

Tom O'Reilly Sorted By Project

300082 - DMO Support - Wave Glider

- Assisted Wahl in data log retrieval from deployed Hot Spot Wave Glider (Week 7)
- Installed software on new "Hotspot-3" payload, testing modems; will proceed to full end-to-end test with payload integrated with Wave Glider Hansen in next several days. (Week 36)
- Integrated serial Iridium modem with Building G network to simplify over-the-horizon communications with Wave Glider, e.g. while at Station M. (Week 41)
- Integrated and tested Iridium modem into MBARI's network, allowing easier remote access to Hotspot and other assets. (Week 42)
- Configuring onboard software on "Hotspot 3" payload, in preparation for deployment in early 2021 (Week 50)
- Configuring onboard software on "Hotspot 3" payload, in preparation for deployment in early 2021. Updated software on "Hotspot 3" payload with current "master" version. (Week 51)

901009 - CANON

- Working with Carlos Rueda to test and refine our MXM "planning service" which will enable planning and operation of a variety of robotic vehicles, e.g. Wave Gliders, LRAUVs, UAVs, Dorado, and many others. Third-party and platform-specific such as Neptus, LRAUV dash, wgms and others can be integrated with MXM to enable easier and more robust coordination in the field. (Week 40)
- Working with Carlos Rueda to integrate LSTS Neptus planning tool into our prototype Mission Execution Mediation Service, which will enable coordination of multiple robotic vehicles and types (AUVs, Wave Gliders, UAVs, etc) (Week 41)
- Working with Carlos Rueda to refine and test mission execution manager service, which is intended to allow easier coordination of diverse robotic vehicle types (e.g. Wave Gliders, AUVs, UAVs, etc) through a variety of user interfaces developed at MBARI and elsewhere. Integrating University of Porto's Neptus planning software as a test case. (Week 42)
- Integrating the Porto "Neptus" map-based mission planning application with our prototype "MXM" middleware, which integrates planning and scheduling for diverse robot vehicles. Using Neptus as a real-world example helps Rueda and I to refine the MXM interface so that other third-party tools can be integrated with MBARI's robotic fleet. (Week 47)
- Refining design of our "MXM" middleware that enables coordination of multiple kinds of autonomous vehicles and platforms. Integrating University of Porto's "Neptus" graphical planning software with MXM as a test case, revealing ways we can improve the MXM design. (Week 48)
- Investigating standards for commanding and coordinating autonomous vehicles, for potential use in our Mission Execution Service (MXS). Use of standards could simplify integration of third-party planning software and vehicles into MBARI's autonomous fleet. In particular looking at Open Geospatial Consortium's SensorThings standard, designed to connect "Internet of things". (Week 49)
- Attending Open Geospatial Consortium annual meeting, including sessions on OGC SensorThings middleware standard, and autonomous vehicle domain working group, which advances standards and best practices for AUVs and UAVs. Coauthored invited presentation "Use of OGC standards in marine observation platforms" which describes how the Polytecnic University of Catalunya is using OGC PUCK (developed at MBARI) and other OGC standards to integrate instruments and retrieve their data on various low-power/low-bandwidth sensor platforms. (Week 50)
- Based on connections made at last week's Open Geospatial Consortium meeting, I'm learning more about standards for planning and coordinating autonomous vehicle fleets, including the Joint Architecture for Uncrewed Systems (JAUS). The JAUS standard was developed by the US DoD and has been evaluated by the US Navy with vehicle networks containing AUVs, USVs, and aerial drones. Kongsberg Geospatial is using

J AUS and other standards to develop a Standards-based UxV Interoperability Test-bed, a control station allowing an operator to monitor and control multiple vehicles across multiple domains (air, surface, sub-surface). These systems could be quite relevant to CANON and MBARI autonomous vehicles in general. (Week 51)

