

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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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*

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	

Please include all test certificates for the umbilical testing listed in section 2.4.3.2 of the specification

3.4 SURVEILLANCE

3.4.1 Cameras

Need to include the verification of the FOCAL video switcher

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.

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 +24VDC, pin 2 ive. - Confirm RS485 link			
15.	P&T-25 (2) 	- Confirm power @ pins 1&2 of harness +24VDC, 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.

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)			

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3.4.4 Sonar

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	
28.	Obstacle Avoidance Sonar	Confirm Signal 24VDC @ 500mA			

3.4.5 Responder

should also check pulse width and latency

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	
29.	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			

3.4.6 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	
30.	Digiquartz	Confirm Operation			



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3.4.7 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	
31.	Homer	Confirm Signal 24VDC @ 500mA			

3.4.8 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	
32.	DVL	Confirm Operation			

3.4.9 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	
33.	Altimeter	Confirm Operation			

3.4.10 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	
34.	CTD	Confirm Operation			

verify operation of oxygen optode sensor

verify operation of custom SMD serial isolation boards



3.4.11 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, ensure fuse resets.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
35.	Spare, 24VDC RS232/485 2A Rating	Confirm Operation JB1-13			
36.	Spare, 24VDC RS485 2A Rating	Confirm Operation JB1-14			
37.	Spare, 110VAC Ethernet 10A Rating	Confirm Operation JB1-16			
38.	Spare, 24VDC RS232 2A Rating	Confirm Operation JB2-15			
39.	Spare, 24VDC RS485 2A Rating	Confirm Operation JB2-16			

3.4.12 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, ensure fuse resets.

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



See attached Word Doc. for additional tables & comments

3.4.13 Data transfer

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

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
44.	Digiquartz	Confirm Format (Float)			
45.	Heading	Confirm Format (Float)			
46.	Pitch	Confirm Format (Float)			
47.	Roll	Confirm Format (Float)			
48.	Altitude	Confirm Format (Float)			
49.	Hydraulic Pressure	Confirm Format (Float)			
50.	Dive Number	Confirm Format (Integer)			
51.	Auto-Head State	Confirm Format (Boolean)			
52.	Auto Depth State	Confirm Format (Boolean)			
53.	Auto Altitude State	Confirm Format (Boolean)			
54.	Pan X	Confirm Format (Float)			
55.	Pan Y	Confirm Format (Float)			
56.	Pan Tilt up-right	Confirm Format (Boolean)			
57.	Pan Tilt up-left	Confirm Format (Boolean)			
58.	Pan Tilt down-right	Confirm Format (Boolean)			
59.	Pan Tilt down-left	Confirm Format (Boolean)			
60.	4-way toggle – up	Confirm Format (Boolean)			
61.	4-way toggle – down	Confirm Format (Boolean)			
62.	4-way toggle – left	Confirm Format (Boolean)			
63.	4-way toggle – right	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.

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

Use load to simulate overload condition in order to test fuse protection schemes

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
65.	System Pressure (Thruster circuit)	Confirm Operation			
66.	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
67.	Motor Winding Temp	Confirm Operation			
68.	Thruster circuit oil temp	Confirm Operation			
69.	Pod Temp	Confirm Operation			

Verify operation & accuracy of pitch & roll sensors

3.6.3 Linear Transducers

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

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
70.	Reservoir volume	Confirm Operation			
71.	Compensator #1 volume	Confirm Operation			
72.	Compensator #2 volume	Confirm Operation			
73.	Compensator #3 volume	Confirm Operation			
74.	Compensator #4 volume	Confirm Operation			

A section is needed for the verification of the ground fault monitoring system and ground fault interruption

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
75.	Main Pod	Confirm Operation			
76.	Thruster Control Unit	Confirm Operation			
77.	HCU	Confirm Operation			
78.	STBD Junction Box	Confirm Operation			
79.	PORT Junction Box	Confirm Operation			
80.	Lamp Dimming Box	Confirm Operation (Cabling only)			
81.	Umbilical Termination	Confirm Operation (Cabling only)			

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	
82.	Verify motor power rating	Note manufacturer plate. (Ziehl-Abegg)			
83.	Start Motor	Confirm Operation Note current at idle Note idle pressure in thruster	 Amps bar (thruster)		
84.	Auto shutdown Demonstrate override of auto shutdown	Confirm motor automatically shuts down in the event of the reservoir becoming less than 30% full			
85.	Motor Alarm	Demonstrate motor winding hi-temperature alarm	 deg C		
86.	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.

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
87.	ROV Forward (FWD)	Confirm Operation			
88.	ROV Reverse (REV)	Confirm Operation			
89.	ROV Port Lateral (P.L)	Confirm Operation			
90.	ROV Starboard Lateral (S.L)	Confirm Operation			
91.	Roll Clockwise (R.C)	Confirm Operation			
92.	Roll Counter-Clockwise (R.CCW)	Confirm Operation			
93.	ROV Ascend (AC)	Confirm Operation			
94.	ROV Descend (DC)	Confirm Operation			
95.	Spare servo station FWD	Confirm Operation	check flow		
96.	Spare servo station REV	Confirm Operation			

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
97.	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.

