Underwater Glider User Group

UG2 WORKSHOP '24

September 10-12, 2024

Palmer Commons · University of Michigan · 100 Washtenaw Avenue · Ann Arbor, MI

Final Report

Compiled by the UG2 Coordinator and UG2 Steering Committee

Underwater Glider User Group

Our Mission:

To be a community-based coalition aimed at bolstering scientific collaboration, information, and resource sharing for gliders.

underwatergliders.org

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UG2 Coordinator's Remarks

The Underwater Glider User Group (UG2) is a vibrant and growing community of passionate and dedicated glider users from across North America and around the world. Over the past decade, both the community and the technology have seen remarkable growth, driven by innovative developments, new glider labs, and dynamic partnerships. Organizing this workshop was a collaborative effort, with the primary goal of bringing UG2 members together to exchange ideas, present their research, and foster networking opportunities. We were thrilled to welcome 140 participants from eight countries for three exciting and action-packed days.

We concluded the workshop with several key action items from each breakout session, both near- and long-term, that will help us better achieve the UG2 mission and objectives, along with a renewed commitment to enhancing both the community and the utility of underwater gliders.

Throughout the planning process, I was delighted by the enthusiasm of industry partners and other organizations that eagerly stepped up to sponsor the event, and I'm deeply grateful for their continued support. Lastly, a heartfelt thank you to the UG2 Steering Committee and the planning team for their time, energy, and invaluable contributions. Their dedication and passion were instrumental in bringing this workshop to life. I'm excited to see how UG2 will evolve and grow over the next 18-24 months by the next UG2 Workshop.

Georgia Coward
UG2 Coordinator

Workshop Overview

Basis for the Workshop

The fourth Underwater Glider User Group (UG2) Workshop helped strengthen and coordinate underwater glider activities for marine monitoring, services, and scientific research as well as provided an opportunity for continued collaboration between the United States UG2 and the broader global community.

Meeting Goals

The overarching goal of UG2 was to establish a community that facilitates sharing and cooperation of glider mission resources both in the U.S. and internationally within areas of ocean monitoring, operational reliability, and data management. This workshop was designed to strengthen this collaboration through community dialogue, information exchange, sharing of experiences and research, and development of priorities and action items for the future.

2024 Workshop Objectives

1. **Harmonize Glider Efforts:** Data management, leveraging partnerships, documenting best practices, collaboration within U.S. and international community;
2. **Share New Developments:** Sensors, gliders, emerging requirements, novel glider applications;
3. **Share/Refine Operational Activities:** Sustained observing, reliability, sampling strategies, ocean modeling impacts (physical and biological), connecting coastal to open ocean biogeochemical observations;
4. **Identify Action Items and Needs for UG2:** Determine gaps in UG2 communication platforms; share functionality of Slack; identify needs for UG2 (next steps); and
5. **Network with Glider Users:** Speak with and network with glider users from across the United States and globally to build collaboration and strengthen partnerships.

Workshop Components

Oral Presentations. Glider experts updated the community with science, practice, and case studies. Practitioners representing the full scope of the glider community, from federal, state, and local agencies to industry and academia, covered a wide breadth of examples, methodologies, key research findings, and general uses of gliders.

Breakout Sessions. The breakout sessions were varied in their format and created opportunities to interact with colleagues and work toward a specific outcome or goals, such as developing a plan for sustained glider observations, obtaining feedback on community communication needs for UG2, providing a space for pilot and operation questions, and aligning data management practices.

Poster Presentations. In order to promote networking between participants, the poster sessions coincided with extended morning and afternoon coffee breaks and a lightning advertisement presentation session. Research, tools, and information were showcased on a 36" x 48" poster.

Industry Sessions. There were two industry-focused sessions during the Workshop: a panel-based Q&A session with key industry partners that determined and outlined community needs, and a vendor presentation from the Tier 3 sponsors (Teledyne Webb, Alseamar, Nortek, RBR, and Hefring Engineering).

Early Career Mentorship Luncheons. We held two Early Career Luncheons offering the chance to network with leaders in the glider field and refine elevator pitch and keyword usage. Day 1 offered hands-on activities, while Day 2 provided opportunities to network with representatives from federal, academic, and industry sectors; ask questions; and gain valuable insights into diverse glider career paths.

Sponsors

Federal and Tier 3

IOOS Integrated Ocean Observing System

NORTEK

RBR

HEFRING ENGINEERING

TELEDYNE MARINE Everywhereyoulook™

ALSEAMAR ALCEN

Tier 2

ROCKLAND SCIENTIFIC

SEA-BIRD SCIENTIFIC

Tier 1

MTS marine technology society Opportunity runs deep™

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

OCEAN FRONTIER INSTITUTE

Led by DALHOUSIE UNIVERSITY

Key Topics & Outcomes

Key Topics

The UG2 Workshop covered several key topics, including:

1. **Advancements in Glider Technology:** Discussions on the latest innovations in underwater glider design, sensors, and data collection methods.
2. **Operational Best Practices:** Sharing of experiences and strategies for effective deployment, maintenance, and data management of underwater gliders.
3. **Environmental Monitoring:** Use of gliders for monitoring oceanographic conditions, climate change impacts, and marine ecosystems.
4. **Data Integration and Analysis:** Techniques for integrating glider data with other oceanographic data sources and advanced methods for data analysis.
5. **Future Research Directions:** Identifying emerging research areas and technological needs to guide future developments in underwater glider applications.

