

Liquid Robotics, Inc.
Field Operations

MBARI – Smooth Ridge
Mission Plan



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1 EXECUTIVE SUMMARY

Client: MBARI

Mission Date Range: 140625-140710

LR Project Manager: Ryan Carlon

Wave Glider Info: 1ea. SV3

Theater(s) of Operations: Monterey Bay (36.711367,-122.186817)

Mission Description: The Benthic Rover is deployed in 870 meters of water near Smooth Ridge (19.8 nm from Moss Landing). Users 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 SV3 “Tiny” will be used to communicate acoustically with the Rover with a human in the loop managing specific commands to the Rover.

Special Operational Considerations: Standard piloting (advance course architecture/construction).

Operational Risk Assessment Summary: Operating area well understood. Neighboring buoys identified with exclusion operation polygons representative of their watch circles. Standard Commercial salmon season runs through 30-Jun, and resumes 15-Jul though 13-Aug south of Pigeon Point.



	OpArea	Mitigation
• Navigational Authority	●	
• Power Margin	●	
• Bathymetry	●	
• Vessel Traffic	●	see navigation protocol
• Hazards to Navigation	●	see navigation protocol
• Political Interests	●	

Local Authorities & Permitting:

- Request for publication in USCG-D11 Local Notice to Mariners submitted by LRI on 140611 for 140625-140710.
- Notification of operational plans with the NMS will be managed by MBARI.

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

2 KEY STAKEHOLDERS

2.1 Points-Of-Contact			
Client POC:	Brian Kieft (primary) (contact info below) Thom Maughan tm@mbari.org +1 805 245 4890 (cell) +1 831 775 1865 (office) Paul Coenen +1 831 334 7285 Tom O'Reilly +1 831 325 9878 Mark Chaffey +1 831 236 5191 Chris Wahl +1 949 929 7598	LR Project Mgr.:	Ryan Carlon Sales Engineer Ryan.carlon@liquidr.com +1 530 520 0816
LR Sensor Eng.:	NA	LR Field Ops Mgr.:	Keith Kreider VP Operations, Wave Glider keith.kreider@liquidr.com +1 408 636 4277
Client Eng./Tech:	Brian Kieft bkieft@mbari.org +1 831 334 7658	LR WGOC Mgr.:	John Appelgren Dir, Customer Support Operations john.appelgren@liquidr.com +1 408 636 4260
LR Acct Rep.:	Jamie Griffith Sales Engineer jamie.griffith@liquidr.com +509 993 8216	LR WGOC:	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: Primary liaison to client, and governing entity of the mission. PM coordinates communications and personnel required to support the field deployment in conjunction with Field/Customer Support Operations. PM authorization is required to affect mission objectives as well as manage any deviation requests subject to WGOC vetting for operational risk assessment.

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).

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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: Provides project oversight ensuring mission plan aligns with client's business needs.

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

3 MISSION PLAN

3.1 Client Deliverables

Specific to Client P01410470, LRI S00226

- **Sortie 1:** Query Benthic Rover near Smooth Ridge for basic health and status information.

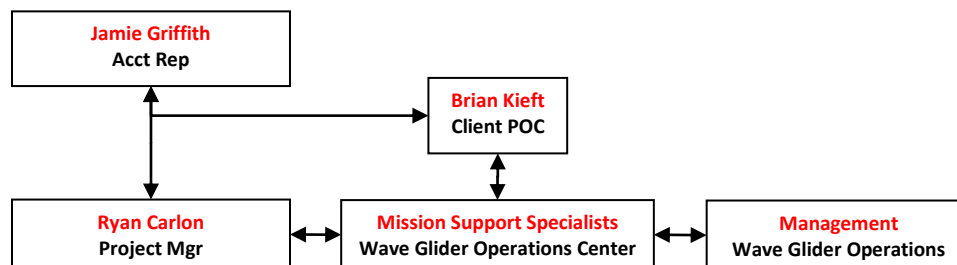
Professional Service: LRI mission planning logistics and piloting services.