901101 - Ocean Imaging

- Assessing object-oriented design approach for new MB-System, testing installation procedures (Week 11)
- Assessing how current C-code could be modified to C++ in preparation for “Son of MB-System” (Week 12)
- Refining “Son of MB-System” map viewer application (Week 13)
- Refining MB-System bathymetry viewer prototype, this new version based on C++ and Qt/QML toolkit, which is a more modern and maintainable platform than X11/Motif which nearing end-of-life (Week 14)
- Developing prototype GUI for bathymetry grid viewer, working with Caress to distribute for team evaluation/feedback (Week 16)
- Provided prototype MB-System grid-viewer app to prototype to Dave Caress - prototype is based on Qt/QML, a more modern and better supported graphics platform than used by current MB-System (Week 17)
- Working with Dave Caress to modify MB-System install procedures, with support for Qt/QML. (Week 17)
- Refining Qt-based prototypes to view bathymetry grids (Week 19)
- Working with Caress to evaluate and compare approaches to display bathymetric data. Goals are to update MB-System and simplify its development, distribution and maintenance (Week 20)
- Refining MB grid viewer prototypes, planning software design review (Week 21)
- Preparing for software design review, which will present options for MB-System GUI upgrades (Week 23)
- Preparing for MB-System+ design review (Week 24)
- Refining MB-System+ bathymetry grid viewer prototype (Week 26)
- Preparing preliminary design review for MB-System+ upgrade; PDR will be held on Friday 6/26 at 9:00 PDT (Week 26)
- Held preliminary design review for “MB-System+” improvements. Compared various approaches to upgrading interactive MB-System GUI apps, which allow users to view, analyze, and edit bathymetry datasets. Discussed next steps, schedule, etc. (Week 28)
- Evaluating integration of Visualization Toolkit (VTK) to visualize bathymetric surfaces, with Qt/QML toolkit to quickly design and generate user interfaces (menus, buttons, etc), portable to a wide variety of platforms including mobile. (Week 30)
- Released MB grid viewer prototype which combines tools from the Visualization Toolkit (VTK) for 3D surface rendering with Qt, which enables rapid user interface development. This looks to be the best approach so far to upgrading MB-System (Week 31)
- Released latest bathymetry grid viewer prototype to MB-System team for their feedback. We’ve been evaluating several software approaches to interactive viewing and editing of 3D bathymetry data, with criteria including flexible visualization, efficiency, programming effort required, maintainability and portability to different OS’s. This latest C++ prototype utilizes ‘Qt’ and ‘Visualization Toolkit’ libraries - both built on OpenGL - and in my opinion best meets our criteria. (Week 33)
- Helping Caress prepare code release of latest MB-System GUI prototype. Like the rest of MB-System the system must be easily built and installed on a variety of operating systems, including Linux and MacOS (Week 42)
- Continuing tests of improved cross-platform installation and build of MB-System software, using ‘cmake’, which is easier to refine and maintain than the more antiquated “autoconfig” system currently used by MB-System. This is important, as MB-System is used on diverse operating systems by many users; we have to make the software easy to distribute and install (Week 49)

901513 - Targeted Sampling by AUVs

901618 - Pelagic-Benthic Coupling

- Planning to integrate various acoustic geolocation software into Hot Spot for application to Benthic Rover at Station M; discussed schedule with project team. (Week 6)
- Working with Paul McGill to implement the “loop-and-cross” acoustic geolocation method on the Wave Glider Hotspot. We believe this algorithm will be most efficient when we have a reasonable “fuzzy” initial guess of target location, to within a few hundred meters (e.g. for Benthic Rover at Station M). While implementing loop-and-cross I’ve modified and streamlined our existing Hotspot code, making it more extensible to future applications. (Week 33)
- Working with McGill to refine ‘loop-and-cross’ acoustic geolocation algorithm and automated Wave Glider navigation script. We believe that loop-and-cross will be most efficient in cases where target location is known to within roughly 2 kilometers. First sea-trial is planned in a few weeks on Wave Glider ‘Tiny’ at MARS, using SES as a target. If tests are successful, we will use loop-and-cross to geolocate Benthic Rover at Station M later this year. (Week 34)
- Installing software into new Hotspot payload box, preparing for Hotspot integration with Wave Glider ‘Hansen’, for onshore testing of loop-and-cross algorithm (Week 34)
- Refining software and test plans for “loop and cross” technique for acoustic geolocation of Benthic Rover and other targets. (Week 36)
- Running tests of “loop-and-cross” acoustic search algorithm with Wave Glider tiny’s Hotspot, using SES modem as a target. I’m working with Paul McGill, Chris Wahl, and Brian Kieft to setup and run these tests. Depending on results we may use this algorithm to geolocate Benthic Rover on next Wave Glider trip to Station M (Week 38)
- Tested and refined loop-and-cross geolocation algorithm on WaveGlider tiny’s Hotspot using MARS SES acoustic modem as target. Will refine software further based on test results before deployment to Station M, where algorithm will be used to geolocate Benthic Rover. (Week 39)
- Refined and tested “loop-and-cross” Wave Glider Hotspot algorithm to geolocate Benthic Rover at Station M. Will compare accuracy and efficiency of loop-and-cross with “autoranging” script results, which was also run. (Week 46)
- Working with McGill to analyze results from Hotspot “loop-and-cross” geolocation runs at Station M, and to refine algorithm further based on this experience. (Week 47)

