perform launch and recovery operations in suitable weather conditions. Deteriorating weather conditions may require the early termination of a dive, as may any malfunction which could affect safety or the continuation of operations. The Submersible Operations Coordinator and/or pilot are responsible for making decisions based on these factors.

2. Support Vessels

Harbor Branch Oceanographic Institute @ Florida Atlantic University (HBOI@FAU) owns and operates a state-of-the-art research vessel capable of supporting the JSL's. R/V *Seward Johnson* is 204 feet long and has a beam of 36 feet. It was designed specifically for HBOI@FAU and was commissioned in 1984.

In addition to the systems required to launch, recover, track and communicate with the submersible. The ship has an Integrated Mission Profiler (See Section III-5c). A compliment of small boats, air compressors, recompression chambers, winches and cranes are available for surface or scuba operations with advanced notice. Further information is available in the **Research Vessel Cruise Planning Manual** and in Figure 6. Contact the Manager of Marine Operations or Administrative Assistant for a copy.

SECTION III – Systems Descriptions

1. Life Support

   a. Oxygen

High pressure oxygen is plumbed to a pressure reducing regulator coupled with an adjustable flow meter in each compartment. It is bled into the compartment atmosphere at the approximate rate of 1/2 liter/man/min. This rate maintains an oxygen level of 21% which is monitored continuously.

   b. Carbon Dioxide Scrubbers

      (1) Primary System

The purpose of the HBOI@FAU scrubber is to remove CO_2 from the atmosphere within the submersible. The HBOI@FAU primary scrubber unit consists of two semi-circular canisters which hold a total of 14 lbs of chemical absorbent. The canisters clamp around the fan/power unit which draws air through the canister and over the absorbent bed then back to the atmosphere. The units are cycled on and off as necessary to maintain a percentage between .03 > .5% which is monitored continuously.

      (2) Secondary System (Thermal Regenerator Scrubber-TRS)

The purpose of these units is to remove CO_2 within the submersible on an emergency basis. These are to be used when the normal system is inoperable and the submersible is unable to surface and correct the problem. Failure of the normal system is grounds for aborting the dive.

A TRS unit is provided for each occupant. It consists of a canister which holds 4.8 lbs of chemical absorbent, an oral/nasal face mask with a thermal regenerator and the interconnecting hoses. These units require no power other than the user's lungs to draw air through the canister then over the absorbent bed and back to the atmosphere. The thermal regenerator stores the heat generated by the absorbent bed and through exhalation thereby increasing efficiency as the ambient temperature drops.

      (3) Chemicals

Two chemical carbon dioxide absorbents are available on board the JSL. They are Sodasorb High Performance (HP) and Lithium Hydroxide.
Sodasorb HP is the registered trade name for soda lime, manufactured by the Dewey Almy Chemical Division of W.R. Grace and Co. It is used on a daily basis in the HBOI@FAU primary scrubbers. It is also stored in each compartment (sphere-48 lbs, AOC-48 lbs) for emergency use in either the primary or secondary CO_2 scrubbers. Sodasorb HP however is sensitive to temperature. As the temperature decreases, so does its ability to absorb CO_2.

Lithium Hydroxide (LiOH) is manufactured by Cyprus Foote Mineral Co. It is to be used only with the HBOI@FAU primary scrubber when the temperature drops low enough to render the Sodasorb HP ineffective. Forty pounds of LiOH are stored in the AOC where the temperature can drop as low as 40F. In a temperature drop from 80F to 40F, Sodasorb HP loses 63% of its scrubbing capacity while LiOH loses only 6%. LiOH, however, is highly caustic and corrosive and special handling techniques must be used.

c. Emergency Breathing Regulators

Two emergency breathing regulators are provided in each compartment. In the pilot's sphere, they are U.S. Divers Conshelf scuba regulators and are supplied with high pressure air from the pilots control panel. In the AOC, they are U.S. Divers Royal scuba regulators supplied with high pressure air from the AOC main gas supply.

Their purpose is to provide life support to the occupants in the event of atmosphere contamination.

d. Atmosphere Analyzers

A Crowcon (GasmanII) oxygen monitor and a Bacharach MOD 2800 carbon dioxide monitor are installed in both compartments on the JSLs. Their purpose is to measure the percentage of oxygen and of carbon dioxide so that the crew can make the adjustments necessary to maintain the O2 and CO_2 levels within acceptable limits.

e. Thermal Protection

The acrylic sphere is a very good insulator and must be air conditioned to maintain a comfortable temperature. It is advisable to carry a sweat shirt or other long sleeved shirt in case it gets cool. (See also Section V-7a)

The aluminum AOC is the compartment most subject to drastic temperature drop. A 1000 watt heater is installed along with long underwear, snowmobile type jump suits and chemical heat packs to provide the occupants with protection in case of long exposure.

f. Food and Water

Both compartments carry 2 quarts of potable water, 2 one gallon desalting kits plus enough vacuum sealed food sticks (USCG approved life raft rations) to provide 5 days life support.

2. Pneumatic Systems

a. Air

High pressure air is stored in 3 banks; forward, aft and the gas sphere. The forward and aft banks each consist of 4 Compositek fiberglass wound aluminum cylinders with a bank capacity of 1748 SCF at 3600 PSI. The aluminum gas sphere has a capacity of 1800 SCF at 1900 PSI.

The high pressure air is used for ballast and buoyancy control. Buoyancy is obtained by the use of the Main Ballast Tanks (MBT) which provide a total of 3500 pounds of lift in JSL I and 3700 pounds of lift in JSL II (in seawater). Ballast is adjusted by using the Variable Ballast Tanks (VBT) which can hold a total of 270 pounds of seawater in JSL I and 340 pounds in JSL II.

All controls are located at the pilot’s panel on the port side of the sphere. Besides operating the ballast and buoyancy control, high pressure air is also used for the release of the drop lock, tow line, and emergency buoy. The banks also supply the sphere and AOC with air for emergency breathing. There are several spare pneumatic functions available.

b. Oxygen

Oxygen is stored in two banks; port and starboard. Each bank consists of one Compositek fiberglass wound aluminum cylinder with a bank capacity of 403 SCF at 3000 PSI. Either bank is available in the pilots sphere with the port being the normally selected one. Both banks are available in the aft observation chamber with port and starboard on line at all times. Oxygen is used only for addition to the compartments atmospheres to replace that which is lost due to metabolic consumption by the occupants.

3. Hydraulic Systems

The hydraulic system provides fluid power to the manipulator and auxiliary manifold. It produces from .5 to 4 GPM at 350 to 1100 PSI via a servo controlled by-pass valve. Fifteen functions are available simultaneously or a spooler can be activated to shift power to ten alternate functions. This gives a total of 25 functions available on any given dive. The seven function manipulator was designed and built by HBOI@FAU. It has continuous wrist rotation and a built in line cutter capable of cutting up to 1 inch soft line. Maximum lift at full extension is 150 lbs. The manipulator work envelope is shown in Figure 2. The hand consists of opposing overlapping finger pairs. It is specifically designed to grip instruments which are fitted with a standard 'T' handle (see Figure 3).

4. Electrical Systems

a. Main Battery

The main battery consists of fourteen 2 VDC Exide (type E110-33) lead-acid cells providing 49.3 kWh (1760 Ahrs) at 28 VDC nominal. The battery cells are housed in an oil compensated housing that acts as the keel of the submersible. It can be released in an emergency to obtain 2300 lbs of positive buoyancy.

b. Emergency Battery

The Emergency Battery consists of fourteen 2VDC, Exide E75L-5 lead acid cells, providing 4.2 kWh (150 Ahrs) at 28 VDC. The cells are housed in an oil compensated housing on the tail of the submersible. The battery is only used as an emergency power for the life support and communications system.

c. Switch Panel

The sphere switch panel provides central control for most electrical systems. It also displays the resultant water current in knots with an accuracy of .1 knot, heading (flux gate and magnetic), as well as electrical systems status.

d. Inverter

The AC inverter provides a continuous supply of regulated 115 VAC at 60 Hz. The inverter is capable of producing 700 Volt-Amps. It powers the sonar and pan and tilt mechanisms which consume approximately 1/2 of its available power.

e. Thrusters

Nine 1.25 h.p. reversible electric thrusters allow three dimensional mobility. Each thruster provides 80 lbs. of thrust with 14 x 14 LH propellers turning at 400 RPM. The propellers are shrouded with nozzles made from polyethylene for added efficiency and safety.

5. Communication/Tracking/Integrated Positioning System

a. Communication

The JSLs are outfitted with a subphone by Orcatron underwater telephone (UQC). It is a compact, high powered telephone designed for single-sideband, suppressed carrier operation. This is compatible with Navy systems. They can be used for both voice and code communications at two power levels to provide ranges up to 10,000 yards.

The JSL pilot sphere is equipped with a hand held VHF radio for surface communications and a manually operated Emergency Position Indicating Radio Beacon (EPIRB).

Communication from the sphere to the AOC is accomplished in several ways. The primary means is via a Telex IC-1F intercom system. Each observer is supplied with a set of headphones with a built-in microphone. The system is on continuously, allowing the forward and aft observers to communicate at will with hands-free operation. Meanwhile, the pilot and technician communicate over a push to talk mike system. A sound powered phone and buzzer are available for emergencies.

b. Tracking

The submersible's position relative to the ship is constantly monitored by an ORE Trackpoint II tracking system on board the support vessel which utilizes active ultra-short baseline technology. The sub carries a depth transponder which allows the tracking equipment to calculate range, bearing and depth of the submersible every 4 seconds. The Trackpoint can track up to 6 transponders/ pingers (contact Marine Operations for workable combinations) within a frequency range of 22 to 30 kHz. User supplied pingers or transponders should be of sufficient power to allow accurate tracking up to one mile.