These sessions provided a platform for experts to exchange knowledge and collaborate on enhancing the capabilities and applications of underwater gliders.

Notable Advancements

Some of the notable advancements in underwater glider technology discussed at the UG2 Workshop included:

1. **Enhanced Sensor Capabilities:** New sensors that provide more accurate and diverse data, including biogeochemical sensors for measuring parameters like pH, oxygen levels, and nutrient concentrations. There was a large demonstration of passive and now active acoustics data being collected with gliders.
2. **Improved Battery Life:** Innovations in battery technology that extend the operational duration of gliders, allowing for longer missions without the need for frequent recharging. These are pushing the operational limits of the batteries and are a little more additive in terms of cost savings.
3. **Autonomous Navigation:** Advances in AI and machine learning algorithms that enable gliders to navigate more autonomously, improving their ability to adapt to changing ocean conditions and mission requirements.
4. **Data Transmission:** Enhanced communication systems that allow for faster and more reliable data transmission from gliders to researchers, even in remote areas. Starlink and data compression techniques combined with edge computing.
5. **Miniaturization:** Development of smaller, more compact gliders that are easier to deploy and can access areas that larger gliders cannot.

These advancements are helping to make underwater gliders more efficient, versatile, and capable of providing valuable data for oceanographic research and environmental monitoring.

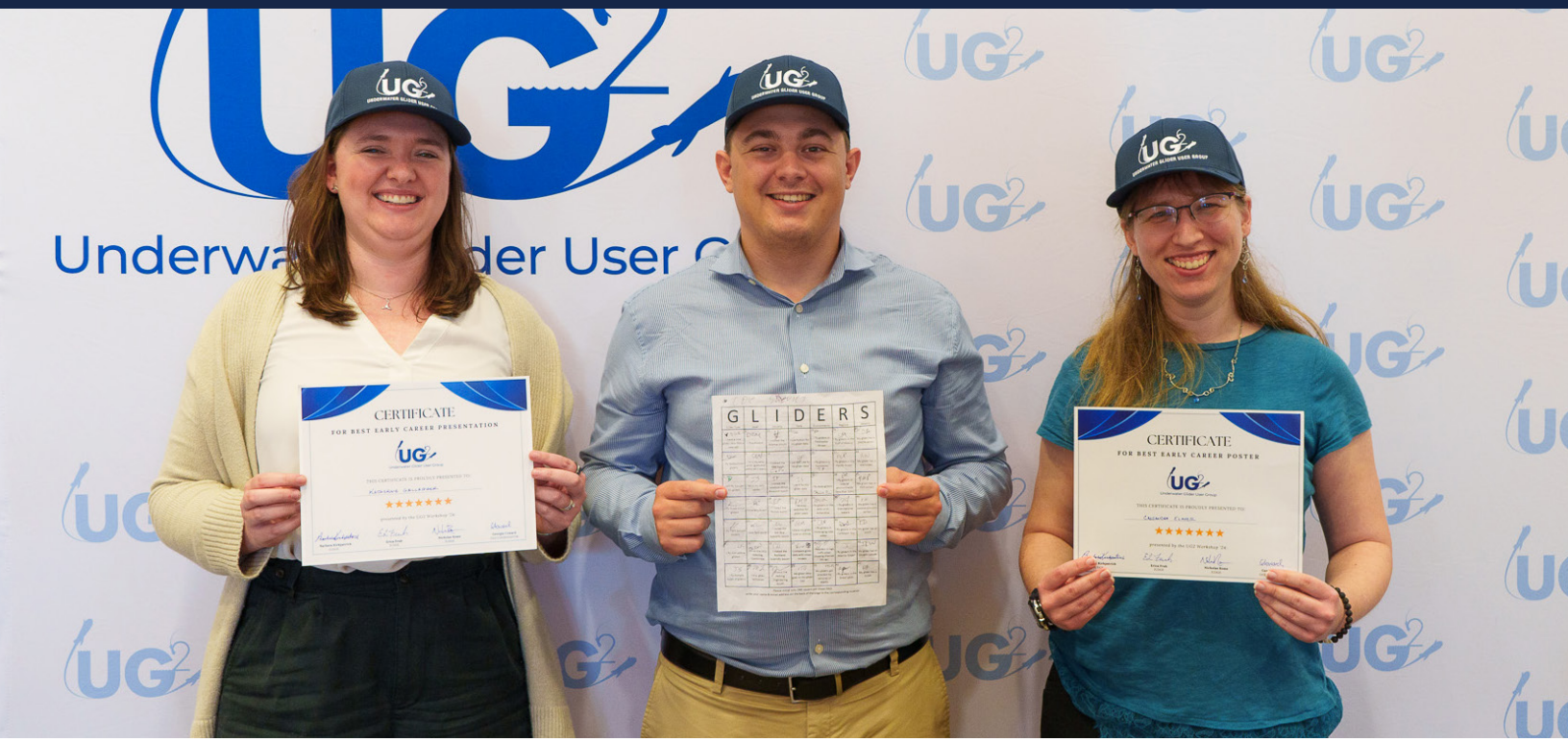
Community Challenges

We also addressed several challenges faced by the underwater glider community:

