

Liquid Robotics, Inc.
Field Operations

MBARI – Station M
Mission Plan



1329 Moffett Park Drive
Sunnyvale, California 94089



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1 EXECUTIVE SUMMARY

Client: MBARI

Mission Date Range: 140205 - 140220

LR Project Manager: Ryan Carlon

Wave Glider Info: 1 SV2

Theater(s) of Operations:

Offshore of Monterey Bay

Mission Description:

The Benthic Rover is deployed in 4000 meters of water near Station M. Client would like to have the ability to query the Rover for basic health and status information. In the event that an anomaly was reported, the team might be able to deal with the issue sooner than the scheduled bi-annual cruise would allow. The Wave Glider “Tex” will be used to communicate acoustically with the Rover with a human in the loop managing specific commands to the Rover. Time on station will be 24 hours or less.

Special Operational Considerations:

Transit direct from launch coordinates through waypoint #3 and loiter in place enabling CTD/Puck data if possible during transit. MBARI will run direct SMC communications once on station to communicate with seafloor Rover.

Standard Piloting (advance course architecture/construction)

Environmental Risk Assessment Summary:

Power is the highest risk factor for proposed mission. For a February deployment, battery life is expected to last about two weeks with a 7W payload. If power draw is increased to 10W continuous, battery life may be depleted in as little as one week. Core payload requirements for an SV2 will draw about 5W. Due to the unique nature of this payload, continuous operation may not be necessary for mission success.

Mitigation

- | | | |
|--------------------------|---|--|
| • Navigational Authority | ● | |
| • Power Margin | ● | <u>power management protocol</u> |
| • Bathymetry | ● | |
| • Vessel Traffic | ● | |
| • Hazards to Navigation | ● | |
| • Political Interests | ● | |

Link to Environmental Risk Assessment: [see Appendix](#)

Local Authorities & Permitting:

- Request for publication in LNM submitted to USCG-D11 by LRI: 140124 (2/1-3/31)
- Request for operations in Monterey Bay and Davidson Seamount Management Zone Marine Sanctuary: Client authorized (Electronic copy of authorization available if needed)
- Request for operations in Pacific Missile Range: No authorization necessary (jurisdiction of NavAir). LNM to be monitored for activity should range be activated. Alternatively, 805-989-1470 (recording of planned operations). Contacted NavAir and confirmed no scheduled launches out of Vandenberg

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AFB during our mission. As a courtesy, planned operations can be faxed to 805-989-0102 which should include a description of the vessel, contact information, and stay duration.

* Evidence of communications and or authorizations required: [see Appendix](#)

2 KEY STAKEHOLDERS

2.1 Points-Of-Contact			
Client POC:	Brian Kieft bkieft@mbari.org +1 831 775 2070	LR Project Mgr.:	Ryan Carlon Sales Engineer Ryan.carlon@liquidr.com
LR Sensor Eng.:	NA	LR Field Ops Mgr.:	Keith Kreider VP Operations, Wave Glider keith.kreider@liquidr.com +1 408 636 4277
LR Field Ops Eng./Tech:	NA	LR WGOE Mgr.:	John Appelgren Dir, Customer Support Operations john.appelgren@liquidr.com +1 408 636 4260
LR Acct Rep:	Jamie Griffith jamie.griffith@liquidr.com (509) 993-8216	LR WGOE:	Pilot-in-Charge Mission Support Specialists opscenter@liquidr.com +1 408 636 4205

2.2 Roles and Responsibilities

Client Point-of-Contact: If deployment is on behalf of an external client, Client POC is the primary liaison to the Project Manager to coordinate mission objectives, and communicate deviations should they become required during fulfillment of mission objectives.

Project Manager: Is the primary liaison to the client. If deployment is in support of an internally managed project, or supporting an external client, Project Manager coordinates all communications and personnel required to support the field deployment in conjunction with Field and Customer Support Operations.

Sensor Engineer: Ensures sensors and Wave Glider are properly integrated and operating consistent with mission objectives (prior to, and during field deployment).

Field Operations Manager: Coordinates and plans logistics of people, equipment, and vessels (responsibility may be fulfilled by Project Manager).

Field Operations Engineer/Technician: Personnel assigned to perform on-location work.

Wave Glider Operations Center Manager: Coordinates mission planning logistics, mission administration, and piloting operations of Wave Glider activities.