901800 - LRAUV Payload & Support

- Testing functionality and measuring performance of LCM/Slate software, which enables easy communication between applications running on main LRAUV cpu and other applications running on other onboard cpus, e.g. for Terrain Relative Navigation (TRN). (Week 6)
- Completed preliminary performance tests of LCM-Slate onboard middleware (Week 7)
- Running tests of lrauv-application with LcmSlateWriter; verifying message passing, assessing cpu loading (Week 8)
- Assessing performance of LCM-Slate middleware on Tethys LRAUV while in test tank (Week 11)
- Running tests, cleaning up code style in preparation to merge new LcmSlateWriter code with our ‘master’ branch (Week 12)
- Working with team on further testing and refinement of onboard LCM-Slate “middleware” (Week 13)
- Refining LCM Slate Writer design to minimize LRAUV CPU load in response to team comments. (Week 14)
- Met with team to discuss further steps to integrate LcmSlateWriter functionality into LRAUV software component with minimum effort. Working with team to formalize requirements. (Week 16)
- Working with team to refine “back seat driver” middleware architecture, helping to prepare documentation for non-MBARI users (JPL, WHOI...) (Week 19)
- Working with team to refine onboard network middleware architecture (Week 20)
- Working with team to refine middleware for “back seat driver” applications (Week 21)

- Reviewed latest “back seat driver” middleware API with team, provided suggestions. Ran preliminary test of API on LRAUV cpu to estimate cpu load. (Week 23)
- Working with team to refine LCM “back seat driver” software interface (Week 24)
- Running tests of LCM onboard the vehicle in the tank, assessing cpu load incurred by publishing data with realistic sensor payload, data frequency (Week 24)
- Conducted cpu load balance tests of latest “backseat driver” middleware/messaging software on LRAUV vehicle in test tank; discussed results with team (Week 26)

901809 - Deep Sea Bioinspiration

- Planning to implement MesoBot acoustic tracking from Hot Spot, and acoustic command/data capability of MesoBot. Discussed requirements and approaches with project teams at MBARI and WHOI. (Week 6)
- Working with Kakani Katija and Dana Yoerger (WHOI) to plan acoustic communications with MesoBot, using Wave Glider hotspot as a relay. (Week 41)
- Collaborating with WHOI’s Dana Yoerger to define acoustic protocols between MesoBot and other vehicles such as MBARI’s Wave Glider hotspot. Eventually we want to send MesoBot camera images over the acoustic link so that human operators are aware of science targets and can modify MesoBot’s mission over the acoustic link. (Week 42)
- Discussing BioBot acoustic comm software options with LRAUV team and Dana Yoerger. Dana is interested to use relevant LRAUV acomm software/formats for BioBot. (Week 46)
- Met with Dana Yoerger, Hobson, Kieft, and Raanan to discuss options for MesoBot acoustic comms. Afterward discussed how to move forward with WHOI in a way to bring MesoBot back to Monterey Bay. (Week 47)

901902 - Aerial Drones for Sci&MO

- Planning software design review for onboard, ground, and data processing systems. (Week 6)
- Working to set up ADS-B receiver at MBARI; our UAVs will carry an ADS-B transponder that periodically broadcasts vehicle location, speed, altitude, heading - like an aerial version of AIS. Procured receiver and antenna, preparing Raspberry PI host for the receiver. (Week 7)
- Evaluating tools and developing workflow to generate drone mission plans, taking factors such as solar illumination and wind into account. (Week 7)
- Helping team to document checklists, “rules of the road” for UAVs at MBARI (Week 7)
- Preparing material for UAV software review to be held later in the spring (Week 7)
- Testing low-cost AIS-B receiver on Raspberry PI. AIS-B is the aerial equivalent of AIS; all crewed aircraft transmit AIS-B messages containing registration number, speed, heading, altitude, location, other parameters. UAVs such as ours will carry AIS-B receivers, along with collision-avoidance software, so that the UAV can autonomously detect and avoid aircraft in their vicinity. (Week 8)
- Planning for next week’s test flights of Believer-1 fixed-wing UAV at Hollister airfield. Will exercise mission planning tools, autonomous mission execution and camera triggering, data processing chain, vehicle performance (Week 8)
- Developing MBARI UAV user guide, based on document from University of California. Document will include links to MBARI UAV policy, MBNMS permit, best practices, pre- and post-flight checklists, emergency response, etc. (Week 8)
- Refining image processing and archiving procedures in preparation for Believer fixed-wing UAV test flights later this week (Week 11)
- Helped team prepare for last week’s ‘Believer’ fixed-wing test flights at Hollister airfield; refining data and image processing chain using imagery acquired during those flights. (Week 12)
- Refining image and data processing chain, from onboard flight logs and raw images through geolocated and corrected imagery. Using data/photos collected during test flight at Hollister field two weeks ago - very useful and instructive. (Week 13)
- Described “best practices” for timekeeping in sensors aboard UAV based on review of available techniques and analysis of Hollister test flights. Developing and evaluating tools for post-flight data analysis, evaluating

metadata standards to enable efficient image retrieval from archives. Planning for project software review, date TBA. (Week 17)