1. **Data Quality and Calibration:** Ensuring the accuracy and reliability of data collected by gliders, especially when using new or experimental sensors.
2. **Operational Logistics:** Managing the deployment and recovery of gliders in remote or harsh environments, which can be logistically complex and costly.
3. **Battery Limitations:** Despite improvements, battery life remains a constraint for long-duration missions, particularly in deep-sea or polar regions.
4. **Communication Issues:** Maintaining reliable communication with gliders, especially in areas with limited satellite coverage or during adverse weather conditions
5. **Environmental Impact:** Minimizing the ecological footprint of glider operations and ensuring that their presence does not disturb marine life.

These discussions over the three workshop days aimed to identify solutions and strategies to overcome these challenges, fostering a more robust and effective use of underwater gliders in marine research.

Early Career



From left to right: *Katherine Gallagher from Stony Brook University, winner, Best Oral Presentation; Cole Sheeley, University of the Virgin Islands, winner, Networking G-L-I-D-E-R-S Game; and Cassandra Elmer, NIWA, Best Poster Award.*

A key highlight of the workshop was the strong participation from early career professionals and students, who comprised over 35% of attendees. Recognizing them as the next generation of glider users, the workshop provided tailored training sessions on writing proposals and developing elevator pitches, along with numerous networking opportunities. Many of these early career individuals also assisted with note taking, mic running, and timing activities throughout the workshop.

For the first time, UG2 leadership also offered constructive feedback on all student and early career posters and presentations, culminating in awards for the highest scoring in each category. This initiative highlighted and encouraged student and early career engagement and fostered the collaborative UG2 spirit! Katherine Gallagher from Stony Brook University received the best oral presentation for her presentation entitled *"Matching synoptic oceanographic data and baleen whale detections in time and space"* and Cassandra Elmer from NIWA received the best poster award for her poster entitled *"Not-So-Straight Glider Trajectories near Cook Strait"*.

As a way to help participants, particularly early career and students, network and to remember who they talked to about specific things, the UG2 Early Career Sub Focus Group created a 'networking G-L-I-D-E-R-S game' for the workshop (think BINGO!) and Cole Sheeley from the University of the Virgin Islands was our lucky winner!

Breakout Sessions

Breakout sessions were a key component of this dynamic workshop. We held multiple sessions and their outcomes, action items, and objectives are listed below.

It is important to note that the intent of BOON is to provide coordination and linkage for a global observing program. BOON was a topic of discussion in the 2022 UG2 Workshop in Seattle. The regional networks that comprise BOON intend for their observations to be sustained year-round. One of the benefits of coordination would be improved and sustained quality control of glider data. The ultimate realization will be a global network of regional networks that monitor boundary current variability across international borders to the world's benefit.

Sustained National Glider Network

Facilitators: Daniel Rudnick, Scripps Institution of Oceanography; J. Xavier Prochaska, UC Santa Cruz

Within the sustained Global Ocean Observing System, underwater gliders provide long-term, high-resolution observations that connect the coasts to the deep ocean and tie near shore observing networks to basin-scale observing networks. Building on progress previously made by the OceanGliders Boundary Ocean Observing Network (BOON) effort and the sustained glider network discussion at the 2022 UG2 Workshop, this session will further the discussion and determine the need and feasibility for a sustained, glider-based observing network.

Outcomes

SUSTAINED NATIONAL GLIDER NETWORK

SUMMARY

A history of efforts to establish a national glider network was outlined, beginning with a preliminary plan on the U.S. West Coast in 2003, followed by IOOS plans in 2012-2013, the initiation of the OceanGliders Boundary Ocean Observing Network (BOON) in 2016, and continued discussions at OceanObs19.

The group agreed that a sustained national glider network would be transformative, enabling better monitoring of climate impacts on coastal areas. However, the consensus was that such a network does not currently exist. Key barriers include lack of incentives, funding, difficulty in conveying the importance of climate data, and the absence of a flagship product.

To advance this goal, the group recommended using existing data to create state estimates, refining the messaging to communicate the network's value, and exploring models that increase private sector involvement. This will be a continuing topic and discussion in the glider community.

MTS Microcredentials

Facilitators: Liesl Hotaling, MTS; Josh Kohut, Rutgers University

This breakout session focused on sharing the concept of microcredentials and their utility in codifying marine technology use. Presenters shared the drafted framework, competencies, and approach to creating and awarding microcredentials. Attendees were invited to discuss the application and relevance of the microcredential framework in small working groups and offer comments and suggestions for revision and improvement.

Background

To increase workforce capacity, we must collectively take action to establish attractive, innovative, agile and equitable educational opportunities. These opportunities should capitalize on skill sets for a diverse range of workers and encourage engagement pathways for life-long learning through stackable microcredentials and professional certificates to promote personal growth. The Marine Technology Society (MTS), in collaboration with community members, is in the process of creating an infrastructure to issue a variety of stackable microcredentials addressing core competencies required for employment in the blue economy.