The pilots sphere also carries an ARC-406 Emergency Position Indicating Radio Beacon (EPIRB). This beacon is registered with the National Oceanic and Atmospheric Administration (NOAA) and if activated on the surface by the occupants in the pilots sphere will transmit a distress alert via radio transmission on 406 MHZ to the satellites of the COSPAS –SARSAT network. This beacon should only be activated after one hour if the submersible surfaces and is not in direct or relayed contact with the support ship after numerous attempts via VHF radio, Underwater Telephone or line of sight.

c. Integrated Positioning System

In addition to the Trackpoint, both support vessels also carry an Integrated Positioning System (IPS). This is a PC based system that receives the submersible's position relative to the ship from the Trackpoint and the ship's position from the shipboard Global Positioning System (GPS), integrates the two and produces a real-time position of the submersible in terms of latitude and longitude. With pre-dive planning, the submersible can be guided from the surface to an exact position in terms of latitude and longitude. The system also provides instantaneous positional fixes on the submersible's location upon request. At the end of the cruise, dive records from the IPS can be stored on disk for future reference.

6. Navigation Aids

a. Sonar

JSL I and II are presently equipped with Sunwest Technologies Super Search SS300 sonars. They are compact and employ CTFM (Continuous Transmission Frequency Modulated) sonar techniques to provide rapid scanning, high resolution and simultaneous portrayal of signals from all underwater targets that fall within the directivity patterns of the transducers from 20 to 3000 feet away. Artificial targets may be passive echo-producing transponders for providing range and bearing, or active pingers (27, 37 or 45 kHz) to provide bearing. Active pingers should be provided by the user to relocate experiment sites and hardware. Multiple frequencies should be used when visibility is low and sites are close together. It is strongly recommended to consult with the Chief Pilot or JSL Electronics Supervisor to discuss your mission plan and needs.

b. Altimeter

The Altimeter is a Kongsberg-Simrad-Mesotech Model 1007 200 KHZ unit mounted externally aft of the AOC and looking down. A remote read out gives the Pilot the submersibles distance in feet (0-600) above the sea floor or a structure protruding from it (natural or man made).

c. Compass

Two systems are used to determine heading on the JSL. One is a standard aviation magnetic compass and one is a Honeywell Digital Compass module Model #HMR3000 which is displayed on a LED readout at the center of the sphere switch panel.

7. Lower Work Platform

The Lower Work Platform (LWP) is mounted permanently on the front of the vehicle and is primarily a multiple container sampling and storage device. Clear plexiglass buckets 10 inches high are attached to a hydraulically operated titanium drive chain. They are rotated around six sprocket wheels and indexed to stop in position under the funnel and plenum chamber. The LWP is used in conjunction with the manipulator which has a suction tube attached to it as well as a clam bucket scoop. Suction is created by a hydraulic or electric motor-driven pump which draws water through the container via an intake port and expelled through a screened plenum chamber. A flow meter is available for use in line with the suction pump to allow quantitative sampling.

8. Upper Work Bar

The Upper Work Bar (UWB) is constructed of 3 inch 6061-T6 schedule 80 aluminum pipe seal-welded in a "U" shape and attached to the forward upper ballast tanks. An electrically operated pan and tilt mechanism with a xenon short arc light is located on the starboard forward corner of the bar allowing the entire area in front of the vehicle to be illuminated. The UWB also doubles as a tow point when the sub is on the surface.

9. Camera Systems

a. Still Cameras

Photo documentation is accomplished using a Deep Sea Systems Seamax DPC-7000 Camera System. The camera within an aluminum pressure housing is a modified Canon G2, 4 mega pixel unit with an onboard one gigabyte micro drive. It can store up to 500 images per dive at high resolution. It is mounted externally and normally within view of the Operator and controls in the Pilot’s sphere. NOTE: Several options for mounting exist. Contact the Submersible Crew to discuss the option best suited to your dive objectives.

The camera menu and controls such as aperture, shutter speed, white balance, shot review, zoom, focus, and trigger are available on the remote camera control box, also in the Pilots sphere. The selected features are viewable on a LCD monitor along with a thru the lens raw video signal to compose the shot and review the playback. This system also incorporates 4 green lasers which can be toggled on/off by the Operator (see 9d).

b. Video System

The Johnson-Sea-Link's video system is based upon a broadcast quality video camera head sending a composite video signal to the sphere. The video signal is recorded on a consumer-type miniDV recorder, with an 8" LCD color monitor. The video signals are North American standard NTSC format.

The JSL color camera is a 3 chip CCD camera with 850 TV lines of resolution. The lenses is a 6-48mm zoom lens with auto or manual iris. The camera is mounted on an electronic pan and tilt mechanism which is also mounted on a hydraulic operated boom arm on the port side of the lower work platform where it can be panned around 345 degrees or tilted 45 degrees up and 60 degrees down. Local illumination for the camera is supplied via four underwater lights mounted radially around the camera, with 200 watt halogen bulbs painted white to eliminate hot spots. Two lasers are mounted parallel to the camera, on the camera's light ring, spaced 25cm apart, to provide scaling information.

Redundant controls of the principal color video camera are provided for the observer in a small hand grip. This gives the observer control over the lens zoom & focus, and the camera's pan and tilt mechanism. Basic camera settings have been programmed into the camera's memory and give good results over a wide range of situations. An advanced control box (the 'paint box') is available to those who need manual control over all the camera's functions. These functions include; master pedestal, red/blue pedestal, red/blue gain, white balance, black balance, shutter speed, manual iris, and overall gain.

Facility to incorporate a user supplied camera can be provided. This camera's signal can be sent to the miniDV recorder or a user supplied recorder.

One output from the video system delivers power and external video to the AOC. The video signal in the AOC is displayed using a 5.6" LCD monitor.

For more detailed information, see Appendix A, JSL Video System.

c. Video Overlay

During the dive, sensor data from the Sea-Bird Electronics Inc. 19 Plus Datalogger is transmitted to the sphere in RS232 format. The video overlay system then calculates and displays the depth (in feet), the temperature (in degrees C) and the salinity. This data along with time and date is added to the main cameras video signal and sent to the miniDV recorder and to the AOC video monitor. The CTD data and or the time/date can be toggled on/off by the Pilot if requested during the dive.

d. Lasers

Most photographic efforts on the JSL’s are enhanced by mini-laser for scaling and aiming. On the main color camera, two mini-lasers are arranged around the circumference of the camera with opposing lasers 25 cm apart. On the digital still camera 4 green mini-lasers are arranged to form a square of 10 cm per side.

10. Lighting

Forward illumination is provided by 6 dimmable and 2 non-dimmable underwater mini-lights for a total of 2100 watts of lighting. These are arranged both high and low around the front of the submersible and are individually selectable. Two standard-sized underwater lights are mounted on either side of the sphere with 700 watts of additional lighting. To augment this, an HBOI@FAU-designed xenon short arc light of 1000 watts (30,000 lumens, 6000 Kelvin color temperature) is mounted on an electric pan and tilt mechanism on the Upper Work Bar to provide a search light for obstacle avoidance and fill-in light for video. Video lighting is described in Section III, 9b.

Aft illumination is provided by 2 standard-sized, 350 watt underwater lights mounted on either side of the AOC near the viewports.

SECTION IV – Science Equipment and Interfaces

Sub Crew personnel will direct the installation of all science equipment and will make necessary interconnections to the submersible. Because the number of persons available for this work is limited, it is recommended that the user test his equipment prior to installation and resolve all interface questions through early consultation with the Sub Crew. The successful performance of user supplied hardware is entirely the responsibility of the user and all pre-cruise engineering efforts add up to a greater chance of success. Last minute offshore engineering and manufacturing is highly discouraged.

Weights of all equipment to be used on a JSL must be known, i.e., the air weight for equipment to be installed in the sphere and both the air weight and weight in salt water for outside equipment. This information should be submitted with the Cruise Plan.

Custom oceanographic instrumentation can be designed, produced and tested by the HBOI@FAU Engineering R&D Division, if the need arises.

1. Pressure Housings

Certification of implodable volumes requires hydrostatic testing to 2000 PSI with a one hour hold at pressure. This would allow operation to 3000 feet. Any vessels designed for shallower operation must be tested to 1.5 times their normal working depth. Leakage or visible signs of external damage shall be cause for test failure. Where several housings of a particular type are to be utilized, each housing shall be pressure tested; i.e., representative testing of one vessel in a series will not be accepted. Each vessel tested must have a unique identification number referenced on all related test documentation.

Although pressure test certification does not expire, consideration should be given to testing every five years. The Submersible Ops Coordinator may refuse to honor a valid certification if he feels the condition of the housing has deteriorated since its last pressure test.

The test chamber pressure recording chart (or copy) and/or statement of test details signed by the chamber operator shall be provided to the Chief Submersible Pilot prior to the cruise.

HBOI@FAU has a chamber available to conduct hydrostatic testing to 4500 psi. It can be outfitted with electrical penetrators for power and instrumentation purposes. The chamber can accept cans up to 23” O.D. with a maximum length of 51” including connectors, bolts or instrumentation adding to the overall length. Or the 1500 PSI chamber has an internal diameter of 10 inches and is 60 inches deep. Consult the Marine Operations Division for costs and scheduling.

