

SOIL MACHINE DYNAMICS LIMITED



**MONTEREY BAY AQUARIUM RESEARCH
INSTITUTE**

TIBURON II ROV SYSTEM

REMOTELY OPERATED VEHICLE

FACTORY ACCEPTANCE TEST

SMD Reference C903-18-001

SMD Serial Number of Unit under test:

ROV (C903RV).....

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TABLE OF CONTENTS

1	SAFETY	5
2	INTRODUCTION	5
3	ROV TEST RECORDS	6
3.1	LOAD TEST LIFT POINT	6
3.1.1	Pre Load Test	6
3.1.2	Test Procedure	6
3.1.3	Post Load Test	6
3.2	LOAD TEST FRAME	6
3.2.1	Pre Load Test	6
3.2.2	Test Procedure	6
3.2.3	Post Load Test	6
3.3	ACCEPTANCE CRITERIA	6
3.3.1	Acceptance Checks	6
3.3.2	Acceptance Tables	8
3.3.3	Acceptance Certification	9
3.4	SURVEILLANCE	10
3.4.1	Cameras	10
3.4.2	Pan & Tilts and Rotator	11
3.4.3	Lamps & Ballast	12
3.4.4	Sonar	13
3.4.5	Gyro Compass	13
3.4.6	Responder	14
3.4.7	Depth Sensor	14
3.4.8	Homer	14
3.4.9	Doppler Velocity Log	15
3.4.10	Altimeter	15
3.4.11	CTD	15
3.4.12	SMD Isolation Boards	15
3.4.13	Spare Comms & Power	16
3.4.14	Tool Sled Power and Comms	16
3.4.15	Ground Fault Monitoring	17
3.4.16	ROV Control Interface Telemetry String Data transfer	17
3.4.17	ROV Control Interface Command String	18
3.4.18	DVECS Serial Input String	18
3.4.19	DVECS Serial Output String	20
3.5	ROV POWER SUPPLY	21
3.5.1	Subsea Transformer Specification	21
3.6	Instrumentation	21
3.6.1	Pressure Transducers	21
3.6.2	Temperature Sensors	21
3.6.3	Linear Transducers	22
3.6.4	Moisture Sensors	22
3.7	General Hydraulic Tests & Power Pack	23
3.7.1	General	23
3.7.2	Hydraulic Oil Cleanliness	24
3.7.3	Power Pack	24
3.8	Hydraulic Circuit	25
3.8.1	Thrusters	25
3.8.2	12-ST VT	25
3.8.3	Manipulator	26



MONTEREY BAY AQUARIUM RESEARCH INSTITUTE

TIBURON II – Ref :C903-18-001 - ROV FAT	
3.8.4	Launch Line Release..... 26
3.8.5	Spare Functions – 12 Station Vehicle HCU 1 26
3.8.6	Variable Buoyancy 27
3.8.7	Belly Pack..... 27
3.8.8	MBARI Specific Controls 28
4	ROV TEST RECORDS..... 29
4.1	Weight and Trim Analysis..... 29
5	ROV wet tests..... 30
5.1	Test 1 30
5.2	Test 2 32
5.3	Test 3 33
6	SUMMARY 34
APPENDIX: TEST CERTIFICATES..... 35	



1 SAFETY



SAFETY NOTE

Appropriate personal protective equipment must be worn and safety precautions observed when witnessing tests on the factory floor. Customers are advised to come equipped with their own overalls and safety boots. Safety glasses and hardhats can be provided by SMD.

2 INTRODUCTION

The objective of the Factory Acceptance Test (FAT) Plan is to demonstrate the correct operation of the ROV and to verify compliance with the Customer's Specification.

Prior to the tests being conducted the equipment will be thoroughly tested and commissioned by SMD as part of the assembly and build program.

The ROV will be connected to the control system via the umbilical cable whilst in the factory and dunk tests. The system power supply will be 440 Volts @ 60Hz.

The tests will be carried out in accordance with the instructions and checklists in this document. The tests will not necessarily be completed in the order that they are listed.