Outcomes

MTS MICROCREDENTIALS	
DISCUSSION TOPICS	**OPPORTUNITIES/CHALLENGES**
Structure of the microcredentials program	Current structure of foundational, intermediate and advanced seems a reasonable approach. Do the assessors need to have earned the microcredential themselves? Suggestion to create Advanced level competencies now so existing pilots can "check out" and earn the credential, then have a network of credentialed instructors. Create a "visitor" program for credentialed instructors to visit other organizations/ locations implementing microcredentials to learn from each other and as a community improve instruction.
Potential for adoption and growth	Splitting the glider microcredentials into "hardware" and "software/piloting" is a strategic approach to addressing future needs. Utility of the microcredential approach for a variety of learners – traditional students, reskilling/upskilling, recognition of existing skill sets. Strong potential for local adoption working with members of UG2. Assistance with local implementation questions will need individualized attention – as implementation models emerge, provide those on the MTS site to help future organizations envision how they might formulate adoption.

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Breakout Sessions

MTS MICROCREDENTIALS	
DISCUSSION TOPICS	**OPPORTUNITIES/CHALLENGES**
Fundamental competencies	Agreement that the foundational glider microcredentials can be platform agnostic as the competencies address fundamental topics applied to all platforms. Unresolved discussion topic - Intermediate level might require more consideration regarding the ability to keep agnostic, may need to bifurcate into separate microcredentials for different platforms – or may not…more discussion is needed as competencies evolve.
Evaluation rubrics	Generally, a good concept to get a common evaluation strategy. Flip rubrics from 5->1 to 1->5 for ease of evaluation. Unresolved – how to certify someone as a rubric checker/evaluator and microcredential assessor?
Expiration of microcredentials	Should there be refresher courses to recertify – but that might differ depending on the trajectory of the person. A favorable suggestion is to include a “date received stamp” with the microcredential and let the employer decide if that credential is still valid.

MTS MICROCREDENTIALS	
GOALS	**OBJECTIVES**
Develop microcredentials for learners – foundational, intermediate and advanced	Finalize foundational hardware and pilot microcredentials by Autumn 2024. Finalize evaluation rubrics by Autumn 2024. Discuss with a small group the possibility of “leap frogging” Intermediate competency development in favor of creating Advanced competencies to provide opportunities for the UG2 community to earn their microcredentials now(ish) and be credentialed when teaching the future learners.
Develop microcredentials for early career/first time job	Future goal – perhaps 2 years out?

Glider Operations and Logistics

Facilitators: Karen Dreger, Skidaway Institute of Oceanography; David Aragon, Rutgers University

This was a group discussion covering topics, questions, and challenges associated with glider operations and logistics. Topics ranged from batteries to international shipping to do-it-yourself repairs. This session was a good opportunity to discuss multiple topics with several seasoned pilots and to network with other operators.

Outcomes

GLIDER OPERATIONS AND LOGISTICS	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Wide range of experience	Piloting operations continue to be defined by a wide gap between experience. For instance, Class A and Class B pilots. Class B handling a brunt of the monitoring, Class A handling difficult situations, mission planning, and anomaly events. • Can we train more Class A pilots, and faster than real-time? • What is the best approach for Class B pilots? • Microcredentials for piloting to handle some of these cases?
New users	Are there enough resources and training available for new users? Every two years at UG2 likely is enough to connect with peers and learn of training opportunities, but not adequate in terms of covering intricate issues. Realistically: not everyone can be an expert. Avenues for small operators to lean-on or request compensated time and expertise. Not feasible (without external support) to set up a glider lab for 1-2 deployments / year operated by undergraduate or graduate students.
Safety on shore	Lithium safety equipment (lithium fire extinguisher/powder, fire suppression systems) Safe transportation and storage of gliders and batteries. Making sure local safety regulations are followed. For instance, utilizing fire cabinets for batteries not being actively used. The largest risk to a water compromised glider is internal pressure and not battery fire. Monitor internal pressure sensor and open using long reach tools Utilizing carts, dollys, and cranes properly to move equipment safely for operations and gliders. Some gliders are quite large and efforts to reduce the amount lifted by human power are practiced.

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Breakout Sessions

GLIDER OPERATIONS AND LOGISTICS	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Safety at sea	STCW or 1-2 Fishing partnerships training for ocean-going personnel Glider signage critical to communication at sea • Contact Number & Address • Active research dates • Short form Instructions on what to do if encountered • International: stress no value if found or recovered Issue Notice to Mariners for operating areas Announce deployment intentions on CH16 to have alert nearby vessels Local Education always helpful in keeping community abreast of operations which improves glider safety at sea Would like to work towards accepted standards for surfacing time/interval so to minimize vessel strikes and occurrences at sea. Glider community would prefer to not be labeled a safety concern. Safer operations = less losses/claims/costs and better insurance. Better community relationships and better data gathering!
Shipping and logistics	International shipping and logistics are never easy, every country and situation poses a different set of requirements and challenges. All an operator can do is combine knowledge into the best available approaches Carnets can help, but can be their own hassle when lost or misplaced or unsure how to be processed Airtags help in terms of peace of mind and to usher along the shipping process if slow or delayed. Vibration can have negative effects on equipment, work to minimize.
Service intervals	Group began to define service intervals for flexible equipment on gliders. On the order of 2 to 10 years for certain parts. Certainly required for continued operation of gliders. Can we bring new life to old equipment? Creating hybrid G2/G3 gliders. If enough interest industry could implement. A good opportunity for UG2 members to find one another and communicate to industry. Perhaps another slack channel would be useful.