2. Electrical Systems

The power available for the user is listed below. Contact the Submersible Crew for the part number, vendor, and or availability of connectors and cables to complete your interface.

28 VDC	Sphere	8 amps
28 VDC	AOC	5 amps
28 VDC	External	8 amps
28 VDC	External	15 amps
28 VDC	External	50 amps
120 VAC	Sphere	2 amps

If other types of power are required the user is urged to consult the Electronics Supervisor at HBOI@FAU who can recommend existing power supplies or the manufacture of one.

The standard method for accessing external equipment electrically from the sphere or AOC consists of "science signal blocks". The sphere block is permanently wired from an external junction box on the port side of the sphere to the sphere junction box just behind the pilot. The AOC block is permanently wired from an external junction box on the port side of the AOC to the AOC junction box just forward of the technician. The external junction boxes have 16 contacts arranged in 8 connectors each accepting a male connector Model VMG-2-FS made by Seacon Brantner. Internally, the 16 individual conductors are accessed through a female metal shell Cannon plug provided by the Sub Crew. All connections are rated at 5 amps.

Auxiliary penetrations in the sphere or AOC are arranged on an as needed basis and require ample lead time. The penetration plates have several thread sizes available and, with advance notice, through-hull penetrators can be installed or compatible existing ones made available. Power can also be wired as needed if advance notice is given.

3. Hydraulic System

Connection to the auxiliary manifold described under HYDRAULICS requires hardware rated to 1500 PSI. Fittings at the manifold are stainless steel Swagelok bulkhead unions part number 1/4-400-61. Flex tubing is recommended for ease of installation. A suitable tubing would be Parflex nylon tubing (catalog number NBR-4-050) with a .050 inch wall thickness. The JSL’s use aviation hydraulic oil specification number MIL-H-5606A.

4. Video

User supplied external video cameras must run on 24 or 12 VDC with Brantner XSL-6-CCP or XSL-5-CCP connectors respectively for connection to the video switching system. Current draw should not exceed 36 watts per camera (3 A for 12 VDC supply, and 1.5 for 24 VDC supply).

Connector pin-outs are as follows:

XSL-6-CCP:
Pin 1 Video
Pin 2 Video Shield

Pin 3	Not Used
Pin 4	Not Used
Pin 5	+ 24 VDC
Pin 6	DC GND

User supplied internal video equipment should be self-contained. If not, arrangements must be made ahead of time for obtaining auxiliary power supplies to run off 28 VDC. Video in and video out connections on the video console use standard BNC connectors and the audio out is an RCA jack.

5. Datalogger

Each JSL is equipped with a Sea Bird 19 Plus, which contains an internal pressure, conductivity and temperature sensor along with external dissolved oxygen and pH sensors.

There are 2 external voltage inputs available for other compatible instruments, e.g. transmissometer, fluorometer, or PAR. Any auxiliary instruments are to be supplied by the scientist. Requests to add auxiliary instruments should be made in time to allow cable ordering, bracket construction, and other interfacing issues to be dealt with.

The instruments are calibrated annually unless a request for a more recent calibration is made. Post cruise calibrations are not routinely done. Please note that due to entrainment, lack of redundant sensors, and inability to sample water for post processing comparisons, these instruments should not be considered to be in compliance with WOCE standards. Despite lack of absolute accuracy, they are successfully used for relative measurements, and show trends such as water layer boundaries and thermoclines adequately for field service.

Data from the instruments are downloaded as needed by the scientist, usually at the end of the day. The files necessary for plotting graphs are available on CD-R's, supplied by the scientist. The native HEX files, for use in SeaSoft, or comma-delimited ASCII files are available.

Real-time readouts of depth, temperature, and salinity are available in the sphere during the dive.

More info can be found at http://www.seabird.com.

6. Configuration Options

    a. Pelagic Sampling System

Specialized collection gear has been designed and fabricated by HBOI@FAU to collect delicate pelagic animals. This equipment is owned by individual P.I.'s but may be available for lease. Contact the Submersible Crew for information.

b. Forward Basket/Tray Area

The area forward to the LWP can accommodate sampling devices by the means of two 2 7/8 inch O.D. pipes with two half inch set screws each. The pipes are 29 1/2 inches apart at their centers and can accept 2 3/8 inch O.D. pipes up to 40 inches long. The devices can not weigh more than 150 pounds fully loaded with samples and should not exceed 60 inches long by 36 inches wide.

Two basket/tray devices already exist that are considered readily available. One is the benthic tray for box and punch cores and the other is a basket with a hydraulic lid. Figures 4 and 5 show their inside and outside dimensions and weight capabilities. Either basket/tray can accommodate two "spikes" to act as the contact point of the submersible against inclined slopes or walls.

7. Suction Sampler

The suction pump is attached to 3 inch flexible suction hose normally run along the length of the arm. The end effector is a 3 inch O.D. piece of plexiglas tubing trimmed at a 45 degree angle for ease of operation.

The containers described under LOWER WORK PLATFORM will accept lids with 3 inch openings which allow the attachment of various net bags or additional screening or smaller mesh.

The Signet 5100 flow monitor flowmeter with a rotor sensor can be installed between the plenum chamber and the pump to indicate gallons per minute and total gallon count in the sphere. The readout determines the average flow rate with an accuracy of one percent full scale.

8. Water Sampling

a. General Collections

Water sampling can be conducted at depth from the AOC. Quantities are best kept to a maximum of five gallons and glass containers are forbidden. Collapsible plastic jugs are readily available and use very little space when not in use.

Water is admitted via a through-hull penetration fitted with a ball valve hull stop and a metering valve in series providing 2 means of shut off and flow control. Both are operated by the submersible crew. Different end connections are generally available and the water source can be piped from a preselected point on the sub. Consult the submersible crew for options.

b. Use of Reagents

In situ chemical analysis of the water sample in the AOC is discouraged. However, if it is necessary to use any reagents within the confines of the JSL, they must be approved in advance by the SOC.

The user must supply material safety data sheets for all reagents to be used, prior to the cruise, for review by the Marine Operations Division. These sheets must be available on board ship at the time of use. In addition, appropriate materials must be supplied by the user to neutralize an accidental spill and protective eye wear and gloves must be supplied for both personnel. Wherever possible, it is recommended that the quantities be kept to a minimum and the container be plastic.

9. Miscellaneous

Additional sampling capabilities are continuously being developed for Harbor Branch Oceanographic Institute @ Florida Atlantic University and other scientists. Many times, sampling hardware may already have been designed and tested during previous missions. The Chief Submersible Pilot is usually aware of such equipment and should be consulted before any construction is undertaken on new gear.

SECTION V - Operations

1. Safety

The JSL's have a demonstrated good safety record, however, there are some inherent risks to diving in any HOV. Those risks may be associated with mechanical failures, electrical failures, loss of buoyancy, entanglement, fire, breathable atmosphere, and life support. All precautions have been taken to prevent these risks from occurring. This section is presented to allay any fears that the first time user, his/her associates, or the members of his/her family may have.

Mechanical or Electrical

Perhaps the most misunderstood effect is that of pressure at the maximum operating depth of 3000 fsw. At no time are the operators or the observers exposed to other than normal (1 atmosphere) pressure and temperature. The forward and aft pressure hulls have been pressure tested to American Bureau of Shipping requirements of 1.25 times the rated design depth of the vehicle. The test depth is 3750 fsw and the JSL's maximum operating depth is 3000 fsw, well under the test depth.

In order to ensure that no water leaks into either compartment, all penetrations for wires, pneumatic lines, view ports and hatches are designed in such a way that they actually provide a tighter seal the deeper the vehicle dives, and these devices are inspected prior to each dive.

Buoyancy

While the vehicle weighs 14 tons in air, when submerged it can be made exactly neutral by trimming with the variable ballast system so only a very slight force is required to move it up or down. It is therefore possible, even if all power is lost, to ascend to the surface by blowing the variable ballast system dry or by blowing a small amount of compressed air into the main ballast tanks. If for any reason additional buoyancy is needed, the main ballast tanks can be blown completely dry using controls from either compartment. If this should fail, the main battery pod can be released mechanically giving an additional 2300 lbs. of positive buoyancy.

Entanglement

If the submersible becomes entangled and cannot free itself using the ballast tanks, thrusters or manipulator, a buoy can be released from either compartment that will carry a Kevlar line to the surface. This line acts as a guide and enables the support ship to attach a lift line to the submersible and winch it off of the bottom (Downhaul Retriever Rescue System).

Fire

The most probable cause of fire in the JSL will be an overloaded circuit. Prior to a fire, the submersible occupants are likely to detect an odor of smoldering insulation and/or possibly see smoke. In the event of smoke or fire, the pilot will secure the power and the oxygen flow, and occupants will don emergency breathing gear, if warranted. Fire extinguishers are available in each compartment.

Breathable Atmosphere

The breathable atmosphere within each compartment is continuously monitored with electronic analyzers for oxygen and carbon dioxide. Oxygen is supplied to each compartment from external tanks through a regulated flow meter. Two independent oxygen systems are available in each compartment. Carbon dioxide is removed from the atmosphere by chemical scrubbers. As a back-up, an emergency scrubber is available for each occupant.

Life Support

A normal dive lasts about 3 hours, however, sufficient oxygen, water and supplies are provided to allow the submersible to remain submerged in an emergency situation for a period of up to five days.