Once the equipment has passed all relevant parts of the test plan, the factory acceptance test certificate on the last page of this document will be endorsed accordingly.

3 ROV TEST RECORDS

All operations described in this procedure should be conducted in accordance with SMDH safety policy requirements. The load test area must be cordoned off to all personnel with the exception of those directly involved in the test.

3.1 LOAD TEST LIFT POINT

3.1.1 *Pre Load Test*

All component parts shall be visually examined prior to the load test for flaws, cracks, deformation and signs of defective manufacture. All welds in the load path shall be examined in accordance with drawing AB5465.

Note: - This will have been carried out as part of the fabrication process and may be carried out at the fabricators premises.

3.1.2 *Test Procedure*

The load test will be carried out on the ROV lift point in accordance with drawing number AB5465

3.1.3 *Post Load Test*

The lift point shall be visually examined for signs of flaws, cracks and permanent deformation.

3.2 LOAD TEST FRAME

3.2.1 *Pre Load Test*

All component parts shall be visually examined prior to the load test for flaws, cracks, deformation and signs of defective manufacture. All welds in the load path shall be examined in accordance with drawing AB4312.

Note: - This will have been carried out as part of the fabrication process and may be carried out at the fabricators premises.

3.2.2 *Test Procedure*

The load test will be carried out on the ROV frame in accordance with drawing number AB4312

3.2.3 *Post Load Test*

The frame shall be visually examined for signs of flaws, cracks and permanent deformation.

3.3 ACCEPTANCE CRITERIA

3.3.1 *Acceptance Checks*

a. All visual examinations shall reveal no damage or deformation or other evidence of failure.



b. All weld inspections shall reveal no cracks, flaws or signs of deformation which may render the structure unsuitable for use.

3.3.2 Acceptance Tables

	SMDH	Third Party Test House
PRE-LOAD TEST		
a) Visual Examination		
b) Weld Tests		Report Ref:
LOAD TEST 1 (Standard Lift Point)		Certificate Ref:
LOAD TEST 2 (Emergency Lift Point)		Certificate Ref:
LOAD TEST 3 (ROV Frame)		Certificate Ref:
POST-LOAD TEST		
a) Visual Examination		
b) Weld Tests		Report Ref:
COMMENTS :		

3.3.3 Acceptance Certification

The following certification and records should be collated and passed to the project manager along with signed off copies of this document.

	Check
a. Pre-load test visual inspection results	
b. Pre-load test weld inspection results and NDT operator qualification certificates	
c. Load test certificate (report of thorough examination of lifting equipment)	
d. Load cell calibration certificate	
e. Post-load test visual inspection results	
f. Post-load test weld inspection results and NDT operator qualification certificates	

3.4 SURVEILLANCE

3.4.1 Cameras

Check that each camera harness is routed to the required position, where no camera is supplied, check power and signals using test pattern generator at end of harness. Item 7 will be used to test items 8-11. Individual loads will be tested as part of item 121.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
1.	HDTV Camera (Power)	Confirm power @ pins 1&2, 5&10 of harness +24VDC, pins 1&5 $\oplus$ive			
2.	Pilots Cam	- Confirm power @ pins 1&2 of harness +12VDC, pin 1 $\oplus$ive. - Confirm signal			
3.	Digi Still Cam	- Confirm power @ pins 1&2 of harness +24VDC, pin 1 $\oplus$ive. - Confirm signal			
4.	Digi Still Cam Strobe	- Confirm power @ pins 5&10 of harness +5VDC, pin 1 $\oplus$ive. - Confirm signal			
5.	Digi Still Cam/Digi Still Cam Strobe	Ensure continuity between Cam pin 5, strobe pin 2 & Cam pin 18, strobe pin 3			
6.	Internal P&T Cam	- Confirm power @ pins 3&5 of harness +24VDC, pin 5 $\oplus$ive. - Confirm signal			
7.	Umb Cam	Confirm Operation			
8.	Aux Cam 1	Confirm Operation			

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
9.	Aux Cam 2	Confirm Operation			
10.	Aux Cam 3	Confirm Operation			
11.	Aux Cam 4	Confirm Operation			
12.	Tool Sled 1	Confirm Signal			
13.	Tool Sled 2	Confirm Signal			

