

George Stern Sorted By Project

300078 - DMO Support - AUV

- Continued schematic entry/detailed design for the Dorado Prop/Actuator board (Week 2)
- Peer review for the board (Week 2)
- Prop drive board - Completed peer review updates and adding hooks for the actuator board to hopefully eliminate the need to layout and build a very similar 2nd card (Week 3)
- Created a greatly reduced layout effort and build time board for preliminary pressure tests. The board will mostly answer the question if solder joints on QFNs and other parts survive the stress of repeated cycles to 6km while enabling some live checkout at pressure (Week 3)
- Reviewed layout of the pressure test sample and cut some corners to get it on order in time; unfortunately build questions pushed the completion date into the PCBway lunar new year holiday so now I lose at least 2wks. (Week 4)
- Pressure test board bring up (Week 8)
- First pressure test to 6km completed, one cap visually changed but still works, all other parts look good (Week 11)
- Attempting to bring up the board for a powered pressure test (Week 11)
- Met with Aaron to brainstorm options for very long pressure test (Week 12)
- Brought up the pressure test board sufficiently to enable a minimal powered test at pressure (Week 12)
- Casually looking into automating small pressure chamber to accommodate many cycle testing, current large chamber does not reach 6km pressure. (Week 13)
- Looked at process controllers to add cycle programming to smaller pressure chamber (Week 14)
- Worked with Aaron to rediscover how to program the small pressure chamber to run many cycles to begin testing if chips stay on the board; unfortunately, during the effort we learned the chamber's calibration appears to be off and should probably be corrected before testing. (Week 16)
- Quotes and final proposal for new gauge/safety interlock for the small pressure chamber to enable testing reviewed with Aaron and sent to Paul (Week 20)
- Found money to fix the small pressure chamber (Week 21)
- Found money and ordered new gauge for small pressure test chamber so in ~6wks we can start 7km tests (Week 22)
- Began looking into PID controllers and reverse engineering the small pressure chamber design to make the testing easier (Week 50)
- Finally identified and ordered a replacement for the stripchart recorder and pressure controller (Week 51)

- Rough housing sketch and ordered housing/parts for the small pressure chamber upgrade to make eventual testing easier (Week 52)

701147 - MARS O&M IV

- Few meetings to begin picking up Paul's knowledge (Week 24)
- Meeting with UW and some initial documentation review (Week 25)
- Began reviewing MARS documentation (Week 27)

901007 - Benthic Biology & Ecology

902106 - Niobicon-Based AUV Docking Development

- Met with team and looked through current design (Week 9)
- System review and power line modem and spec research (Week 10)
- Procured and tested with a cheap modem designed to a competing spec (G.hn wave1) as the current nonfunctional one (Homeplug AV) - performance was no better and possibly worse (Week 10)
- Ran a tank test with signal generator and scope connected to the charging rod/brush to better visualize what was happening - it is a giant cap (Week 10)
- identified/ordered a Homeplug AV2 modem set but it is doubtful it will make significant improvements over the current module; anticipate needing to redesign the rod or make a complex RF transceiver with custom amp. (Week 10)
- literature review of path loss/impedance of sea water and looked into SDR transceivers/amplifier options (Week 11)
- Meeting to review test results and next steps (Week 11)
- Tested a Homeplug AV2 compliant modem; it worked noticeably better than the last modem but not well enough to consider the communication problem solved. (Week 12)
- Tested newly arrived backup modems and accidentally discovered both sets only enumerate at 1Gbps which isn't compatible with existing 10/100 switch, also a bit large - looking for alternatives again, no good options... (Week 13)
- Ordered Nb for contact area test (Week 13)
- Began researching feasibility of underwater wifi hotspot, antenna designs and cots software defined radio options - just need to lower the the frequency by a GHz (Week 14)
- Continued search for suitable modem chipsets - identified a few more and ordered the most promising in an inconvenient commercial package (Week 14)
- Reverse engineered PLC modem frontend and modified the development board to improve driver performance (increasing risk of thermal/transient induced failures); testing indicated we might now get performance all the way to end of the pole. (Week 15)
- After positive tank testing outside the system, the new modem was added to the system and performed terribly. It appeared like at least one card stopped communicating completely, additional testing is needed. (Week 16)
- Project proposal discussions and retesting power line modems with a shorter pole indicated that the giant capacitor theory is not the only problem. (Week 26)