2. Observer Pre-dive Briefing

At the start of every cruise, each scientist is given a verbal briefing by the SOC with regard to the safety considerations during launch and recovery of the HOV; the time, location, and purpose of the pre-dive briefings; and information regarding the emergency procedures briefing the observer will receive prior to his/her dive. Observers are informed that, before they make their first dive, they will be required to sign a statement confirming that they have been provided a copy of the JSL Cruise Planning Manual, they have read the manual, and they understand what they have read (see Appendix C).

Every observer is given a briefing inside the submersible prior to making his/her first dive. This briefing, which takes approximately 10 minutes, is done at the time of the individual's first dive just prior to launching. It details the location of observer controls, instrumentation, video equipment, cameras and covers normal and emergency procedures. Emergency procedure cards are located in both compartments and are readily accessible to the observers. There is a pilot's handbook, located in each compartment, which contains procedures for operating the vehicle.

3. Operating Guidelines

a. Operational Limits

The *Johnson-Sea-Link* submersibles operate within various limits. These limits are based on safety, environmental, electro-mechanical and operational factors and were developed in order to provide the safest and most reliable submersible system in our class.

The limits listed below are not to be exceeded except in the case of a properly approved, preplanned mission or in case of emergency to ensure the safety of personnel.

- The Pilot-in-Command will have the authority to terminate a dive by whatever means necessary at any time that he feels a hazard to the submersible or personnel exists, without regard to mission success or completion.

- The JSL will not be operated where the bottom depth exceeds 3300 fsw.

- The JSL will not be operated below a depth of 3000 fsw.

- The JSL will not be operated with less than 2 submersible crew on board.

- The JSL will abort any attempt to operate near wreckage, debris or natural terrain features which have entanglement or entrapment potential when visibility is low, current is high, or battery voltage is low.

- The JSL will remain clear of any explosive devices which may be sighted.

- The JSL will not work or be on station beneath or near a suspended load, or a towed array.

- The JSL will not transect in blackout conditions within 50' of the bottom or towards vertical walls or high relief areas.

- JSL will not transect in a current strong enough to prevent stopping the submersible to avoid an obstacle.

b. Limiting Conditions

The *Johnson-Sea-Link* submersibles and their support ships are a matrix of systems, subsystems and back up systems. Each one has its own function and operating characteristics. Every attempt is made to ensure that all systems are fully functional. Some systems, if not functional, pose no threat to operating safety. It is up to the SOC, Chief Scientist and/or Mission Coordinator to determine what, if any, effect loss of this equipment has on the scientific success of the dive. Other systems, particularly that for life support, main power, communications and tracking are indispensable and must be operational any time the JSL submerges. Loss of this equipment during a dive constitutes a reason to switch to back up systems and abort the dive.

The ability of the *Johnson-Sea-Link*'s to complete their mission successfully is also affected by conditions beyond any control; high current, low visibility, surge or heavy seas, rugged topography, overhangs or the over abundance of entangling artifacts such as commercial fishing gear. Any of the above may require a modification to the dive plan based on the pilot and/or the SOC assessment of the risk involved.

Weather and sea condition play an important part of a successful mission. It is up to the SOC to determine that there is a reasonable fair weather window to ensure a successful launch, dive and recovery. Every situation is different, i.e., wave height, period, wind speed, height and direction of underlying swell, and weather forecast, so it is difficult to place a predetermined limit on launch or recoveries. However, the probability of a successful launch and/or recovery is low when the wind is above 20 knots or the sea state is higher than 4 (6-8 foot waves). Night operations entail an increased hazard and thus require optimal weather conditions and proper notice and preplanning.

4. General Information

a. Clothing

It is important for JSL users to bring proper clothing along. The temperature on the bottom is often 30 degrees F colder than on the surface. People in the aluminum AOC may often need long pants, socks, and a sweat shirt to stay comfortable. The acrylic sphere is an excellent insulator and therefore remains relatively warm during a dive. This compartment is air conditioned for cooling and dehumidifying and it is advisable to bring a long sleeve shirt.

b. User supplied consumables

- Mini DV tapes, Panasonic MiniDV #AYDVM63PQ 63 minutes or equivalent.
- Video tapes can be purchased from most video suppliers including:
- Computer Disks – blank CD's or USB stick
- Batteries: Various size batteries for personal records or other user supplied equipment.

5. Submersible Operating Day

A submersible operating day is a 12 hour period (typically 0600 - 1800 or 1800 -0600), depending on the type of mission. This is 12 consecutive hours and includes predive checks, briefings, dive time, replenishment, down loading and debriefing. It may also run concurrently with undivable sea states and will not advance as the weather moderates.

The basic daily schedule will be established during the pre-mission communications so that proper allowances will be made for gear or crew changes, steaming times and port calls. Major changes to the schedule at sea are discouraged.

The support ship operates on a 24 hour day that commences at 0000 local and continues until 2400 hrs local time. Any part of a day including arrival and departure days is considered a full operating day and must be taken into consideration in the request for ship time. Long transits between dives should be avoided or scheduled during the 12 hours between submersible ops. Ideally, dive sites for a single day should be no more than 35 nautical miles apart. Otherwise, part or all of the next dive will be lost. When moving to a new site, additional time may be required to establish vessel set and drift for sub launch and to run fathometer transects of the dive site.

6. Daily Dive Scheduling

Normally, two 3-3.5 hour dives per day are conducted typically starting at 0800-1100 and 1500-1800 with surface replenishment taking place in between dives. For missions requiring more than two dives per operating day (12 hours), the depth, duration and specific tasks will dictate the dive profile. The limiting factor is the battery which requires recharging between dives. Therefore, when conducting more than two dives in a 12 hour period, the total dive time can not exceed 6 hours. The total dive time for two dives per day can not exceed 7 hours.

Special dive scheduling can be accommodated where shallow depth and short duration allow rapid turn around. When planning your dive schedule, 7 hours is the maximum total dive time to be scheduled in any operating day. (Dive time is calculated from deck to deck.) This is done so that maximum battery life is achieved throughout an operating year.

It is recommended that the Chief Scientist meet each evening with the SOC to finalize the dive schedule and identify the names and weights of personnel and equipment to be on board the JSL the following day. Submersible Dive Planning Forms (Appendix B) will be provided for this purpose. This is so that adequate time can be allotted for installation of gear and resolution of implementation problems. Equipment that comes out of the box just prior to dive time or at the start of an overnight transit has little chance of making the morning dive. Scheduling of major changes in submersible equipment (i.e., benthic to midwater collecting) should be noted in the pre-mission communications and discussed with the SOC at the start of the cruise.

Notes:

1. Battery capacity is reduced by water temperature below 10C (50F) and can reduce dive time.
2. Dives covering long distances reduce battery capacity faster than dives remaining in a given area.
3. The pilot constantly monitors the battery condition and can elect to shorten a dive if conditions warrant.

7. Training Dive Policy

The *Johnson-Sea-Link* submersibles were designed to blend science and engineering in the undersea environment. Our goal is to provide the scientific community with the safest, most productive submersible available to accomplish their mission objectives and to do that in a timely and professional manner.

To help us achieve this goal, we have instituted this policy. It enables us to provide the scientist with submersible pilots of the highest caliber through hands on training under the direction of an experienced pilot and a scientist.

The policy is as follows: one out of every 10 dives is to be designated as a pilot training dive. This will be based on consecutive JSL dive numbers. The determination as to which specific dive will be scheduled for training will be made by the Submersible Ops Coordinator, based on input from the Chief Scientist and/or the Mission Coordinator. During this dive, the forward sphere will be occupied by a trainee and a pilot-instructor or two pilots. The pilot instructor will be in continuous contact with the Chief Scientist or his/her designate in the aft observation chamber. A video monitor is provided for the aft observer to monitor the dives progress and communicate his/her decisions to the trainee through the instructor.

Some flexibility will be allowed, but scientists are encouraged to plan this as a normal working dive in pursuit of your objectives. This will optimize the desired effect of in situ training rather than simulated exercises.

SECTION VI

1. Scheduling, Planning and Reports

a. Scheduling and Financing

Harbor Branch Oceanographic Institute @ Florida Atlantic University is a member of UNOLS--the University National Oceanographic Laboratory System (http:\\www.unols.org). As such, scheduling is a joint effort with other member institutions, maintaining the following objectives: 1) maximum utilization of oceanographic facilities; and 2) accessibility of these facilities by the oceanographic community.

Ship scheduling at HBOI@FAU is done by the Marine Operations office. Shiptime requests for NSF funding MUST be submitted to NSF by Feb. 15, along with research proposal, for research planned in the following calendar year. Shiptime Request Forms should also be submitted to the UNOLS Office on line at http://www.gso.uri.edu/unols/ship/mainmenu.html with hard copy to the HBOI@FAU Marine Operations office.

Marine Operations will accept ship time requests from other sources at any time during the year. Every effort to schedule optimum dates will be made.

Once a Chief Scientist has been assigned a block of time, he/she will be requested to submit a Cruise Plan to the Manager of Marine Operations as soon as possible, and a Marine Technology Group Configuration Form to the Scientific Liaison to provide the information necessary to arrange for logistic support, ports of call, a ship's agent (if necessary), ship's outfit, and any special equipment requirement, as well as a Scientific Party List which includes participating scientist names, affiliations and position for the cruise. This information is used for preparing an Operations Schedule and to ensure the proper equipment is on board. Requests for installation of any equipment provided by the scientific party should be made as soon as the need is identified. We recommend that any Chief Scientist unfamiliar with the ship arrange for a brief tour when the vessel is in port to gain some familiarity with the layout of the scientific spaces. We also recommend pre-cruise meetings with the ship's crew, technicians and scientists prior to sailing to familiarize those involved with sampling procedures and special handling considerations.