Account Representative/Channel Partner: Provides project oversight ensuring mission plan aligns with client's operational immediate and future business needs.

Wave Glider Operations/Customer Support Call Center: Personnel assigned to perform shore-side piloting operations.

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3 MISSION PLAN

3.1 Client Deliverables

Specific to Client PO# 1211279 (LRI SO# 1064rev3):

Sortie 1: Acoustic mission. Client plans to spend very little time on station and will begin the transit home as soon as acoustic communications have been established.

Professional Service: LRI mission planning logistics and piloting services.

Data: Device preparation, data acquisition and analysis under client control.

Reports: No LRI operations reports specified.

Communications:

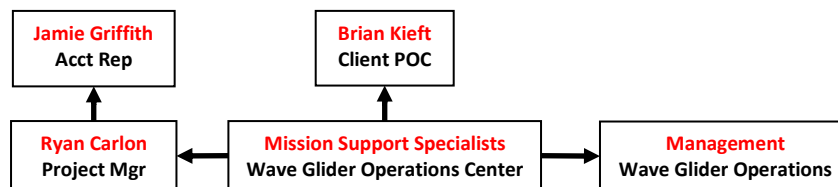
Non-emergency:

- Drift or evasive navigation causing breach of, and return to a defined survey area to be communicated to Client POC and Project Manager immediately.
- Device duty-cycling in compliance with power management criteria to be performed by will be performed by MBARI and communicated to WGOC.

Emergency:

- Core system and or device malfunctions to be communicated to LR Project Manager.

Escalation Interfaces:



3.2 Operations Logistics

Project Code:	[#####]	LR Field Ops Eng/Tech Req.:	Total days on location: NA Total days underway: NA
Deployment Type:	Deployment from Client chartered vessel.	Schedule (dates):	140205 - Personnel Arrival 140205 - Mobilization 140205 - Vessel Underway 140220 - Demobilization 140220 - Personnel Departure
Vessel:	R/V Paragon (No. 993613) Chartered by: Client	Client/Vessel Required Certs:	Credentials required: Client responsibility
Port:	Moss Landing		
LR Field Operations Accommodations: NA			
Field Replaceable Units (FRUs/Spares) and Special Tools: Client responsibility			

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Freight Forwarding Logistics: Client responsibility

Pre-Launch Validation: Core systems and sensor calibration (pre-launch checklist) to be distributed to WGO (mission/case record) by client prior to deployment. Operations and HSSE review preceding voyage is clients responsibility: [see Appendix](#)

Launch/Recovery Reports: Authored by field resource following task; distributed to WGO (mission/case record) and Field Operations; expanded distribution to affect quality improvement initiatives.

Post-Recovery: SL1 inspection/servicing available (client PO required) to stage vehicle for next mission.

Vessel & Equipment Specifications: [see Appendix](#)

3.3 Vehicle Configuration & Operating System

Wave Glider Info:	Vehicle/tracker name: SV2 - Tex/Tracker-87 Tex	WGMS Org: mbari.wgms.com
	Detailed Vehicle Parameters: see Appendix	Org, WG, Dashboard Prep: Ready date: [yyymmdd]
Float Devices:	PL1: CTD and or Eco-puck PL2: Benthos MF modem (MBARI controlled hot spot) PL3: RTE	WGMS Access: MBARI.wgms.com Submit request to opscenter@liquidr.com User name, email, phone# (LR Account Representative authorization required)
Sub Devices:	NA	

3.4 Navigational Tasking

Mission Description and Theater of Operations:

Executive Summary

Sortie 1: Deploy vehicle near MBARI buoy and navigate Wave Glider Tex out to Benthic Rover for sub-sea communications and then return to shore for recovery.

Task 1: Safely deploy within 3 nm vicinity of MBARI buoy followed by core system and device validations performed by WGO. Begin transit offshore to Benthic Rover estimated position following the path using coordinates listed below (MBARI PL to be off during transit in both directions):

- 1.) 36.6480, -122.0000 (36 38.8800, -122 0.000): Approach
- 2.) 35.1185, -122.9752 (35 07.1089, -122 58.5125): Station M
- 3.) 35.1185, -122.9851 (35 07.1089, -122 59.106) Estimated position

[yyymmdd, hhmmz, lat/lon – task start]

[yyymmdd, hhmmz, lat/lon – unplanned events: challenges; special discoveries; etc...]