- Troubleshooting on the dock (Week 34)
- Fixed the actuator sensor range on the next docking design and assembled it in the can for testing - it worked. (Week 39)
- meeting (Week 45)
- Root caused docking arm stuttering to LRAUV SW control; very unlikely it had anything to do with docking failure. (Week 46)
- G.hn COTS UTP/STP transmitters and anticipated performance research (Week 50)
- Other coms options to spend this years money (Week 50)
- Reviewed development kit and transmitter options and resulting phy layers for cable purchase (Week 51)

902204 - Scalable Robotics

- Tested and integrated 3 new cap boards (Week 1)
- Tested 2 new led boards (Week 1)
- Built up 1st HSI light RevB; unfortunately discovered ponoko web entry form has a dangerous feature I missed; updated parts and re-ordered (Week 1)
- Continued debugging motor controller software (Week 1)
- Ordered Charuco targets (Week 4)
- Fixturing and setup to test if luxonis software accepts external camera sync (Week 6)
- Tested luxonis camera triggering which didn't seem to be working as specified; it isn't and luxonis is now debugging (Week 7)
- Fixturing design for revised mola light controller can (Week 8)
- Order material for can build (Week 8)
- Designed light/laser controller can mounting fixture for mola (Week 9)
- Tweaked a fixture design and completed assembly and testing of the mola laser and light can on mola (Week 10)
- Completed reassembling mola with light and laser control can (Week 11)
- Disassembled the mola control station and identified an easier approach to blocking the MQTT server that didn't require hardware modifications; after more updates from Boxfish, there is an even easier method with two nice script commands they should have given us years ago (Week 20)
- Spent far too much time learning the overly complicated boxfish fiber termination; then broke it after following the process. New parts on order. (Week 24)
- Reterminating the fiber tether on mola; still not working after more than 5 attempts representing days of work. The boxfish design seems overly complicated considering most of the pieces are custom machined. Thank you James and Bryan for the help and advice on terminating fiber (Week 25)
- After many failed attempts finally got mola fiber reterminated and tested, thank you to Bryan, James and DJ for recommendations, tool loans and support (Week 26)
- After 2mths and some skillful prodding from Eric to their BD folks, luxonis responded to my help request providing new hardware requirements and previously undocumented code snippets to make FrameSync work. Initial testing indicates my current hardware solution will not meet the new requirements and must be reworked; testing with external

TE to ensure the new solution will actually work this time once the hardware conforms to the new requirements is in progress. (Week 26)

- Tested Luxonis's minimal code for external camera sync; it works much better when jitter is kept to less than a microsecond (Week 27)
- Reworking current mola microcontroller software to eliminate IRQs which add too much jitter (Week 27)
- Completed testing luxonis new code with an Arb and completed initial rewrite of uC code to remove all software interaction except to setup peripherals; appears to have decreased jitter by 2 orders of magnitude so it might now play nicely with the luxonis hardware (Week 28)
- Designed a PWB with a few logic gates to support functions removed from SW to lower jitter (Week 28)
- Continued working on samd21 code for strobe timing (Week 29)
- Tried to identify a proximity sensor solution for mola docking; unfortunately VCSEL lasers are almost all 940nm and magnetometers alignments without mechanical coupling aren't going to work so visible light point clouds from an OAKD appear best. (Week 29)
- Mola light strobe control board built and tested (Week 30)
- Continued working on solid models and system design for a stereo vision distance sensor for docking (Week 31)
- Completed Mola Dock Stereo Vision box design and started drawings (Week 32)
- Completed fixturing design and drawings (Week 33)
- Purchased and received remaining mechanical hardware (Week 33)
- Electrical interconnect planning and procurement (Week 33)
- Fit checked printed parts and COTs cables for OAK-D camera in a box (Week 34)
- Completed HSI camera LED board design and routing (Week 34)
- Schematic capture place and route for a power conditioning board (Week 35)
- Updated LED board layout for single layer and order (Week 36)
- Finished Cap board layout and order (Week 36)
- Integrating SAMD light controller board with Luxonis OAK D (Week 36)
- Integrated camera/light controller board with luxonis card and discovered uC pll was not sufficiently stable/jitter was still too high at low frame rates and each camera type needed an independently adjustable strobe timing. Respun a new board in kicad with external oscillator/multiple strobe signals and updated software. (Week 37)
- Ordered parts for HSI light build (Week 37)
- Setup a ros2 node publishing 3d depth and image data from a luxonis camera on a raspberrypi (Week 38)
- Assembled the Mola Docking Camera can and mostly wired it (Week 38)
- Began reviewing ArduPilot IOMCU code for potential modification for a mola thruster control board; bare metal development might be easier (Week 38)
- Discovered MOLA ESCs are one software version off from supporting a really simple uart communication based bus but can't be upgraded because of ukraine war. (Week 38)
- Continued trade into using ArduPilot IOMCU vs baremetal for Mola ESC control; planning to try baremetal. (Week 39)