3.4.2 Pan & Tilts and Rotator

P&T units will be operated through its full range whilst checking for clearance with adjacent structure and free movement of harnesses. Confirm position feedback sensor operation. Item 16 will be used to test circuit in place of items 17.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
14.	P&T-25(1)	- Confirm power @ pins 1&2 of harness, pin 2 ⊕ive - Confirm RS485 link			
15.	P&T-25 (21)	- Confirm power @ pins 1&2 of harness, pin 2 ⊕ive - Confirm RS485 link			
16.	P&T-10 (1)	Confirm Operation			
17.	P&T-10 (2)	Confirm Operation			

3.4.3 Lamps & Ballast

Each lamp will be switched on briefly to confirm operation. Lamps 1-4 are designed to dim individually. Ensure HMI light head is submerged in water before striking the ballast, ballast must not be ignited in air for more than 15minutes. Wait 10 seconds between re-strikes.

Item 18 will be used to test Items 19 - 21. Item 22 will be used to test Items 23 – 27, though a single ballast.

Individual loads will be tested as part of item 121.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
18.	Lamp 1 – On / Off Dimming	Confirm Operation (max 5 secs in air)			
19.	Lamp 2– On / Off Dimming	Confirm Operation (max 5 secs in air)			
20.	Lamp 3– On / Off Dimming	Confirm Operation (max 5 secs in air)			
21.	Lamp 4– On / Off Dimming	Confirm Operation (max 5 secs in air)			
22.	HMI Lamp 1– On / Off	Confirm Operation (max 5 mins in air)			
23.	HMI Lamp 2– On / Off	Confirm Operation (max 5 mins in air)			
24.	HMI Lamp 3– On / Off	Confirm Operation (max 5 mins in air)			
25.	HMI Lamp 4– On / Off	Confirm Operation (max 5 mins in air)			
26.	HMI Lamp 5– On / Off	Confirm Operation (max 5 mins in air)			
27.	HMI Lamp 6– On / Off	Confirm Operation (max 5 mins in air)			

3.4.4 Sonar

The sonar processor should be powered up and the self test routine observed.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
28.	Obstacle Avoidance Sonar	Confirm Operation			

3.4.5 Gyro Compass

Lift the ROV and rotate to confirm that the heading changes and tilt to verify the pitch and roll. Pitch and roll can be measured with a suitable pendulum angle meter.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
29.	iGC Gyro	Demonstrate and confirm operation	Note Serial No. / Mode		
30.	Heading	Confirm Operation			
31.	Pitch	Confirm Operation			
32.	Roll	Confirm Operation			
33.	Turns Counter	Confirm Operation by swinging on factory crane. Confirm ships heading is taken into account.			
34.	iFG	Demonstrate and confirm operation, including pitch and roll signs.	Note Serial No / Model		

3.4.6 Responder

Verify that it is appropriately secured to the vehicle. A voltage will be supplied to the responder input at the back of the cabin to simulate HPR “ping”. Confirm that signal is carried through system to responder.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
35.	USBL Sonardyne 8070	- Confirm power @ pins 2,3&4 of harness +24VDC, pin 3&4 $\oplus$ive. - Confirm power @ pins 1&2 of harness +24VDC, pin 1 $\oplus$ive. When responder triggered			

3.4.7 Depth Sensor

Verify that it is appropriately secured to the vehicle. Verify that the depth sensor outputs data relating to external pressure. Demonstrate that pressure can be zeroed to simulate ROV entering water to give a referenced output.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
36.	Digiquartz	Confirm Operation			

3.4.8 Homer

Demonstrate the Homer signal links to the control cabin using two PC's with RS232 outputs. Measure the voltage on terminals. Confirm capable of meeting power rating.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
37.	Homer	Confirm Signal 24VDC @ 500mA			

3.4.9 Doppler Velocity Log

Verify that it is appropriately secured to the vehicle. Ensure Altitude reading can be obtained from DVL as well as altimeter. Full operation to be confirmed during wet test.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
38.	DVL	Confirm Operation			