Breakout Sessions

GLIDER OPERATIONS AND LOGISTICS		
FUTURE NEED	**DISCUSSION**	**ACTION ITEMS**
Increased efforts in training/ collaborating	Training faster than real time for piloting possible? Many experienced groups out there, could there be a way to 'pay for expertise time'. Setting up a glider lab for 1-2 deployments isn't feasible. There always has to be an experienced group/operator in the mix for successful missions. Put more training focus on the big picture vs how it works. For instance, a glider in a large dangerous ocean with risks, let's all operate safely and efficiently. Leverage others who do for advice. Building codes exist for a reason, we should try to standardize operations	Discuss need and utility of SOPs A hands-on training day for pilots/ operators at UG2 2026 Increase the number of pilots and technicians at future UG2 Workshops
Resources for and tools used for proper piloting		Increased availability of resources and tools for pilots
Insurance	This remains a turbulent field. Self-insuring is certainly the best option but not possible for some and likely not feasible for most. Group insurance could help group together needs but it possesses consequences of looping varying risks into the same pool.	
Small and specialized Task Forces for the improvement of gliders	These could report issues to interact with industry more effectively with the aim of improvement	Creation of small Task Force or representation on the UG2 Steering Committee/Industry Panel

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GLIDER OPERATIONS AND LOGISTICS		
FUTURE NEED	**DISCUSSION**	**ACTION ITEMS**
Safety & respect for people, gliders, and for everything/ one else	Lithium safety equipment (lithium fire extinguisher, lithex powder) and transportation STCW and 1-2 day safety courses available for ocean-going folks (ex. Fishing Partnership) Glider safety at sea starts with responsible glider operation and ends with proper mariner communication & education. Plays into insurance. Safer operations = less claims = less stress. Insurance nearing cost-prohibitive Shipping – logistics are never simple, tracking assets (airtags) and minimizing vibration during transportation.	Piloting trainings / methods- closing the gap between junior (newer) pilots and senior pilots (experienced) Group Insurance for gliders across multiple universities or institutions or for regional associations Shipping database for different locations/ regions/countries

Piloting – Q&A

Facilitators: Karen Dreger, Skidaway Institute of Oceanography; Kevin Martin, University of Southern Mississippi; Doug Wilson, University of the Virgin Islands

This session offered a more general Q&A session on topics related to piloting gliders.

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Multiple battery types	Most users seem to primarily be Li Mix of rechargeable
Rechargeable batteries – do you need to degauss after some time/charge cycles?	Generally yes on Sea gliders Teledyne indicates it may not be a large issue, degaussed at factory Slocum in-situ compass cal is an option

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Breakout Sessions

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
With extra bay rechargeable – on long mission, there may be some additional consideration with self drain in the rechargeable	If 550 Ahr, recover around 500. Groups leave a margin. Rutgers University does this by voltage curve, pulled before the curve using historical data. NOC pulls at 80%. Electrochem – discharge rates can be acquired. Rates vary dramatically based on load and temp. Higher rates and lower temps reduce capacity.
Battery safety	Rutgers University used to require a fire cabinet, but now have to have Class D fire extinguishers where the batteries are located Some groups keep batteries in the fire cabinet. Also keep near Class D fire extinguishers. Can be charged overnight. Long term storage is when they get put back in the cabinet. Fire marshal indicated that 8 Li primary packs in storage was too much for the building's fire suppression system. OSU – class D extinguisher may not be suitable for Li battery fire. Only for bare metal. Specific Li battery fire extinguisher is available though and is ~$2k If there's a fire – Webb protocol is to evacuate. Just get out! LithEx (sp?) is a drum of some kind of powder that you might be able to put a failing pack in before it becomes a fire. With a leak… • Open outside away from structure? • Possible extra considerations if a lot of water • Electrochem says the voltage differential isn't that high in saltwater and are reasonably safe as far as a Li pack goes when exposed to seawater • Might want to check internal vacuum if possible • It can indeed burp pressure out
Shelf life primary Li	3-4% per year de rate is standard … 5% per year is probably safe (from what's left?) Can track with a spreadsheet that calculates

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Breakout Sessions

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Glider transportation	Apple AirTag in shipping crate to keep tabs on it Small flatbed cart to wheel them around on (can put the glider cart on it) Cranes on and off cart to table Small dolly can be put under the rear pegs of the glider cart • Homemade options pretty easy Trucks and vans common vehicle options Vibration issues could cause things to shift or loosen • Rubber isolation might be good • Ships vibrate a lot as well • Any cushion options are helpful. Avoid potholes • Don't let it tip over on its side
Pre deploy sensor checks	Sanity checks? Check with second sensors? pH sensors … spectrophotometric cross check. Requires overnight conditioning TS doesn't really drift… Aandera optode can be checked with 2 point calibration. Similar to YSI success • Using Winkler titration in house • Goal is to try to characterize drift • Maybe try to check with other gliders in the tank at the same time • If DO sensor dries out… takes several days to come back into spec – Store wet if possible Ballast tank CTD is very helpful • Might be useful to do specific gravity check as well • RBR concerto with recent calibration • Densometer, refractometer, etc.