Data: Client managed

Reports: None 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 LR Project Manager immediately.
 - Device duty-cycling in compliance with power management criteria to be authorized by client POC.
- Emergency:
 - Core system and or device malfunctions to be communicated to client POC, LR Project Manager, and LR Account Representative immediately.
- Escalation Interfaces:



3.2 Operations Logistics

Project Code:	563000	Client Eng/Tech:	Total days on location: 2 days Total days underway: 2 days
Deployment Type:	Single launch and recovery by client from client chartered vessel.	Schedule (dates):	140625 - Mobilize, Underway, Deploy, Return to Port 140710 - Underway, Recover, Return to Port, Demobilize
Vessel:	Paragon	Client/	Credentials required: Client managed

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Chartered by: Client	Vessel
Port: Moss Landing	Required
	Certs:
LR Field Operations Accommodations: NA Field Replaceable Units (FRUs/Spares) and Special Tools: NA Freight Forwarding Logistics: Client managed Pre-Launch Validation: Core systems and sensor calibration (pre-launch checklist) distributed to WGOC (mission/case record). Operations and HSSE review preceding each voyage: see Appendix Launch/Recovery Reports: Authored by field resource following task; distributed to WGOC (mission/case record) and Field Operations; expanded distribution to affect quality improvement initiatives. Post-Recovery: SL1 inspection/servicing; drive continuous improvement initiatives; stage for next mission.	

3.3 Vehicle Configuration & Operating System

Wave Glider	Vehicle: SV3-011 "Tiny"	WGMS Org: mbari.wgms.com
Info:	Tracker: Tiny Tracker Detailed Vehicle Parameters: see Appendix	Access: Submit request with user name, email, phone# (LR Acct. Rep. authorization required) to opscenter@liquidr.com
Float Devices:	Skeg mounted Benthos LF modem and 3g modem for user interaction. 1U PL w/ SMC & PIB/PCOM connected to GPCTD+DO, and an EcoPuck Fluorometer. 1U will be connected to available VMC "S" port (activity predicated on receipt of 1U PL and PIB/PCOM week of 6/10).	WGMS, Dashboard Ready: [yymmdd]
Sub Devices:		

3.4 Navigational / Operational Tasking

Mission Description and Theater of Operations:

Executive SummaryAppendix

Sortie 1: Query Benthic Rover near Smooth Ridge for basic health and status information.

Task 1: Safely deploy in vicinity of 36.80833, -121.85 followed by core system and device validations. Following systems validation, begin mission making best speed to next task by way of WP9 (**caution: monitor for salmon fishing**).

- [\[yymmdd, hhmmz, lat/lon – task start\]](#)
- [\[yymmdd, hhmmz, lat/lon – unplanned events: challenges; special discoveries; etc...\]](#)

Task 2: Benthic Rover deployed in 870 meters of water near Smooth Ridge (19.8 nm from Moss Landing; WP9; 36.711367,-122.186817). Upon arrival, orbit a 100m circle (WPs 10-17) enabling user to have ability to query the Rover for basic health and status information. Upon user direction following completion of

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task, make best speed to next task.

- MBARI to conduct data harvesting tasks.
- Upon MBARI direction... make best speed to next task (**caution: monitor for salmon fishing**).
 - [yyymmdd, hhmmz, lat/lon – task start]
 - [yyymmdd, hhmmz, lat/lon – unplanned events: challenges; special discoveries; etc...]

Task 3: Safely recover in vicinity of 36.80833, -121.85, 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	SV2 criteria (minimum safe operations for 48 hrs. of total solar insolation... increase thresholds by 100wh for SV3) • Light: Launch/recover/emergency use only ◦ <i>Night use requires local authority authorization</i> • Radar Target Enhancer: Threat evasion use only • Telemetry: : 5min nominal; 10-15min (200wh auto) ◦ <i>Consider glider position (AIS notification diminished at TRR >5min)</i> • Water Speed Sensor: < 200wh, use as needed • Weather Station: < 200wh, use as needed • Payloads: Adj sample rate, or off at <200wh • AIS: Off at 100wh ◦ <i>Consider glider position (no vessel awareness aides, and risk of power loss)</i> • Move to Safe Harbor: At 50wh • Power Restoration: In reverse order +25wh ◦ <i>Increase thresholds by 100Wh when entering periods of deteriorating weather forecasts)</i>	• Notify Program Manager if total available power reaches 300Wh • If course change required
SV3 Operational Notes	• WiFi: Use on shore for checkout only • Thruster: Use as necessary (< 400wh, emergency use only) • Cell Modem & Ethernet Switch: Off at 100wh ◦ <i>Set default coms channel to Iridium</i> ◦ <i>Cell Range Edge Option - command cue mitigation (requires client authorization)</i> ▪ <i>Set WGMS default coms channel to Iridium</i> – <i>Benefit:</i> Mitigate “out-of-cell-range” risk (VR/Cell commands getting cued in relay). Low coms volume; operator can override to VR/Cell coms channel if available. ▪ <i>Clear default channel from vehicle</i> – <i>Benefit:</i> Vehicle coms default to VR/Cell 1st... Iridium 2nd. High coms volume benefits from	• Notify LR Project Manager if VR/Cell commands do not Acked. Decision required: ◦ <i>Acknowledge risk of aged/cued commands</i> ◦ <i>Disable VR/Cell to prevent aged/cued commands from being executed upon return to cell range</i>