3.4.10 Altimeter

Verify that it is appropriately secured to the vehicle. Ensure altitude reading can be obtained with Altimeter as well as DVL. Full operation to be confirmed during wet tests.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
39.	Altimeter	Confirm Operation			

3.4.11 CTD

Verify that it is appropriately secured to the vehicle; verify depth reading can be obtained with CTD as well as Depth Sensor. Full operation to be confirmed during wet tests.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
40.	CTD	Confirm Operation			

3.4.12 SMD Isolation Boards

Verify that each RS232, 485, 422, Ethernet and video channel is independently isolatable.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
41.	RS232 card x2	Confirm Isolation			
42.	RS485 card x2	Confirm Isolation			
43.	Video card	Confirm Isolation			

3.4.13 Spare Comms & Power

Demonstrate the spare serial ports on the junction box link to the control cabin using two PC's with RS232 / RS485 / Ethernet outputs.

Measure the voltage on terminals. Confirm each capable of meeting power rating. Use simulated load to increase drain beyond fuse rating for one of each rated fuse, ensure fuse resets.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
44.	Spare, 24VDC RS232/485 2A Rating	Confirm Operation JB1-13			
45.	Spare, 24VDC RS485 2A Rating	Confirm Operation JB1-14			
46.	Spare, 110VAC Ethernet 10A Rating	Confirm Operation JB1-16			
47.	Spare, 24VDC RS232 2A Rating	Confirm Operation JB2-15			
48.	Spare, 24VDC RS485 2A Rating	Confirm Operation JB2-16			

3.4.14 Tool Sled Power and Comms

Demonstrate the spare serial ports on the junction box link to the control cabin using two PC's with RS232/RS422

Measure the voltage on terminals. Confirm each capable of meeting power rating. Use simulated load to increase drain beyond fuse rating for one of each rated fuse, ensure fuse resets.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
49.	Tool Sled RS 232	Confirm Signal at pins 1-3			
50.	Tool Sled RS 422	Confirm Signal at pins 4-7			
51.	Tool Sled 240VDC 4A Rating	Confirm power @ pins 11-14 of harness +240VDC, pin 13 & 14 $\oplus$ ive			
52.	Tool Sled 48VDC 5A Rating	Confirm power @ pins 15 & 16 of harness +48VDC, pin 16 $\oplus$ ive			



3.4.15 Ground Fault Monitoring

Trigger ground/LIM fault on all main power busses and ensure relevant notification through software. Demonstrate override facility of LIM and manual monitoring of MBARI Ground Fault Monitors.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
53.	+24VDC Reg	Confirm Operation			
54.	0V (+24v) Reg	Confirm Operation			
55.	+24VDC Unreg	Confirm Operation			
56.	0V (+24v) Unreg	Confirm Operation			
57.	+48VDC (1)	Confirm Operation			
58.	0V (+48v) (1)	Confirm Operation			
59.	+48VDC (2)	Confirm Operation			
60.	0V (+48v) (2)	Confirm Operation			
61.	110VAC	Confirm Operation			
62.	240VDC	Confirm Operation			
63.	0V (240v)	Confirm Operation			

3.4.16 ROV Control Interface Telemetry String Data transfer

Demonstrate data frequency and latency using two channel Oscilloscope. Confirm format of data transmitted from DVECS to MBARI ROV controls interface.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
64.	Auto-head state	Confirm Format (Boolean)			
65.	ROV control enable	Confirm Format (Boolean)			
66.	Observation Mode state	Confirm Format (Boolean)			
67.	Bypass Mode	Confirm Format (Float)			
68.	Heading	Confirm Format (Float)			



ID	Item /Function	Procedure	Comments	Witness SMD Client	
69.	Pitch	Confirm Format (Float)			
70.	Roll	Confirm Format (Float)			
71.	Depth	Confirm Format (Float)			
72.	Altitude	Confirm Format (Float)			
73.	Heading summed cmd	Confirm Format (Float)			
74.	Lateral summed cmd	Confirm Format (Float)			
75.	Axial summed cmd	Confirm Format (Float)			
76.	Vertical summed cmd	Confirm Format (Float)			