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Breakout Sessions

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**

Repair timelines	Slocums – rubber parts wear out … manufacturer recommendations are per cycle
	• 4ish months at sea for fwd pumps
	• Air bladders – every 5 years
	• External power cord has finite lifespan – 10yrs or so
	Old gliders…
	• Hybrid gliders! Put the G3 pump on the G2 glider??
	  – Teledyne can implement it
	  – Teledyne is happy to upgrade stuff if possible
	  – Radome fin upgrades not uncommon
	• NOC is updating the entire aft end cap to G3 kind on G2.
	• Make end caps to pressure test … send out or do in house

Sea operations/vessels	Do a rosette side by side for water samples? Niskin bottles?
	Cross calibrate at deployment and verify sensor readings
	Deploy off a big ship from the stern. Timing – big drop or small drop
	Safety at sea – some projects require full STCW training (contracted energy work sometimes)
	• Not too readily available. Ft. Lauderdale, Boston, Alaska?
	• Whale lookouts
	• Defibrillator sometimes needed
	• Coast Guard physical
	• As long as one person is trained – okay for some groups
	• OSV's require all the same safety documentation
	• Free one day basic safety at sea courses exist for fishing crews
	SOPs can be helpful. Needed to write one for USCG Healy.
	• NOAA also required on Nancy Foster
	Vessel options
	• Hourly rates: $500/hr for Rutgers
	• Daily rates on bigger ships
	• Charter fishing boats can be $150/hr plus fuel
	  – Might discount from normal fish charter cost
	• Commercial fishing boats around $250-300/hr
	  – Either zero interest at all or super excited about the idea
	• Sea Tow and Marine Towing have been successful and helpful
	• Sailboats work – use the boom as the lifting point!
	• Locate with a helicopter or drone??
	• Capella Space is using .5m SAR to locate stuff
	  – Works for saildrones but need to try with a Slocum.

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Breakout Sessions

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Sea & shore communications	Start with a plan. Plan for no cell signal but use it if you have it. If just simple recovery, easy to just coordinate Iridium GO with texting works well • But not all providers supported Have to relay SFMC alerts via a different webpage sometimes A cell phone booster is a potential option to get better reception. • 20+ mile extensions possible • Ability to tether phones and get some web data. Limited but doable. Oceanscout allow use of Iridium onboard as relay Custom script to look for new surfacing … parse log and format dedicated message with just name/pos/time and relay separately from SFMC default Universities may have very specific networking security and don't like root-sent emails Iridium Extreme phone – can automatically send message of phone's position as email to track boat for recovery or deploy • Garmin InReach can do it too
Glider safety and responsibility at sea	Don't want gliders to have a bad connotation Glider could be a risk to boat … don't want that What kind of signage? • Leave out dates • "research glider" "please report sighting" phone numbers to call • University Police mixed results Export Control might apply – some Universities might require somebody to be around at all times unless able to close off entirely (Texas A&M) Release Notice to Mariners before planned deployments • Securite announcements on Ch 16 Education might be helpful so that non-research boaters know that it's supposed to be out there. Word spreads fast among fishermen. • Social media can enable this If inadvertently recovered – make sure the script is clear and they do NOT put the glider back in the water… be ready for the possibility Losses due to fishing in shallow water • Ship strikes risky • Big shark strikes a possibility – broken tie rod a risk

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Breakout Sessions

PILOTING – Q&A	
DISCUSSION TOPICS	**DISCUSSION ITEMS**
Insurance	Overall – self-insured is not common/hard to actually do Insurance companies seem to drop groups a lot Might be good to have liability written in in case glider catches on fire and damages boat NOC will sometimes write in replacement glider for high risk glider missions What if the glider causes damage to the boat?? Rutgers – insured, tumultuous … very expensive For outright replacement, updated annually A&M – Bill Lingsch/Tony Knapp trying to do group insurance? 2 categories: in lab is one cost; in water is another cost, call insurance before deployment (RAEON similar – 50k deductible on land, 10k deductible in water) Dalhousie – insured. Very expensive. Cost varies based on instruments on board. Calculated per deployment. 4 deployments with no loss and could have purchased a new one. Trying to build a pot of money instead. Some charter boat insurance companies may disallow gliders onboard due to value
Shipping/travel/logistics	Airtag tracking in boxes • Android equivalent exists Pelican cases for chunks of gliders Hazmat shipping by sea is slow… • Carnet might help for some shipments (specific countries) • Very specific requirements to get one … support equipment can cause issues/ delays • Freight truck shipping might have placards? • Lots of gliders in personal vehicle – if it's sealed, it's a "vehicle" • Lots of paperwork Useful to each have hazmat shipping certifications • Lasts 2yrs. DG-certified paperwork requires it

UG2 Communications and Outreach

Facilitators: Jennifer Sevadjian, Scripps Institution of Oceanography; Georgia Coward, UCAR COL; Cassie Wilson, UCAR COL

We held an informal feedback session focused on supporting UG2 community needs related to communications, outreach, and engagement. The UG2 Communications Sub Focus Group shared some quick demonstrations of our collaboration space on Slack and the newly revamped UG2 website. The remainder of the session was an open discussion and Q&A for questions and comments about ways we can facilitate collaboration and communication among members.