- Identified potential microcontroller and began poking through pertinent sections of docs for DMA and timer control. (Week 39)
- Pitched development plan (Week 39)
- Began testing/integrating HSI light electronics; found two issues possibly related to build that I have been unable to reproduce despite torture testing and a few additional tweaks to further optimize performance, but all the components fit on the pads, preliminary fit check looked promising and electronics are working well enough that a respin seems unlikely (Week 40)
- Got USB talking on a bare metal STM32 dev board for the mola ESC control project, lot more code to write. (Week 40)
- Killed 2nd FET on the HSI light current controller board; datasheet dive to reverify SOA curves and correctly configuring FET controller; everything looked right, PCBs assembled correctly, and all signals looked good; continued testing to try to capture a failure on the scope, killed another FET and might have caught the start of the failure. Reduced power by 10W and added likely unneeded protection diode. Could not get the infrequent death to occur again... is it fixed? (Week 42)
- Checked thermal lockout circuit, regulated in air to ~85C. Little warmer than expected but ok, (Week 42)
- Assembled HSI light housing (Week 42)
- Continued ESC controller code, can now send and receive messages over USB UART without missing bits when characters are sent quickly. (Week 42)
- Continued build/testing on HSI light housing (Week 43)
- Got DMA driven PWM working (scope) and finished code to send USB uart throttle commands and translate them into Dshot PWM messages; next step is to test it with Mola ESCs and motors. (Week 43)
- Finished assembly of the first HSI light but the 2nd electronics stack is not working; the manufacturer comments on their forum that the problematic chip is capable of destroying itself and says they are in the process of replacing the older products with things that don't self destruct, unfortunately there are no drop in replacements - now trying to find the magical combination of white wires which will keep everything happy and puzzled over why the first was ok (Week 44)
- Rebuilt the OakD500 can with the latest light and camera controller and helped integrate on mola; initial testing is positive (Week 44)
- Continue integrating the OAKD500 strobe board with drivers on mola with higher level software drivers/support (Week 45)
- The HSI light project continues to be a challenge; one light was fully assembled, tested and working until a power clip slipped off a connector while testing optical performance shorting the cap bank and requiring complete rebuild. The other light had another FET fail; the design has a lot of positive margin against all requirements so failure mode remains unclear. Fixes and root cause were identified for the other FET failure mechanism; margin testing was conducted and no additional failures have been observed after fixes. (Week 45)
- Rebuilt PoE and HSI camera cans with finalized trigger board (Week 46)

- Rebuilt electronics HSI light housings a few additional times; root cause for switching chip failure remains unclear and another odd failure mode was identified; best effort to keep them working for the deployment today, hopefully they work (Week 46)
- Began updating the HSI strobe schematic to fix problems banded during the last deployment; discovered likely root cause for one of the issues: Vishay SOA curves are garbage and they are slowly fixing their datasheets (Week 47)
- Updated Mola500D strobe trigger board with new oscillator to facilitate 0.03 to 3fps mode; Sebastian tested the current board in mola and is getting 3 or more fps successfully. (Week 47)
- Opened OakD500M can to replace SD card and timing card (Week 49)
- Updated HSI schematic (Week 49)
- Tested new extremely accurate clock trigger board and rebuilt Mola's OAK-D500m chassis with the board (Week 50)
- Updated HSI light schematic (Week 50)
- Worked with Jose on the HSI light respin layout (Week 51)
- Ordered light and pcb bom (Week 51)
- Bracket for light faceplates (Week 51)
- 1st remote test of the OakD/RPI in a water proof box; camera looks terrible and it kept losing connection (Week 51)
- HSI cap board RevB first board bring up completed without issue; need to test at least one more PCB before considering the design working (Week 52)
- Next two LED boards tested (Week 52)
- Opened existing HSI lights and began rebuild (Week 52)
- Fixed ethernet continuously disconnecting in the mola dock stereo camera (Week 52)

902208 - Mini ROV Operations

- Began analyzing loads; there should be 60-80V of margin (plenty - alot) in the present design based on both analysis and measurements so perhaps something else is causing the problem? (Week 15)
- Continued to review the system and identify some additional considerations and scoping questions for Alana when she returns from vacation (Week 16)
- Began looking at high voltage DC DC converters (Week 16)
- Continued reviewing power supply options, vicor makes some neat products but it is unclear if they will work, need to find out what the typical max thruster RPM is (Week 20)
- Began looking at converters in 400-700V tier as most of the 800V products announced last year still aren't available yet. (Week 24)
- Identified another supply which is currently being sold and might fit power needs; company responded quickly to everything but a request for a quote. (Week 25)
- Reviewed brightloop power supply datasheet+manual and requested a quote/NDA form to continue (Week 27)
- Got quote and preliminary integration discussion with BrightLoop regarding a potential power supply candidate (Week 28)