3.4.17 ROV Control Interface Command String

Demonstrate data frequency and latency using two channel Oscilloscope. Confirm receipt of data transmitted from MBARI ROV Control Interface to DVECS. Verify serial interface integrity by sending improperly formatted strings, improper baud settings, and interrupting transmission.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
77.	Heading cmd	Confirm Format (Float)			
78.	Lateral cmd	Confirm Format (Float)			
79.	Axial cmd	Confirm Format (Float)			
80.	Vertical cmd	Confirm Format (Float)			

3.4.18 DVECS Serial Input String

Demonstrate data frequency and latency using two channel Oscilloscope. Confirm receipt of data transmitted from MBARI Navprocessor to DVECS. Verify serial interface integrity by sending improperly formatted strings, improper baud settings, and interrupting transmission.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
81.	HD camera leak	Confirm Format (Boolean)			
82.	HD camera humidity	Confirm Format (Float)			
83.	Pilot camera leak	Confirm Format (Boolean)			



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TIBURON II – Ref :C903-18-001 - ROV FAT

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
84.	Pilot camera humidity	Confirm Format (Float)			
85.	Port light pan	Confirm Format (Float)			
86.	Port light tilt	Confirm Format (Float)			
87.	Starboard light pan	Confirm Format (Float)			
88.	Starboard light tilt	Confirm Format (Float)			
89.	HD camera pan	Confirm Format (Float)			
90.	HD camera tilt	Confirm Format (Float)			
91.	Pilot camera pan	Confirm Format (Float)			
92.	Pilot camera tilt	Confirm Format (Float)			
93.	Umbilical payout	Confirm Format (Float)			
94.	Umbilical delta	Confirm Format (Float)			
95.	Depth (MBARI calculated)	Confirm Format (Float)			
96.	Ships heading	Confirm Format (Float)			
97.	Ships latitude	Confirm Format (Float)			
98.	Ships longitude	Confirm Format (Float)			
99.	ROV Latitude	Confirm Format (Float)			
100.	ROV Longitude	Confirm Format (Float)			



3.4.19 DVECS Serial Output String

Demonstrate data frequency and latency using two channel Oscilloscope. Confirm format of data transmitted from DVECS to MBARI Navprocessor.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
101.	Pressure (digiquartz)	Confirm Format (Float)			
102.	Heading	Confirm Format (Float)			
103.	Pitch	Confirm Format (Float)			
104.	Roll	Confirm Format (Float)			
105.	Altitude	Confirm Format (Float)			
106.	Hydraulic pressure	Confirm Format (Float)			
107.	Dive Number	Confirm Format (Integer)			
108.	Auto-head state	Confirm Format (Boolean)			
109.	Auto-depth state	Confirm Format (Boolean)			
110.	Auto-altitude state	Confirm Format (Boolean)			
111.	Pan x	Confirm Format (Float)			
112.	Pan y	Confirm Format (Float)			
113.	Pan Tilt select up-rt	Confirm Format (Boolean)			
114.	Pan Tilt select lo-rt	Confirm Format (Boolean)			
115.	Pan Tilt select up-lt	Confirm Format (Boolean)			
116.	Pan Tilt select lo-lt	Confirm Format (Boolean)			
117.	4-way toggle up	Confirm Format (Boolean)			
118.	4-way toggle dn	Confirm Format (Boolean)			
119.	4-way toggle rt	Confirm Format (Boolean)			
120.	4-way toggle lt	Confirm Format (Boolean)			

3.5 ROV POWER SUPPLY

3.5.1 Subsea Transformer Specification

Use load to simulate surveillance equipment and tools not shipped for FAT in order to test transformer at full load and overload.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
121.	Full load power test	Confirm Operation			
122.	Excessive load test	Confirm Operation			

3.6 Instrumentation

3.6.1 Pressure Transducers

Pressure transducer operation will be checked using an external test gauge at an appropriate test point. Appropriate measurements will be taken to confirm the transducer calibration.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
123.	System Pressure (Thruster circuit)	Confirm Operation			
124.	System Pressure (12 Station 1)	Confirm Operation			