Investigators holding NSF grants or ONR contracts may be awarded ship time wherein the ship time costs can be included in those agency's ship grants or contract to HBOI@FAU. Other investigators should include ship costs (cost figures provided by Marine Operations) within the budget of their particular project.

Uniform Operations & Cost Accounting Terminology

The following definitions are proposed for uniform usage within UNOLS:

OPERATING DAY - All days away from home port in an operating status incident to the scientific mission. Includes days in other ports for the purpose of fueling, changing personnel, etc. Includes transit time. Includes day of arrival and day of departure from homeport. Does not include any days in homeport except unusual cases to meet a specific cruise need. Operating Day is the basic unit for ship time funding and support.

DAYS AT SEA - All days actually at sea incident to the scientific mission. Includes day of arrival and day of departure. Includes transit time. Includes time anchored (except port call anchorages), hove to, and drifting. Does not include days in foreign ports.

LAY DAYS - Days in homeport for purposes of fitting out, cruise preparation, crew rest and upkeep. May in rare cases include similar periods in other ports.

MAINTENANCE DAYS - Days undergoing overhauls, dry-docking or other scheduled or unscheduled repairs during which the ship is not available for service.

DAYS OUT OF SERVICE - Periods during which ship is laid up out of service for an extended period for reasons of economy, unemployment or unfit for service.

DAILY RATE - Daily cost factor for a ship arrived at by dividing the total operating costs for the scientific mission (including indirect costs but excluding depreciation) by the operating days for the same period. Unless otherwise specified, the daily rate ordinarily reflects a one year period.

b. Submersible Operating Day

The normal operating schedule for the JOHNSON SEA-LINK submersible and crew is one continuous 12 hour period on, then 12 hours off. This period can be adjusted to accommodate various dive schedules. Long transits between submersible dives should be avoided or scheduled during the off time. Ideally, dive sites for a single day should be no more than 35 n.m. apart.

Departure and arrival schedules from Harbor Branch @ Florida Atlantic University are based on high tide during daylight hours. If this presents a significant scheduling problem, the Marine Operations office will work with the Port of Fort Pierce for dockage availability that is not tide-dependent. Tidal and traffic restraints may also apply in other ports. Please contact the Marine Operations Office for information on specific ports of call.

c. Submersible Cruise Planning

Successful missions do not just happen; they are planned. This is possible only if we are informed of the scientists' expectations well in advance of the cruise by way of the Cruise Plan. It should not be based on assumptions; if a piece of equipment is essential to the mission, it must be stated in the Cruise Plan.

This formal written request should contain all the information as outlined in Section VI 1-a and the following information as it pertains directly to the submersible.

1. A complete dive profile, including day/night schedule, major gear changes, number and duration of dives, site locations, bottom conditions expected and number of revisits anticipated.

2. Equipment requirements and descriptions (dive by dive, if possible) with particular care taken to indicate equipment or services to be provided by HBOI@FAU (by division, e.g., Marine Operations, Engineering R&D, Science, etc.) or by another organization or contractor. Equipment, if provided by user or outside contractor, should be detailed by size, weight (in and out of water), pressure rating and power requirements.

3. Certificates of pressure testing as specified in Section IV, 1-Pressure Housings.

4. Material Safety Data Sheets (MSDS) (for review and approval) of reagents to be used in the submersible as specified in Section IV 8b.

5. Requirements for in situ sampling and photo/video documentation.

6. Submerged navigation requirements.

7. Name and phone number of Principal Investigators or technicians to be contacted regarding details of the dive plans.

This information, even if very detailed, still may raise some questions. Telephone calls or written correspondence to members of the submersible crew are encouraged and can be a valuable source of information.

Once the plan is received, the Manager of Marine Operations will review it in detail and may reply with information and comments before developing a final Operations Schedule for distribution.

d. Post-cruise Reports

(1) UNOLS Research Vessel Post Cruise Assessment

This form is to be submitted on line by the Chief Scientist. Its purpose is to provide information that will enable UNOLS to evaluate the performance of vessels in the fleet. It is, therefore, important that the forms be completed frankly with constructive criticism or praise where deserved. http://www.gso.uri.edu/unols/pcarform.htm or www.unols.org

(2) HBOI@FAU Cruise Report

A final cruise report must be received by the Marine Operations Manager within two months.

e. Foreign Clearances

A vessel may pass through territorial waters freely but may not collect data without advance permission. As per international agreement and Department of State procedures, permission is required to conduct research operations and collect data in foreign waters (within 200 miles of any land mass). The Marine Operations office will process such applications based on information provided by the scientists. Such applications must include the following information. (For further information, refer to the UNOLS Handbook for International Operations of U.S. Scientific Research Vessels which is available on line at http://www.gso.uri.edu/unols/for_cln/for_cln.html, or the State Dept web site at www.state.gov/g/oes/ocns/rvc or call the Marine Operations office.)

1. Vessel specifications and description. (HBOI@FAU supplied)

2. Personnel from ship (HBOI@FAU supplied) and science crews (user supplied) participating in the mission.

3. An information sheet with name, address, next of kin, address, date of birth, affiliation, passport #, (or other suitable i.d.), occupation, etc. (See Appendix E) (User supplied)

4. Operations areas, depth, ports of call and dates. (User supplied)

5. Any special equipment being taken on mission, i.e., not part of ship or sub. (User supplied)

6. Cruise Track indicating ops areas or dive sites if Sub Ops. (User supplied)

This information, along with the letter requesting permission, must be submitted to the Department of State a minimum of two months to eight months prior to the mission. **The Department of State will not accept late applications**. Therefore, the HBOI@FAU Marine Operations office must have the information at least one month prior to the lead time requirements. In cases where the research will be conducted in the Bahamas, the Marine Operations office will request permission to operate directly to the Bahamian Ministry of Foreign Affairs at least 2 months in advance.

The science-related costs associated with operating in foreign countries (i.e., agent fees for on/off loading scientific gear, personnel, etc.) will be the responsibility of the Chief Scientist.

Some countries may require placing their scientific observers on board and/or the sharing of data collected in their territorial waters as a condition of the clearance. All costs incurred for this observer travel, subsistence, data duplication, etc., are the responsibility of the Chief Scientist. It is essential that all parties concerned must understand the conditions placed on such clearances. The Chief Scientist must fully appreciate and honor the responsibilities inherent in these circumstances. Observers representing government organizations or scientific institutions are considered members of the scientific party.

Any changes to cruise plans involving research in foreign territorial waters not previously cleared will not be approved under normal circumstances. The ship's Master is prohibited from conducting research other than in strict accordance with the terms of the foreign clearance.

f. Port Calls and Agents

Scientific mission loading is normally scheduled on the day of departure, beginning at 08:00, and off-loading occurs on the day of return, dependent upon time of arrival. Cruise preparation requiring more time in port, vessel or crane services or crew assistance requires careful planning to prevent mutual interference, **especially if another mission leg is scheduled to load and depart shortly after vessel arrival.** Routine vessel maintenance, stateroom and laboratory cleaning and logistics can interfere with laboratory setup due to the congestion of conflicting traffic. Consult with the Marine Operations Manager well in advance so we can plan for your loading and setup requirements. Crew rest must be provided for during in port periods: this dictates that **loading extending beyond 16:30 may not permit the ship to depart until the next day.**

In foreign ports (or some other domestic ports, other than the vessel's home port), the ship may be represented by a commercial port agent. Principal Investigators and other participants may find it convenient to use the same agent to simplify movement of scientific party members and equipment to or from the ship. Services can be provided more smoothly if we are also informed of your requirements. Bear in mind that all services provided by the agency result in sometimes significant charges. Agents typically do not open separate accounts for scientific parties attached to the ship. In order to facilitate our sorting out of the respective charges to the ship, we will provide the vessel Master and Chief Scientist with forms entitled "Request for Port or Agent Services." (**see Appendix D)** This form must be signed by an authorized ship's officer and the scientist generating the request. The agent will be provided in advance with a list of authorized signatories (e.g. the Master, Chief Engineer, Chief Scientist, Submersible Operations Coordinator.) The agent will be instructed that Harbor Branch Oceanographic Institute @ Florida Atlantic University will not pay for any charges made by the ship or science party without a signed authorization. We will bill you for your share of services when the agent's invoice is received, translated if necessary, and reconciled. This has occasionally taken six or more months after completion of foreign research cruises. PI’s should retain funds on hand for expected billings after their cruises. P.I.s must inform the Marine Operations Manager, well in advance, if there is a requirement for a particular pier or unusual port services. Time may also be required at these ports for ship logistics: fueling, provisioning, and normal mission preparations.

Please do not plan quick turnarounds as normal logistics usually require more than eight hours. Also, some crew rest time must be factored in to the port call.

g. Customs and Immigration

All scientific equipment aboard an HBOI@FAU vessel departing for a foreign port must be cleared out by completing a US Customs Certificate of Registration, CBP Form 4455, Appendix D). The Chief Scientist has the responsibility of making all necessary arrangements for customs declarations and clearance for scientific equipment shipped to or from a foreign country. Assistance may be requested through the Marine Operations office and ship's agent in foreign ports. Costs incurred for shipping of scientific equipment, personnel travel of scientific party, and ship's agent activity pertinent thereto will be borne by the Chief Scientist or the benefiting member of the scientific party. If such costs are charged by the Agent to the ship's account, they subsequently will be recharged to the Chief Scientist. Any equipment loaded on board the vessel in the U.S. for foreign operations must be registered with Customs (Shipper's Export Declaration, Form 7525V, See Appendix E) prior to vessel departure if equipment is to be hand-carried or shipping back to the U.S. prior to vessels return. Any equipment not registered will be subject to duty upon re-entry. This cost will also be the responsibility of the Chief Scientist.