902304 - Piscivore Cam

- First rhonda software meeting (Week 3)
- Held meeting with Rhonda SW, few concerns about current trajectory, they are working to answer some of our questions and remainder will wait until the project plan deliverable (Week 4)
- More rhonda meetings - not going well... They don't want to provide total project cost estimates, technical analysis to support their platform choice, or really any information about the product; after sending them \$15k over 6wks ago and now having spent 4 meetings asking for details we requested in the spec we sent them >2mths ago, they finally read the spec and indicated they don't want to do much of what we asked... Hopefully the language barrier or possibly aggressive timeline is causing the issues? (Week 6)
- Continued investigating alternative options - luxonis is so close but conversations with the company indicate either we would need a very complex hardware effort and software contract work they may not be interested in or it is probably over a year away; NVIDIA with GSML3/FPD-Link4 despite being technically risky due to lack of underwater connectors, and consuming too much power are looking better and better. (Week 6)
- Continued looking for rhonda/ambarella alternatives; evaluating some much higher power alternative architectures which also provide a much more open and well developed software ecosystem that would make it easier to establish optical requirements and iterate on optical parts (Week 7)
- Driver and interface research for GSML3/FPD-Link4; trying to scrape breadcrumbs because Analog and TI won't give me datasheets; probably just have to test it and hope for the best... (Week 8)
- More image sensor and driver research (Week 8)
- Researched Oclea Ambarella offerings and Technique/Resideo company (Week 9)
- Looked for lenses (Week 9)
- Meeting/research to discuss alternative system designs and continue pushing forward (Week 10)
- Alternative architecture meetings (Week 11)
- Met with Oclea again and discussed options to get access to their portal so we can evaluate the product without spending 6k on something which isn't ready (Week 12)
- Identified framos parts for GSML3 test (Week 13)
- Almost got NDA for GSML3 but ADI now plans to publicly release datasheets in a month! (Week 13)
- Identified coax cable and connector options for a GSML3 test (Week 14)
- Began ordering Framos parts for the test (Week 14)
- Oclea portal/documentation review; looks like it is worth buying a kit. (Week 15)
- Oclea granted access to additional documentation; after a much deeper review it looks even better and I am trying to buy a kit. (Week 16)
- Began working on a housing design (Week 19)
- Began working on an electrical interface (Week 19)

- Continued working on the can design for the next camera, mostly tried to identify ways to transfer heat from the board to the can without using air since that increase camera noise floor (Week 20)
 - Created one design with thermal straps but it requires machining copper which is a pain (Week 20)
 - Created a 2nd design with heat pipes; but it is unclear how easy it will be to bend them, will see when they arrive. (Week 20)
- Began schematic capture and layout (Week 21)
- Ordering hardware and refining mechanical design (Week 21)
- Completed schematic capture and layout (Week 22)
- Began ordering parts (Week 22)
- Revised mechanical design to increase clearances and add mounting bosses (Week 23)
- Completed ordering everything (Week 23)
- Started on harnessing schematics (Week 23)
- Printed and began fit checking the chassis (Week 24)
- Kitted boards for Etech build (Week 24)
- Attempts to capture sundown to compare video noise/illumination between the next gen and gofish cameras hasn't gone to plan due to buggy cameras and a few software glitches (Week 24)
- Comparative video testing of the new and old camera (Week 25)
- Updated and reprinted the chassis to improve access to connectors and fill around inserts and screws (Week 25)
- Continued to fit check hardware (Week 25)
- Meeting and continued work to integrate electrical and mechanical hardware for the Gen3 camera build (Week 26)
- Finished initial comparative video between Gen2 and Gen3 cameras; there is a material improvement in low light capability, image quality and file sizes in the gen3 camera; FOV is smaller so a different lens may be needed (Week 26)
- Began integrating 1GbE interface (Week 27)
- GigE is now integrated and working (Week 28)
- Updated cable drawing (Week 28)
- Continued build and integration of the housing, completed checking out cards and fit checks (Week 29)
- Built up a 2nd camera stack with spare kit parts (Week 29)
- Began searching for a better lens for the current housing (Week 29)
- Identified a new lens (Week 30)
- First housing is assembled and mostly working (Week 30)
- Continued integrating the new camera (Week 31)
- Began integrating new camera on LRAUV in prep for deployment in 1.5wks (Week 31)
- Tested the new lens and discovered it needed a new holder to get close enough to focus (Week 31)
- RTC is not working, debugging in progress (Week 31)
- Continued integration on LRAUV and final can build a revised lens (Week 32)
- New Lens/Camera comparison test with the gofish camera (Week 32)