3.6.2 Temperature Sensors

A resistor box will be used to check the temperature scale.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
125.	Motor Winding Temp	Confirm Operation			
126.	Thruster circuit oil temp	Confirm Operation			
127.	Pod Temp	Confirm Operation			

3.6.3 Linear Transducers

Verify that the relevant graphics move and confirm operation of function.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
128.	Reservoir volume	Confirm Operation			
129.	Compensator #1 volume	Confirm Operation			
130.	Compensator #2 volume	Confirm Operation			
131.	Compensator #3 volume	Confirm Operation			
132.	Compensator #4 volume	Confirm Operation			

3.6.4 Moisture Sensors

Moisten each sensor and verify that the relevant alarm is activated. Ensure that the sensor is positioned in a suitable place where water would be expected to collect first in the event of ingress.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
133.	Main Pod	Confirm Operation			
134.	Thruster Control Unit	Confirm Operation			
135.	HCU	Confirm Operation			
136.	STBD Junction Box	Confirm Operation			
137.	PORT Junction Box	Confirm Operation			
138.	Lamp Dimming Box	Confirm Operation (Cabling only)			
139.	Umbilical Termination	Confirm Operation (Cabling only)			
140.	Humidity Sensor	Confirm Operation	Relative air Humidity between 40-60%		

3.7 General Hydraulic Tests & Power Pack

3.7.1 General

The following procedure will be followed for each hydraulic function:

- 1) Operate through full working range.
- 2) Check for leaks.
- 3) Check free movement of associated hoses and cables.
- 4) Observe correct operation of appropriate transducers. Verify calibration and graphics screen representation.
- 5) Use Flow meter to ensure sufficient flow.

Confirm that flow control settings are acceptable, where applicable.

3.7.2 Hydraulic Oil Cleanliness

The SMDH oil cleanliness sampler will be used to monitor the oil cleanliness in the HPU during the tests. The sample will be taken from a test point in the manifolds.

	NAS Value	Test Printout Number	SMD	Client
Before Test				
After Test				

3.7.3 Power Pack

The power pack can only be operated for short periods in air without cooling. Careful monitoring of the temperature should be carried out whilst operating the motor in air. Ensure reservoirs are free of air and full of oil before operating the main motor.

ID	Item /Function	Procedure	Comments	Witness SMD Client	
141.	Verify motor power rating	Note manufacturer plate. (Ziehl-Abegg)			
142.	Start Motor	Confirm Operation Note current at idle Note idle pressure in thruster	 Amps bar (thruster)		
143.	Auto shutdown	Confirm motor automatically shuts down in the event of the reservoir becoming less than 30% full			
144.	Auto Shutdown	Confirm manual setting of auto shutdown threshold and override functionality.			
145.	Motor Alarm	Demonstrate motor winding hi-temperature alarm	 deg C		
146.	Activate Load Pump	Confirm Operation Note pressure Demonstrate adjustability and return to factory setting	 bar		

3.8 Hydraulic Circuit

Connect a portable deck HPU to the circuit and confirm operation of all functions.

3.8.1 Thrusters

All thrusters operate from the thruster control unit (TCU) located at the rear of the vehicle. Demonstrate the full flow capability of spare servo by plumbing in an in-line flow meter with hydraulic circuit pressure set at factory setting

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
147.	ROV Forward (FWD)	Confirm Operation			
148.	ROV Reverse (REV)	Confirm Operation			
149.	ROV Port Lateral (P.L)	Confirm Operation			
150.	ROV Starboard Lateral (S.L)	Confirm Operation			
151.	Roll Clockwise (R.C)	Confirm Operation			
152.	Roll Counter-Clockwise (R.CCW)	Confirm Operation			
153.	ROV Ascend (AC)	Confirm Operation			
154.	ROV Descend (DC)	Confirm Operation			
155.	Spare servo station FWD	Confirm Operation	Record max flow (lpm).....		
156.	Spare servo station REV	Confirm Operation	Record max flow (lpm).....		