The Master has the right to refuse the lading of scientific equipment that is not accompanied by certified export documents. Further, scientific equipment found on board without proper documentation when the vessel returns to the US will be manifested and may become subject to import duties. The owner of the equipment retains financial and legal responsibility for the proper re-entry of equipment into the United States.

The ship's Master is the sole authority in processing and clearing the ship, as well as onboard personnel, through U.S. and foreign customs and immigration. No member of the scientific party or ship's operating crew may leave the ship prior to completion of customs and immigration clearance.

Foreign-made personal items such as cameras, radios and tape-recorders should be registered with U.S. Customs before leaving the U.S, otherwise they may be subject to duty upon re-entry. Science personnel leaving the vessel in a foreign port to return to the U.S. may not leave personal items on board.

In clearing U.S. and foreign customs and immigration, various forms are required to be filed by the Master. One of these forms is a Complement List, giving names, addresses, nationality and next of kin for everyone on board, both scientific and operating personnel. The Master, in clearing customs and immigration, states under oath that this list is complete and accurate. Last minute changes to the onboard compliment cannot be made after the clearance has been filed, except in extremely unusual or emergency conditions. Personnel failing to comply with the formalities required can seriously delay vessel clearance.

Shipboard Acknowledgement Form (See Appendix D) must be completed for each member of the scientific party and returned by fax, email or U.S. mail to the Marine Operations office prior to the ship's departure. This information is required in the event of an emergency and for customs and immigration purposes. In addition, the Chief Scientist shall ensure that all members of the scientific party have the required passports, visas (multiple entry), tourist cards, and International Health Certificates as required and that all are up to date.

h. Post-cruise Reporting (Foreign Clearance)

The Chief Scientist will be required to complete a Preliminary Cruise Report for all cruises involving foreign clearances. This report should be promptly submitted to the State Department within 30 days of the completion of the cruise, with a copy to the Manager of Marine Operations. The preliminary report must contain a brief explanation of the cruise results and a complete list of the types of data collected. The Chief Scientist must also include a schedule of his/her own devising for meeting all post-cruise obligations. This schedule must include the estimated date (s) by which report(s), journal article(s) and/or results will be provided. Refer to Appendix D, NTRVO #66, Post-Cruise Obligations. http://www.gso.uri.edu/unols/for_cln/frn_cl11.html

i. Scuba Diving

All diving under the auspices of HBOI@FAU shall be conducted according to the regulations promulgated in the latest edition of the **HBOI@FAU Diving Safety Manual**. All research diving must be approved in advance by HBOI@FAU's Diving Safety Officer (DSO) or Diving Control Board (DCB). Only those divers currently authorized by the DSO or DCB may dive under HBOI@FAU auspices. All diving must meet the minimum standards of American Academy of Underwater Sciences (AAUS).

(1) Diving Control

In a multi-institutional diving cruise, a lead DCB will be designated by agreement of all DCBs involved. The procedures, rules and regulations that govern diving operations for a particular cruise will be those of the designated lead DCB which will nominate the Cruise Diving Supervisor. The Master has responsibility for, and ultimate authority over, diving operations conducted from any HBOI@FAU support ship and her small boats.

(2) Dive Planning

The Chief Scientist is responsible for ensuring that research diving activities are conducted in accordance with all applicable regulations. In a timely manner, the Chief Scientist must supply copies of all diver credentials including Research Diver Certification, current physical, and dive logs, and pre-cruise dive plans **(Research Vessel Cruise Planning Manual)**. Reciprocity for scientific divers in good standing exists between HBOI@FAU and other AAUS member organizations, between HBOI@FAU and the Smithsonian Institution, and between HBOI@FAU and NOAA. Diving by outside contractors on HBOI@FAU vessels will operate under the standards of the lead DCB which will be determined by HBOI@FAU's DCB prior to diving operations.

For safety reasons, scuba diving during submersible operations is limited to less than 60'. Also, no one will dive in a JSL for at least two hours after having completed a scuba dive that is greater than 60' or involves decompression.

It is the responsibility of the Cruise Diving Supervisor to:

1. Submit in advance, divers credentials and pre-cruise dive plan to both the lead DCB and HBOI@FAU's Marine Operations office.

2. Submit, in advance, emergency plans which are acceptable to both the lead DCB and the Marine Operations office.

3. Inform the Marine Operations office, well in advance, regarding what diving emergency medical supplies should be aboard. These are supplied by the ship facility where possible.

4. Assure that a copy of the lead DCB's diving manual is aboard and available to the crew and scientists. This copy should be on the bridge for ready reference.

5. Brief the Master, Mates and Submersible Ops Coord. (when applicable) on the details of planned science diving, and procedures to be followed.

6. Act, at all times, as principal controller and supervisor of diving operations. Before diving, divers should submit, in writing, a detailed dive plan (**Research Vessel Cruise Planning Manual**) to the Cruise Diving Supervisor for approval. The supervisor will then communicate the plan to the Master for final go-ahead. No diving is to be undertaken without the knowledge of both the Cruise Diving Supervisor and the Master or watch officer. Failure to follow this last procedure can result in revocation of diving privileges for the duration of the cruise.

7. Submit all cruise dive logs for each dive and a detailed report of any diving-related accident, injury, or dangerous incident to the DSO as soon as possible.

(3) Small Boats

Wherever and whenever safety permits, diving will be accommodated from the support ships or other small boats. Where feasible, all diving should be done from small boats. Small boats can be operated by a qualified member of the ship's crew or scientific party. At all times when divers are in the water, a small boat with boat operator will standby to assist. The small boat shall be equipped with an oxygen resuscitator. (User supplied) Whenever safety permits and at the Master's discretion, diving can be accommodated from the research vessel (i.e., ship at anchor, not underway, no other ops going on at the same time.)

(4) Tanks

Prior to the cruise, certification of visual internal inspection (VIP) performed according to accepted methods must be supplied by the cruise Diving Supervisor to the lead DCB. All cylinders must be secured aboard ship in an appropriate manner.

(5) Compressed Air

Diving-quality compressed air is available aboard the HBOI@FAU Research Vessel. Certification of air quality for all compressors will be supplied to the lead DCB upon request. All compressors are operated in accordance with manufacturer's specifications and AAUS minimum standards.

(6) Recompression Chamber

A recompression chamber is highly recommended for all scuba diving conducted from HBOI@FAU vessels. A double-lock chamber with qualified operators may be available upon request to the Marine Operations office for a nominal fee.

2. Hazardous Material

a. Radioactive Materials

Policy on Radioisotopes on Board HBOI@FAU Research Vessel

The introduction, use, and disposal of radioisotopes on board research vessels owned and operated by Harbor Branch Oceanographic Institution @ Florida Atlantic University shall comply with the regulations of the Federal Nuclear Regulatory Commission (NRC) and State of Florida “Control of Radiation Hazard Regulations”, be sanctioned by the Radiation Safety Committee and monitored or supervised as appropriate by the FAU Radiation Safety Officer (RSO).

HBOI@FAU research vessels operate under radioactive materials license 734-4, issued by the State of Florida as temporary job sites. All possession and use of radioisotopes aboard must comply with State regulations and FAU Radiation Safety procedures. For all activities outside of Florida waters, additional specific arrangements must be made with the U.S. NRC and any other regulator agencies having jurisdiction. In order to ensure that usage authorization, training certificates, license amendments, reciprocity approvals, etc. are completed in time, it is necessary for the Chief Scientist to submit an Application to Use Radioactive Material on Vessels <u>at least ninety (90) days in advance</u> (the same time required for the preliminary cruise plan). At no time will radioisotope use be permitted on board vessels without approval by the FAU RSO. For information and assistance concerning application or other radiation safety matters, please call the FAU Radiation Safety officer at 561-297-1052.

b. Chemical Handling

If it is necessary to use any reagents on board HBOI@FAU ships or the JSL, they must be approved in advance by the Manager of Marine Operations.

Prior to the cruise, the user must supply Material Safety Data Sheets (MSDS) for all reagents to be used for review by the Marine Operations Division. These sheets must be made available to the vessel Master on board ship at the time of embarking. In addition, appropriate materials must be supplied by the user to neutralize an accidental spill.

Wherever possible, it is recommended that the quantities be kept to a minimum and the container be plastic. All laboratory materials and equipment must be properly stowed and secured to the satisfaction of ship personnel before the vessel departs port. Laboratories must be cleaned by scientific personnel at the end of each mission leg and all unused chemicals, as well as samples, must be shipped out of HBOI@FAU. Dry ice can be arranged through a local vendor if needed.

Lithium batteries are considered hazardous material. The Captain should be informed of all lithium batteries brought on board.