Two separate tests are required.
 1. - full load test to ensure the latch will not release
 2. - partial load test (<1000 pounds) to ensure the latch will release

ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
98.	Vehicle Release	Confirm Operation			

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
99.	Spare #1	Confirm Operation			
100.	Spare #2	Confirm Operation			
101.	Spare #3	Confirm Operation			
102.	Spare #4	Confirm Operation			
103.	Spare #5	Confirm Operation			



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ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
104.	Spare #6	Confirm Operation	Record max flow (lpm).....		
105.	Spare #7	Confirm Operation			
106.	Spare #8 Prop	Confirm Operation			
107.	Spare #9 Prop	Confirm Operation			
108.	Spare #10 Prop	Confirm Operation			
109.	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
110.	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
111.	ROV Forward (FWD)	Confirm Operation			
112.	ROV Reverse (REV)	Confirm Operation			
113.	ROV Port Lateral (P.L)	Confirm Operation			
114.	ROV Starboard Lateral (S.L)	Confirm Operation			



ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
115.	Roll Clockwise (R.C)	Confirm Operation			
116.	Roll Counter-Clockwise (R.CCW)	Confirm Operation			
117.	ROV Ascend (AC)	Confirm Operation			
118.	ROV Descend (DC)	Confirm Operation			
119.	Depth Reading				
120.	Auto Heading	Confirm Enable/Disable			
121.	Auto Depth	Confirm Enable/Disable			

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
122.	Joystick Vertical Lock Mode				
123.	Joystick Horizontal Lock Mode				
124.	Reduced Power Mode				
125.	MBARI Observation mode	Confirm correct thrusters operate, to be fully confirmed during wet tests			
126.	Current Limit	Confirm thruster behaviour			
127.	Redundancy	Confirm Thruster Behaviour			
128.	Auxillary Junction Box	Confirm communication			

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
129.	Overall Height of ROV (mm) Measure and record			
130.	Overall Length of ROV(mm) Measure and record.			
131.	Overall Width of ROV (mm) Measure and record.			
132.	ROV weight in air (zero payload, oil reservoirs full)	Nominally 4700kg		
133.	Payload applied to achieve neutral buoyancy (complete with tool sled)	Nominally 273kg		
134.	Trim in air (lifted on lifting sling)			
135.	Trim in water (neutrally buoyant)			

Need to include a pitch test to verify that the vehicle complies with section 2.1.7.1 of the specification

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
136.	Deck checks complete, set up dive log	Ensure all temperatures logged			
137.	Cameras	Ensure picture from all connected cameras			
138.	Lamps	Confirm operation of all connected			
139.	Pan & Tilt	Confirm operation of all connected			
140.	Sonar	Confirm Operation			
141.	Depth Sensor	Confirm Operation			
142.	DVL	Confirm Operation – Assuming a reading can be obtained in the tank, if not this will be carried out at NAREC.			
143.	Altimeter	Confirm Operation			
144.	CTD	Confirm Operation – Assuming a reading can be obtained in the tank, if not this will be carried out at NAREC.			
145.	Pod Temperature				
146.	STBD Reservoir level				
147.	PORT Reservoir level				
148.	Compensator level #1				
149.	Compensator level #2				



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ID	Item /Function	Procedure	Comments	Witness	
				SMD	Client
150.	Compensator level #3				
151.	Compensator level #4				
152.	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
153.	Record Hydraulic Pressure				
154.	Verify Horizontal thruster operation.				
155.	Verify Vertical thruster operation.				
156.	Pan and Tilt				
157.	Attempt to verify Auto Altitude	(This is dependant on clean water conditions in the tank)			
158.	Verify Auto Heading				
159.	Verify Auto Depth				
160.	Verify Operation of Variable Buoyancy				
161.	PORT Reservoir level				
162.	Compensator level #1				
163.	Compensator level #2				
164.	Compensator level #3				
165.	Compensator level #4				
166.	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
167.	Auto Thrust Heading Gyro – Simulate and verify thruster graphics displays	Confirm Operation		
168.	Auto Altitude – Simulate and observe correct response of thrusters.	Confirm Operation		
169.	Auto Depth – Simulate and observe correct response of thrusters.	Confirm Operation		
170.	Confirm ROV pitch capability	Check with ROV in tank		
171.	Confirm ROV roll capability	Check during dunk test		
172.	Obstacle Avoidance Sonar	Confirm Operation		
173.	MBARI observation mode	Confirm thruster algorithms and power. Ensure clarity of video picture throughout.		
174.	Bollard Pull - Verts	Ensure minimum 500kg thrustActual (kg)		
175.	Bollard Pull – FWD	Ensure minimum 600kg thrustActual (kg)		
176.	Bollard Pull – AFT	Ensure minimum 600kg thrustActual (kg)		
177.	Bollard Pull – LAT	Ensure minimum 600kg thrustActual (kg)		
178.	Verify backup copy of data log taken.			
179.	Soak test for remaining time up to 8 hrs			
180.	Record total ROV in-water runtime to the end of Procedure #3			

6 SUMMARY

Agreed for SMD

Signed

Name

Position

Date

Agreed for MBARI

Signed

Name

Position

Date



7 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)