The workshop offered the perfect opportunity to ask the UG2 community for future UG2 webinar topics. We were inundated with options including: early career science highlights, piloting examples, international regulations, glider tools, sentinel mission, supporting hydrography and open Q&A sessions.

UG2 COMMUNICATIONS AND OUTREACH			
FOCUS AREA	**OPPORTUNITY**	**ACTION ITEM**	**POC & TIMELINE**
Sector/Partner Engagement	Increase engagement with a growing glider community and sector	Engage with active/passive acoustics users for needs	Georgia Coward/acoustics community By 2026 Workshop
Early Career and Students	Increase available resources for this demographic	Include internships, scholarships, fellowships and events section on the website	Georgia Coward By July 2025
		Include a job board at the 2026 UG2 Workshop	2026 Workshop
Website	Promote better understanding of data flow to UG2 community	Create and include a reusable data flow graphic to DAC, NCEI, WOD on website	Jen Bowers/Kathy Bailey By July 2025
	Reduce stagnant website pages to create a more engaging “news” section via LinkedIn	Remove “News” section	Georgia Coward By July 2025
	Promote UG2 research and achievements to the wider community	Explore possibilities of a photo-style blog	SFG By December 2025

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Breakout Sessions

UG2 COMMUNICATIONS AND OUTREACH			
FOCUS AREA	**OPPORTUNITY**	**ACTION ITEM**	**POC & TIMELINE**
Slack	Improve high-level communication regarding DMAC to the community	Create a subchannel or reorganization of the "Data" channel to incorporate a separate space for GDAC/ DMAC announcements	Georgia Coward/Jenn Sevadjian By December 2024
	Improve collaboration with European colleagues	Increase collaboration with European glider users	Georgia Coward By 2026 Workshop
Social Media	Increase dynamic engagement opportunities for the UG2 community	Create UG2 LinkedIn to promote partners, share jobs and news in dynamic way	Georgia Coward/SFG By July 2025
	Promote partner research and achievements	Create playlist on the UG2 YouTube for partners to highlight their work	Cassie Wilson By July 2025

Proposal Writing Training

Facilitator: Yui Takeshita, MBARI

Background

This breakout group was designed to aid early career researchers in writing proposals, focusing on NSF and NOAA. It was relatively informal, and meant to be more of a discussion with the participants. Lisa Clough (NSF) and Emily Smith (NOAA) gave remote presentations about their respective institutions, and included information such as the various programs that are available to accept proposals, key components of a proposal, and review criteria. Yui Takeshita facilitated the rest of the breakout, and led a discussion that focused on providing advice and tips on how to prepare the intellectual merit, and broader impacts sections.

Outcomes

There were no concrete outcomes or action items that resulted from this breakout group. Depending on the feedback from the participants, we may conduct a similar breakout group during the next meeting.

Industry Panel Session

Facilitators: Bill Lingsch, NOAA Contractor; Hank Statscewich, University of Alaska Fairbanks

The Industry Panel in session: *Featuring panelists from Alseamar, Hefring Engineering, Nortek, RBR, Rockland Scientific, Sea-Bird Scientific, and Teledyne Webb.*

Breakout Sessions

Members

Alseamar: Laurent Beguery, *Manager.* **Hefring Engineering:** Freda Zifteh, *CEO*. **Nortek:** Evan Price, *Senior Applications Engineer.* **RBR:** Mat Dever, *Research Scientist*; Eduardo Vaz, *Director of Sales*. **Rockland Scientific:** Candace Smith, *Sales Manager, North America*. **Sea-Bird Scientific:** Calvin Lwin, *Director of North America and Technical Sales*; Natalie Zielinski, *Product Manager.* **Teledyne Webb:** Shea Quinn, *Slocum Glider Product Line Manager*; Cordie Goodrich, *Slocum Glider Technical Support and Field Operations Manager.*

Objective

Our UG2 industry partners participated in a vibrant question and answer session to gauge the needs of the community both now and in the future.