- Final preparations and integration checks for the deployment (Week 33)
- Final prep for deployment (Week 34)
- Reviewed some gen3 footage from Aug deployment (Week 36)
- Fixed focus issue, rebuilt can and prep for canon deployment (Week 36)
- Reviewed some gen3 canon video and extracted gen2 files for ai processing (Week 38)
- Ordered parts for alternate bulkhead (Week 39)
- Ordered more parts for Gen3 (Week 40)
- Looked at more gen3 footage to compare different camera settings (Week 43)
- Reviewed more footage and looked at some focus testing methods (Week 44)
- Meeting and new camera review (Week 45)
- Looked through hundreds of additional lenses on aliexpress and autofocus solutions; identified a few additional possible lens candidates (Week 46)
- Focus testing (Week 47)
- ordered lens/holders (Week 47)
- Last deployment video review of various exposure times and gain settings (Week 47)
- End of year spending plans (Week 49)
- System planning for next year to optimize use of 2025 money (Week 50)
- Purchasing and planning for next year (Week 51)
- Image testing data review (Week 52)

902306 - SINKER

- Began writing software to control the power supplies for battery charging (Week 2)
- Preparation for battery housing electronics assembly (Week 2)
- Continued writing a script to control battery charging from the the Pi (Week 3)
- charger harnessing schematic (Week 3)
- Continued working on battery charger script and finished checking out the battery interface card. Charged a set of LRAUV batteries! But still implementing the hardware fault flag threading (Week 4)
- Finished battery charging script (Week 6)
- Created a charging station in the lab, integrated with the real batteries and simultaneous stack charging; 2 sets of batteries have been charged. (Week 6)
- Began checking out battery interface boards (Week 6)
- Tested and charged all remaining battery packs; boards\design are working as intended. (Week 7)
- Finished harnessing design for pack bulkheads and connecting cable/harnessing for the controller (Week 7)
- Battery harnessing (Week 8)
- Battery charging and support for deployment next week (Week 10)
- Final battery charging and prep for the cruise last monday (Week 11)
- Post cruise meeting to discuss that project has gone so amazing well it doesn't need to be renewed (Week 12)
- Identified a way to improve battery can charging so cans wouldn't need to be opened to charge potentially allowing more projects to borrow them and easily maintain them (Week 12)

- Began rewriting software to support new charging (Week 12)
- Updating electrical architecture so the battery cans don't have to be opened for charging (Week 13)
- Began writing software to support new con ops (Week 13)
- Began ordering hardware (Week 13)
- Continued working on closed can charging script (Week 14)
- Finished harnessing and system diagram for the closed can architecture (Week 14)
- Ordered parts (Week 14)
- Initial build of a battery can firmware build to support closed can charging (Week 15)
- Tested closed can SAMD charging firmware and programmed one board; hopefully the RPi software is as easy... (Week 16)
- MARS meetings and mars cable design - for some reason it does not match the ROVs; thank you to Alana for saving the project by having a Ti MINK10 connector available. (Week 24)
- Cable design and build for MARS (Week 25)
- Dry testing on the MARS simulator node did not go as planned, an odd link layer issue was found where auto negotiation failed to establish a link; hopefully Adriana will have time to work through some additional troubleshooting when she returns from the conference next week. (Week 26)
- Identified potential option to make AGX Orin root read only for MARS deployment (Week 28)
- Programmed controller in the first battery housing to facilitate closed can charging (Week 43)
- Tested the first immaculately wired (etech) closed can charging system, initial testing was positive with the software correctly reviving deeply discharged batteries. (Week 44)
- Flux strobe lighting power analysis and options (Week 50)
- Programmed and tested 3 in work battery pack assemblies; identified a bug and a hardware problem, updated the 3 + the previously completed assembly with new code to patch the bug. (Week 51)
- Retested the fully completed assembly by recharging a pack (working); power consumption tests on the remaining 3 in work assemblies indicates 2 are drawing excessive power; awaiting etech support to confirm a suspected manufacturing issue (Week 51)
- Found, programmed and tested 2 additional battery board som shield assemblies; this means 4 of 6 boards are working as designed; since only 4 boards are needed and there are no current plans to use the battery assemblies; it may not be worth troubleshooting the high current draw on the remaining subassemblies. (Week 52)

Out of Office

- Open house

Overhead

- Began setting up new engineering workstation (Week 12)