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cellular vs. Iridium costs (when in cell range).

3.6 Course Architecture

Overall Operating Area; Close-Ups (tasks, other points-of-interest):

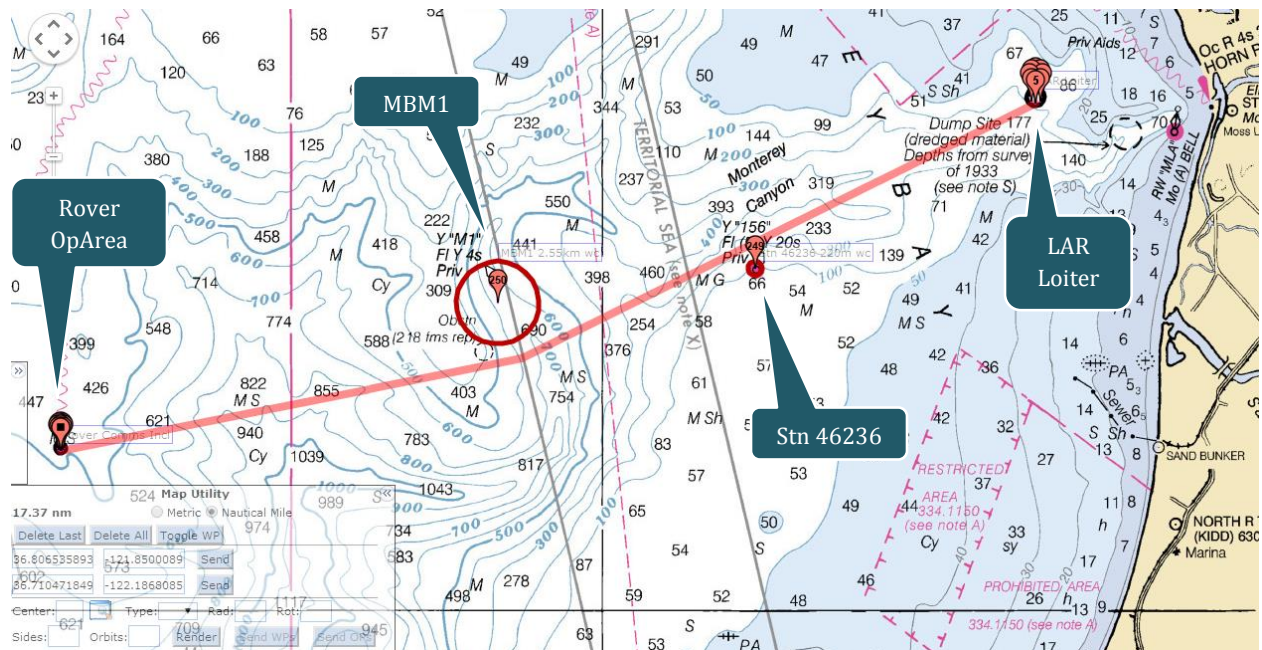


Figure 1 Route from Deploy to Station (17.4nm)

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 know 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.

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, Mission Services: Graham Hine

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4 APPENDIX

4.1 [Evidence of Communications with Local Authorities & Permitting](#)

4.2 Vehicle Pre-launch Validation

4.3 Detailed Vehicle Parameters

4.4 Mission Debrief

- Satisfaction of deliverables (results/details)
- Client Perception
- Budget vs. actual
- Recognition
- Continuous Improvement Initiatives
 - a. Opportunities
 - i. Plan to leverage successes
 - ii. Plan to address issues