Appendix A - *Johnson-Sea-Link* Video System

Camera – Three $^2/_3$" CCD digital processing camera head, with 16:9 or 4:3 aspect ratio (Panasonic AW-E600)
4:3 mode - 850 TV lines (center) horizontal resolution (High Band Detail ON)
16:9 mode - 800 TV lines (center) horizontal resolution (High Band Detail ON)
62 dB signal to noise ratio (High Band Detail OFF)
4:2:2 component serial digital output, 10 bit (SMPTE 259M-C)
Sensitivity 2,000 lux @ f11 with 3,200° K light source
Water correcting optics, diopter & dome port in titanium housing

Lens - Canon J8x6KRS, 6-48mm focal length, 8:1 zoom ratio
Remote zoom & focus, auto or manual iris
Angular field of view = 72.5 x 57.6° (85° diag.) @ 6mm
= 10.5 x 7.9° (13.1° diag.) @48mm
0.3 meter (1 foot) minimum object distance from front of lens,
Full remote focus control from 0.3 meter to infinity
Object dimensions @ M.O.D.= 51.3 x 38.5cm (64.1cm diag.) @ 6mm
= 6.4 x 4.8 cm (8cm diag.) @ 48mm

Main Recorder/Monitor
Sony GVD – 1000 mini DV Recorder with LCD monitor

Pilot's Controls;
Camera and Arc Light pan & tilt
4 camera mounted 200W flood lights - 3200° K
2 extra 28VDC, 15 amp outputs
- usually two 360W lights 3200° K
White Balance, Black Balance set
Auto/manual iris
Zoom & Focus
Record Start/Stop
0 dB, +9dB, & +18dB camera gain
3200° K, Auto white balance & color bars select
Data Overlay On/off

Observer's Handheld Controls;
Zoom & focus
Camera pan & tilt
Optional remote paint box

Arc Light Xenon short arc lamp, 1000W. 30,000 lumen output @ 6,000° Kelvin.

HMI Lights Up to four 400W HMI lights, @ 5,600° K

Notes: Data overlay is recorded as Closed Captioned information in the vertical blanking interval and contains the depth, temperature, & salinity information from the Seabird Electronics 19 Plus CTD datalogger. Shipboard editing will include a dubbing to miniDV only.

Appendix B – Submersible Dive Planning Form

DATE	**DIVE #**	**PERSONNEL**		**LOCATION**			**DEPTH (fsw)**
		Forward WT//	Aft WT//	Site Name	Lat.	Long.	

TASKS (PRIORITY)	**OBJECTIVES**	**LOCATION PRE DIVE WAY POINT LAT. LONG.**		**GEAR REQUIRED (TYPE)**

Appendix C: JSL Science User Pre-Dive Briefing Acknowledgement

Note: This acknowledgement is a UNOLS requirement (UNOLS Safety Standards for Human Occupied Vehicles, Section 8.1, Mar 09) and must be completed to participate in an HOV dive.

Name (printed): ____

Signature: ____

Affiliation: ____

Date: ____

- [ ] I have received, read, and understand the JSL Cruise Planning Manual. ____________
  Initials/Date

- [ ] I have received a verbal safety briefing by the Submersible Operations Coordinator regarding safety considerations during the HOV launch and recovery procedure; the time, location, and purpose of the pre-dive briefings; and information regarding the emergency procedures briefing I will receive prior to my dive. ____________
  Initials/Date

- [ ] I have received a pre-dive briefing inside the submersible prior to making my dive. The pilot/AOC technician briefed me on the following:

  - [ ] how to communicate with the surface via underwater telephone and VHF radio
  - [ ] how to communicate with the AOC/sphere via intercoms and sound-powered phone
  - [ ] how to bring the submersible to the surface using thrusters and/or main ballast tanks
  - [ ] the location and activation switch for the carbon dioxide scrubbers
  - [ ] how to adjust the oxygen flow
  - [ ] the location of the CO_2 and O_2 analyzers; fire extinguisher; and all emergency supplies, including emergency scrubbers and emergency breathing regulators and masks

Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________
Dive #/ Initials/ Date:____________	Dive #/ Initials/ Date:____________