Task 2: Hold station (1km box subject to client redirect) at estimated position of Benthic Rover (PL management to be performed by MBARI to establish communications with Benthic Rover). Upon client notification, begin transit back to shore following same route unless otherwise specified.

[yyymmdd, hhmmz, lat/lon – task start]

[yyymmdd, hhmmz, lat/lon – unplanned events: challenges; special discoveries; etc...]

[yyymmdd, hhmmz, lat/lon – task end]

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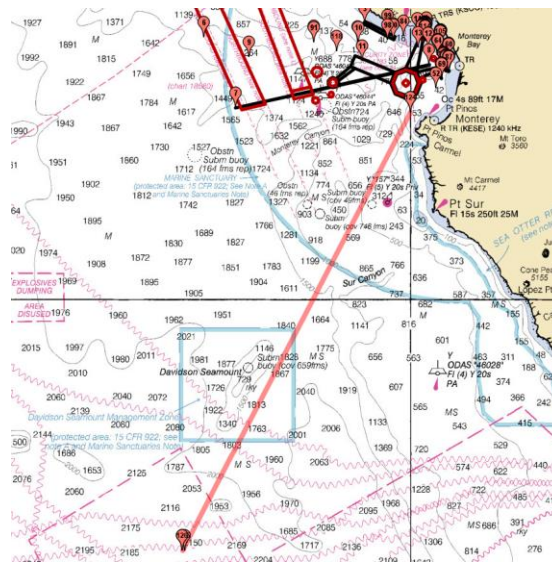
Task 3: Safely recover in vicinity of MBARI buoy, secure vehicle for transit to shore, and end mission.
 [yyymmdd, hhmmz, lat/lon – unplanned events: challenges; special discoveries; etc...]
 [yyymmdd, hhmmz, lat/lon – task end]

3.5 Piloting Tasks

Observations:	Probable Response:	When to Escalate:
Event Notifications	• Navigate (threat evasion; drift management) • Observe power management criteria • Take corrective action • Record accordingly	• Unsafe operation conditions • Mission deviation required
Power Management	• Light: Launch/recover/emergency use only ◦ Night use requires local authority authorization • Telemetry: 10min (250wh); 15min (200wh auto-adj); 20min (150wh); 30min (100wh) ◦ Consider glider position (AIS notification diminished at TRR >5min) • Water Speed Sensor: Off at 250wh • Payloads: Adj sample rate, or off at <200wh ◦ Client to manage payloads • Weather Station: Off at 150wh • AIS and Radar Target Enhancer: Off at 100wh ◦ Consider glider position (no vessel awareness aides, and risk of power loss) • Move to Safe Harbor: At 50wh • Power Restoration: In reverse order +25wh ◦ Increase thresholds by 100Wh when entering periods of deteriorating weather forecasts)	• Notify Program Manager and client POC if total available power reaches 300Wh • Client to manage Benthic modem payload • If course change required

3.6 Course Architecture

Overall Operating Area:





3.7 Emergency Equipment Retrieval

If escalation warrants emergency retrieval of a Wave Glider, local authorities are notified and Marine Operations is engaged to coordinate search and recovery operations. Logistics include: last known disposition for shipping crates; WG cart/stand/saddle; Ops kit (specifically recovery tool, bundling/release straps, sea-catch, and tagline carabineers); and vessel/crew of opportunity contracting/vetting.

Client vessel (Western Flyer) will be the contingency recovery vessel.

3.8 Authorizations

Client POC: Brian Kieft

LR Project Manager: Ryan Carlon

LR Account Representative: Jamie Griffith

Dir., WGO: John Appelgren

VP, Field Operations: Keith Kreider

Sr. VP Product Management: Graham Hine

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4 APPENDIX

4.1 Environmental Risk Assessment (details)

4.2 Evidence of Communications with Local Authorities & Permitting

4.3 Vessel and Hoisting Mechanism Specifications

- LRI minimum VOO specifications, certifications, and audit requirements
- Actual VOO specifications, certifications, and audit results

4.4 Detailed Vehicle Parameters

4.5 Wave Glider Operational Protocol

4.6 Work Flows

- Wave Glider build to mission operations
- Mission planning logistics
- Data harvesting, storage, access

4.7 Device Descriptions