3.8.2 12-ST VT

Connect the deck cart the circuit and confirm operation of all functions on this circuit. These include: -

- 12F Directional valve pack

3.8.3 Manipulator

Demonstrate the operation of the solenoids and full flow capability by plumbing in an in-line flow meter with hydraulic circuit pressure set at factory setting.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
157.	Manipulator	Confirm flow sufficient for manip			

3.8.4 Launch Line Release

With ROV attached to crane and tension on lift point, demonstrate that vehicle release function is operational.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
158.	Launch line release at full load	Confirm no release			
159.	Launch line release at partial load	Confirm release of vehicle at pressure <1000lbs			

3.8.5 Spare Functions – 12 Station Vehicle HCU 1

Demonstrate the operation of the solenoids and pressure change on each spare function using standard pressure gauges. On one function demonstrate the full flow capability by plumbing in an in-line flow meter with hydraulic circuit pressure set at factory setting.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
160.	Spare #1	Confirm Operation			
161.	Spare #2	Confirm Operation			
162.	Spare #3	Confirm Operation			
163.	Spare #4	Confirm Operation			
164.	Spare #5	Confirm Operation			



MONTEREY BAY AQUARIUM RESEARCH INSTITUTE

TIBURON II – Ref :C903-18-001 - ROV FAT

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
165.	Spare #6	Confirm Operation	Record max flow (lpm).....		
166.	Spare #7	Confirm Operation			
167.	Spare #8 Prop	Confirm Operation			
168.	Spare #9 Prop	Confirm Operation			
169.	Spare #10 Prop	Confirm Operation			
170.	Spare #11 Prop	Confirm Operation	Record max flow (lpm).....		

3.8.6 Variable Buoyancy

Activate Pump. Full functionality to be tested during wet tests.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
171.	Variable Buoyancy	Confirm pump operation			

3.8.7 Belly Pack

Confirm Thruster control and feedback to belly pack

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
172.	ROV Forward (FWD)	Confirm Operation			
173.	ROV Reverse (REV)	Confirm Operation			
174.	ROV Port Lateral (P.L)	Confirm Operation			
175.	ROV Starboard Lateral (S.L)	Confirm Operation			
176.	Roll Clockwise (R.C)	Confirm Operation			



MONTEREY BAY AQUARIUM RESEARCH INSTITUTE

TIBURON II – Ref :C903-18-001 - ROV FAT

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
177.	Roll Counter-Clockwise (R.CCW)	Confirm Operation			
178.	ROV Ascend (AC)	Confirm Operation			
179.	ROV Descend (DC)	Confirm Operation			
180.	Depth Reading				
181.	Auto Heading	Confirm Enable/Disable			
182.	Auto Depth	Confirm Enable/Disable			
183.	Control Reverse	Confirm Operation			

3.8.8 MBARI Specific Controls

Confirm controls operate as expected and set up variable parameters as required.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
184.	Joystick Vertical Lock Mode				
185.	Joystick Horizontal Lock Mode				
186.	Reduced Power Mode				
187.	MBARI Observation mode	Confirm correct thrusters operate, to be fully confirmed during wet tests			
188.	Current Limit	Confirm thruster behaviour			
189.	Redundancy	Confirm Thruster Behaviour			
190.	Auxillary Junction Box	Confirm communication			
191.	Confirm functionality of MBARI controls interface				



4 ROV TEST RECORDS

4.1 Weight and Trim Analysis

Connect a single 6 tonne sling to the ROV lift set to ensure sufficient length of sling (min 6m.) between the crane hook and ROV to allow free movement of the ROV during testing. SMDH test tank contains fresh water.

Test to include tool sled with lead ballast distributed to simulate missing tools.

ID	Item /Function	Comments	Witness	
			SMD	Client
192.	Overall Height of ROV (mm) Measure and record			
193.	Overall Length of ROV(mm) Measure and record.			
194.	Overall Width of ROV (mm) Measure and record.			
195.	ROV weight in air (complete with payload, oil reservoirs full)	kg		
196.	Payload applied to achieve neutral buoyancy (complete with tool sled)	kg		
197.	Trim in air (lifted on lifting sling)	<10° pitch		
198.	Trim in water (neutrally buoyant)			

5 ROV WET TESTS

5.1 Test 1

With the ROV on the deck, set up the data logging and perform a complete set of deck checks. Ensure data logging records power in, all temperatures, all pressures and all oil volumes.