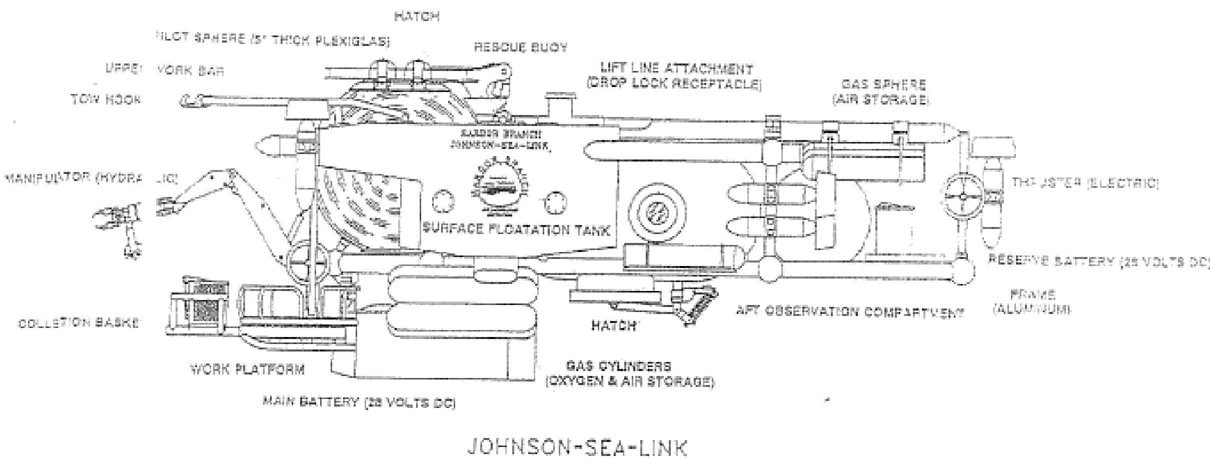


Figure 1. JSL Side View

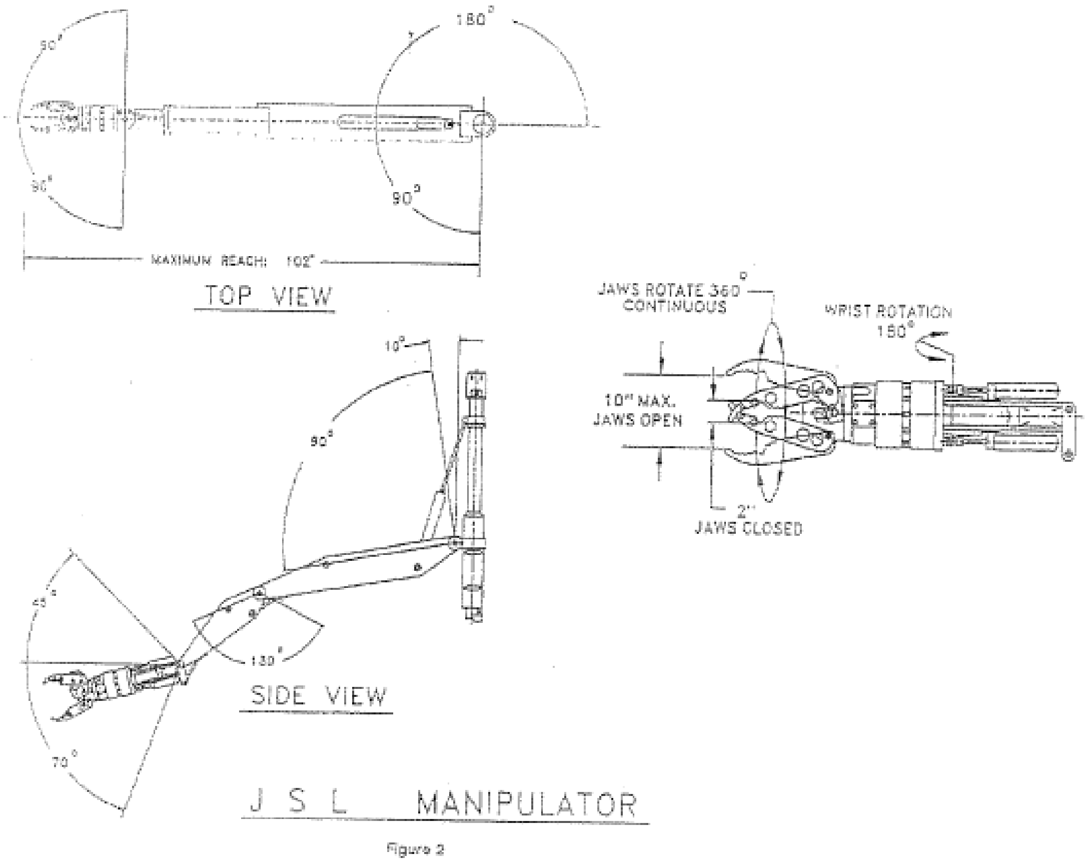


Figure 2. Manipulator Work Envelope

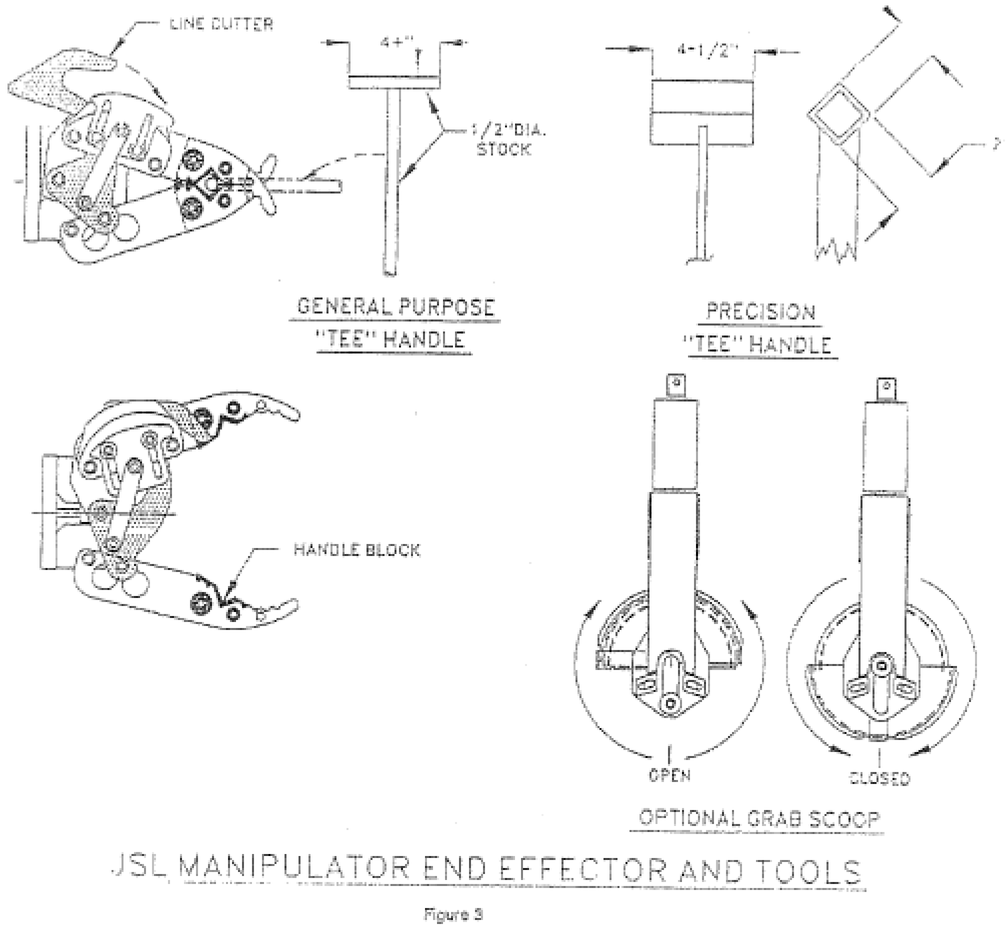


Figure 3 Standard 'T' Handle

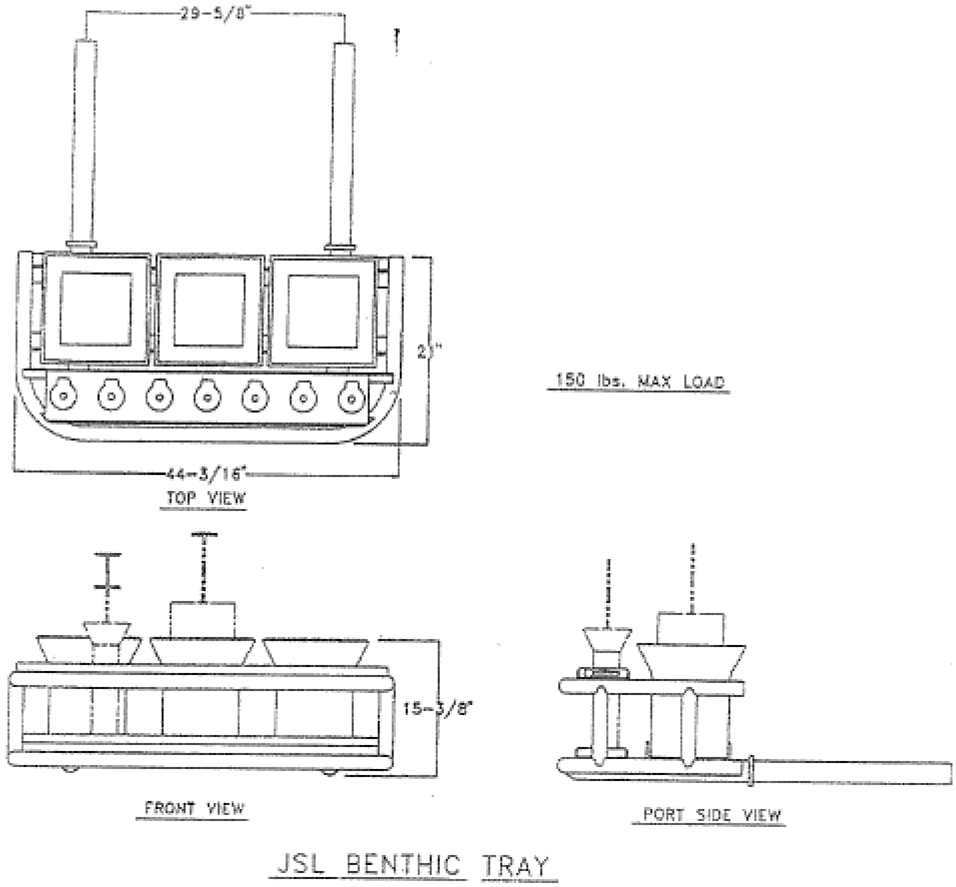


Figure 4 Benthic Tray Data

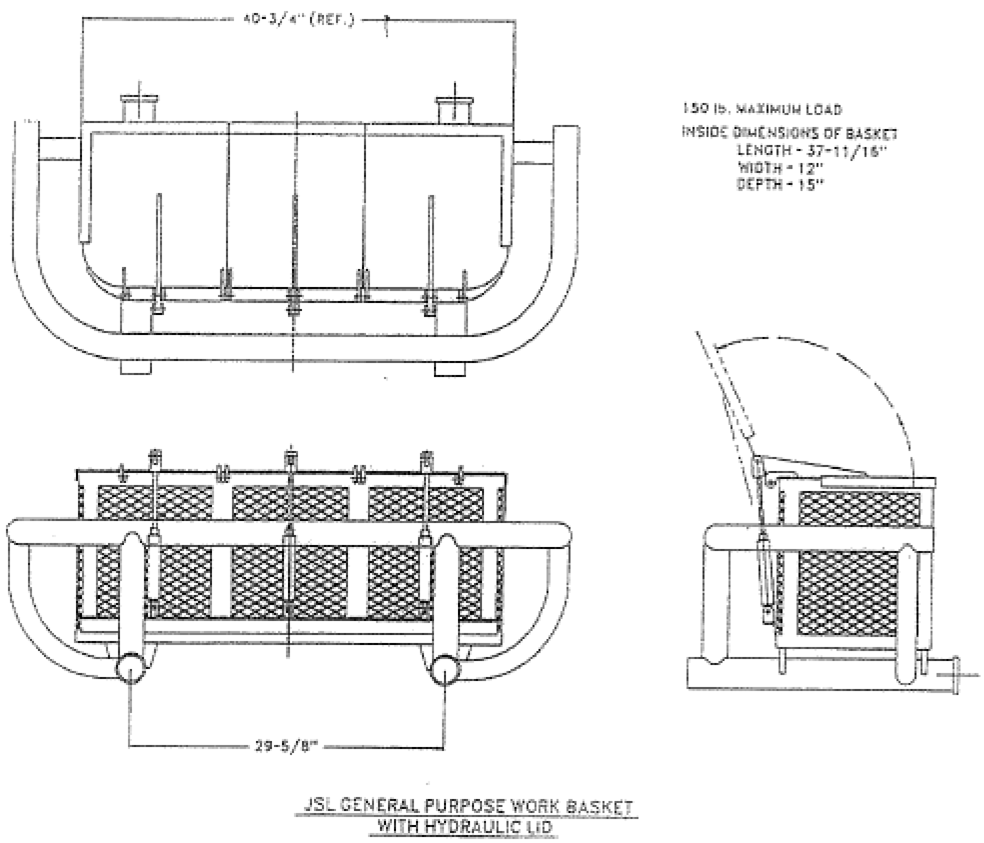
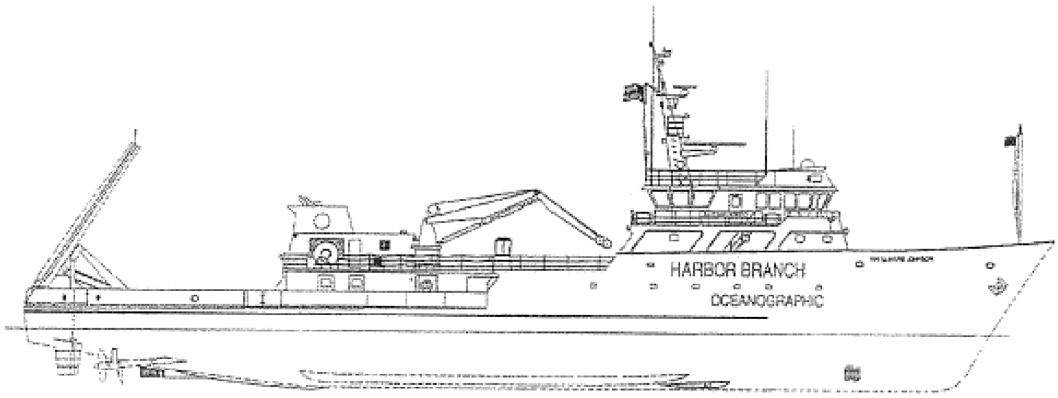


Figure 5 Hydraulic Basket Data



R/V SEWARD JOHNSON

Length Overall	204 feet
Length between perpendiculars	183 feet
Beam, Overall	36 feet
Draft	12 feet
Displacement (weight)	
Nominal Full Load	1,282 Tons
Gross Tonnage	285 GRT
Fuel Capacity	63,000 Gal.
Fuel Consumption	70 gal./hour, normal cruise
Potable Water	18,000 Gal. With RO Unit (4,000 gal./day)
Galley Messing	14
Speed	12 knots
Range	6,000 nautical miles
Year Built/Converted	1984/1994

Figure 6 R/V *Seward Johnson* Specifications