- Met with team to plan software design review (Week 19)
- Planning data processing software review in mid-July - date TBD (Week 20)
- Preparing for data processing software review, which will describe requirements that flow from science goals, discuss various approaches, and early test results (Week 23)
- Preparing for data processing software design review (Week 24)
- Refining data processing pipeline design, software options, etc. Planning data processing PDR (Week 28)
- Completed first prototype of post-flight data processing software, working with Steve Haddock to refine (Week 30)
- Data processing software will be held on Thursday August 20 at 14:00 (Week 30)
- Met with Haddock, Ruhl and Bahr to discuss processing software plans for MBARI's UAV program and CENCOSS/collaborator programs. Discussing how we can easily exchange data/images between the processing systems. (Week 31)
- Preparing for software PDR on Thursday August 20, including conversations with Kudela lab and CENCOOS to coordinate data distribution and sharing between organizations. Refining data product generation software, from "raw" camera images to geolocated reprojected 'geotiffs' more suitable for quantitative analysis and distribution. (Week 33)
- Preparing for data processing PDR, scheduled for Thursday 8/20, 14:00 PDT. Working with team and UCSC/CENCOOS collaborators to refine software design and protocols. (Week 34)
- Held data processing preliminary design review, attended by MBARI engineers and several external collaborators. We received good suggestions on best practices for pre-flight image calibration, maximizing altimeter accuracy, use of standardized image "metadata" to improve interoperability of our data, and more (Week 36)
- Attended Marine Technology Society workshop on oceanographic UAV applications, with presentations very relevant to MBARI's UAV science goals. Gary Wick described NOAA's work to UAV animal surveys, air-sea chemistry and aerosol studies and weather forecasting applications. Iain Kerr described use of "Snot-Bot" to sample whale exhalations for genetic material, microbiome, and stress hormones. Discussion during the webinar and afterwards with Iain via email provided useful tips on how to accurately measure target sizes in images, which is very relevant to our science objectives. You can view a recording of last week's MTS webinar at this link: <https://register.gotowebinar.com/recording/97752491093738767> (Week 40)
- Met with Steve Reichardt of the Open Geospatial Consortium and Don Sullivan of NASA's airborne science program regarding UAV standards and best practices (for operations and data processing). There are a few working groups that are focused on defining and developing these now, including the OGC's "UxS" domain working group and the Small UAS data interest group. The latter group in particular is working to establish best data processing practices and metadata standards for UAS imagery (Week 48)
- Discussing best practices and data standards for processing aerial drone data with members of the Open Geospatial Consortium's Unoccupied Systems domain working group. (Week 49)
- Attending American Geophysical Union Fall meeting, including presentations, posters and town halls addressing UAV design, best practices and standards for operations and data processing. (Week 50)
- Attending American Geophysical Union Fall meeting online, including presentations, posters and town halls addressing UAV design, best practices and standards for operations and data processing. I made connections and shared experiences with others in the UAV science community who are applying UAVs to volcano monitoring and Arctic studies. (Week 51)

902007 - Iridium NEXT evaluation

902009 - AUV UI

- Attended workshop hosted by UCSC collaborator Leila Takayama to brainstorm about new user interface for LRAUV. (Week 48)

Out of Office

- I've taken some vacation this week to participate in a volunteer emergency response group in San Jose. Our non-profit will deliver food supplies to home-bound seniors and other vulnerable people. I'm helping (remotely!) with planning and logistics, setting up web forms where recipients can request food, etc.
- Was on vacation last week

Overhead

- Preparing presentation "Robots in the Sea" for junior-high school students at Friends of Hue children's shelter in Hue, Vietnam. Will make presentation via Facebook Messenger. (Week 11)
- Presented invited lecture to Hartnell College Oceanography class:
"Robotic technology for persistent presence: under, on and above the ocean" (Week 20)
- Met with Mark Reichardt of Open Geospatial Consortium and collaborators at Polytechnic University of Catalunya to discuss how to publicize real-world use of OGC PUCK (developed at MBARI) and other OGC standards used by our collaborators. We also discussed new OGC efforts to standardize data formats and "best practices" for aerial drones. (Week 47)
- Invited by Dr Christoph Waldmann, chair of the IEEE Oceanic Engineering Society, to join their standards and best practices committee (Week 48)
- Invited by Christoph Waldmann (MARUM at University of Bremen) to participate in IEEE OES Standards Committee, to help promote use of appropriate standards in the oceanographic community. (Week 49)