With the ROV on the surface of the water and pump unloaded, verify in water operation of the ROV instrumentation and surveillance.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
199.	Deck checks complete, set up dive log	Ensure all temperatures logged			
200.	Cameras	Ensure picture from all connected cameras			
201.	Lamps	Confirm operation of all connected			
202.	Pan & Tilt	Confirm operation of all connected			
203.	Sonar	Confirm Operation			
204.	Depth Sensor	Confirm Operation			
205.	DVL	Confirm Operation – Assuming a reading can be obtained in the tank, if not this will be carried out at NAREC.			
206.	Altimeter	Confirm Operation			
207.	CTD	Confirm Operation – Assuming a reading can be obtained in the tank, if not this will be carried out at NAREC.			
208.	Pod Temperature				
209.	STBD Reservoir level				
210.	PORT Reservoir level				
211.	Compensator level #1				
212.	Compensator level #2				



MONTEREY BAY AQUARIUM RESEARCH INSTITUTE

TIBURON II – Ref :C903-18-001 - ROV FAT

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
213.	Compensator level #3				
214.	Compensator level #4				
215.	ROV Motor winding Temperature				

5.2 Test 2

With the vehicle submerged, load the pumps and verify operation of the following. Ensure data is logged.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
216.	Record Hydraulic Pressure				
217.	Verify Horizontal thruster operation.				
218.	Verify Vertical thruster operation.				
219.	Pan and Tilt				
220.	Attempt to verify Auto Altitude	(This is dependant on clean water conditions in the tank)			
221.	Verify Auto Heading				
222.	Verify Auto Depth				
223.	Verify Operation of Variable Buoyancy				
224.	PORT Reservoir level				
225.	Compensator level #1				
226.	Compensator level #2				
227.	Compensator level #3				
228.	Compensator level #4				
229.	ROV Motor winding Temperature				

5.3 Test 3

With the vehicle submerged, load the pumps and verify operation of the following. Ensure data is logged.

ID	Item /Function	Comments	Witness	
			SMD	Client
230.	Auto Thrust Heading Gyro – Simulate and verify thruster graphics displays	Confirm Operation		
231.	Auto Altitude – Simulate and observe correct response of thrusters.	Confirm Operation		
232.	Auto Depth – Simulate and observe correct response of thrusters.	Confirm Operation		
233.	Confirm ROV pitch capability	Check with ROV in tank		
234.	Confirm ROV roll capability	Check during dunk test		
235.	Obstacle Avoidance Sonar	Confirm Operation		
236.	MBARI observation mode	Confirm thruster algorithms and power. Ensure clarity of video picture throughout.		
237.	Bollard Pull - Verts	Ensure minimum 500kg thrustActual (kg)		
238.	Bollard Pull – FWD	Ensure minimum 600kg thrustActual (kg)		
239.	Bollard Pull – AFT	Ensure minimum 600kg thrustActual (kg)		
240.	Bollard Pull – LAT	Ensure minimum 600kg thrustActual (kg)		
241.	Verify backup copy of data log taken.			
242.	Soak test for remaining time up to 8 hrs			
243.	Record total ROV in-water runtime to the end of Procedure #3			



6 SUMMARY

Agreed for SMD

Agreed for MBARI

Signed

Signed

Name

Name

Position

Position

Date

Date



APPENDIX: TEST CERTIFICATES

A copy of the following test certificates is attached.

Part No	Cert No	Description
		SMD Work Instruction 63
		Load cell calibration certificate
		ROV Lifting Set certificate
		ROV Load Test certificate
		Pod pressure vessel test
		Motor test certificate
		Certificate of conformity (Quantum ROV Buoyancy Module)
		Testing certification to ensure umbilical conforms to requirements laid out in section 2.4.3.2 of specification document. SMDH RFQ_REV 1.2