The Q&A session covered various aspects of glider technology, from technical improvements to communication and logistical challenges:

INDUSTRY PANEL SESSION	
DISCUSSION TOPICS	**DISCUSSION**
New Technologies and Initiatives	Manufacturers are focusing on increasing sensor capacity, onboard data processing, and adding biogeochemical sensors. Innovations include the Sentinel glider (TWR), deeper and more intelligent X3 glider (Alseamar), primary production glider (Hefring), and improved in situ data processing (Rockland).
Communication Technologies	Iridium remains the preferred low-energy communication choice, though alternatives like Starlink are being considered despite higher power demands.
Sensor Repair Communication	To improve coordination between glider and sensor manufacturers during repairs, including all parties in communication is encouraged. Some manufacturers consider integrating their separate user and manufacturer support teams.
Data Calibration and Standardization	There's interest in centralizing calibration info in a standardized format (e.g., netCDF), aligning with existing Argo standards for easier integration into the Global Data Assembly Center (GDAC).
New Applications for Technology and Regulations	Manufacturers recognize the need for trusted documentation for new applications, while some countries are exploring regulations around glider deployments.
Autonomous Navigation and AI	Many manufacturers are cautious with AI, preferring human-controlled or "backseat driver" functionalities rather than full autonomy, but are open to feedback.

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INDUSTRY PANEL SESSION	
DISCUSSION TOPICS	**DISCUSSION**
Power and Biofouling Solutions	While solar panels are impractical due to glider drift during charging, rechargeable and lithium batteries are standard, though alternatives are being explored. Biofouling remains challenging, with UV and wipers as current, but energy-intensive solutions.
Deployment and Recovery	Air deployment is being considered by some, but recovery poses challenges. Deployments via helicopters or surface vehicles close to the coast are alternatives.
User Communication and Feedback	Manufacturers emphasize the importance of feedback and communication to improve product offerings and resolve issues proactively.

The discussion concluded with a call for users to provide feedback, ask questions, and share ideas for future improvements.

Data Management

Jennifer Bowers, NOAA NCEI; Leila Baghdad-Brahim, Tetratech RPS North America; Jennifer Sevadjian, Scripps Institution of Oceanography; Joshua Hill, The Institute for Advanced Analytics and Security; John Horne, University of Washington

The two-part Data Management Session ("Overcoming Data Hurdles: Multidimensional Insights and Early Data Federation Initiatives" and "Navigating Glider Data: Registration, Submission and Standards") focused on enhancing the robustness and efficiency of data handling practices for underwater gliders. It included interactive elements where attendees had the opportunity to participate in hands on and Q&A activities, enabling practical application of the concepts discussed. Participants explored best practices for data collection, storage, and sharing, ensuring that glider data is accessible and usable for various research and operational purposes. The first session covered topics such as data provider registration, and submission processes for contributing real-time and delayed-mode glider data sets to the U.S. IOOS National Glider Data Assembly Center (NGDAC) and the status of the OG1.0 NetCDF file specification. For the second session, the challenges with multidimensional data and showcase early stage data federation efforts were discussed. This collaborative effort aims to harmonize international data management standards and leverage partnerships to promote new developments in underwater glider technology.

Objective

By the end of the sessions, participants would have a deeper understanding of data management standards and practices, and a framework for how to implement them effectively in their own projects.

Breakout Sessions

DATA MANAGEMENT (TWO-PART SESSION)			
FOCUS AREA	**DISCUSSION/OUTCOME**	**ACTION: NEAR-TERM**	**ACTION: LONG-TERM**
Data Submission and Quality Control	Covering methods for ensuring the accuracy and reliability of data collected by gliders, including calibration procedures and validation against other measurement systems. Lelia Bagdad-Brahim of Tetra Tech represented the IOOS NGDAC providing an overview of the glider data submission process.	The community would benefit if UG2 could improve communication on Data Governance	--
		Use the #data UG2 Slack channel to create a "DMAC Announcements" section to follow up with IOOS questions regarding glider data submission and make high-level announcements easy to find and follow	--
		Promote direct communication for NGDAC issues - email glider.dac.support@noaa.gov	--
		Socialize the NOAA - Navy UxS Metadata Profile. Encouraging industry adoption will simplify and standardize metadata requirements for full lifecycle data management activities.	--

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Breakout Sessions

DATA MANAGEMENT (TWO-PART SESSION)			
FOCUS AREA	**DISCUSSION/OUTCOME**	**ACTION: NEAR-TERM**	**ACTION: LONG-TERM**
Data Storage and Accessibility	Generally encompasses solutions for storing large volumes of data and making it accessible to researchers and stakeholders, including cloud-based platforms and data repositories. Storage solutions for the underwater glider community data value chain starts with data collectors and gets collated at the NGDAC, IMOS or EGO data assembly centers. Where it makes its way to NOAA's NCEI Archive for long term storage and preservation. Glider data are combined with other subsurface physical oceanography parameters, where they go through basic quality control and assurance protocols, are uniformly formatted and subsequently redistributed via NCEI's World Ocean Database.	Alexey Mishnov to present at near future UG2 Webinar on the storage and retrieval from the NCEI endpoint.	--
Data Standardization	Continuous efforts to standardize data formats and protocols to facilitate data sharing and interoperability among different research groups and institutions. The OG1.0 data format has evolved as a standardized format developed by the OceanGliders community to facilitate the consistent recording and sharing of underwater glider data. Key Points include: • OG1.0 uses the NetCDF (Network Common Data Form) system, which is widely used in the scientific community for storing array-oriented scientific data. • It follows the Climate and Forecast (CF) metadata conventions, specifically CF 1.10, to ensure that the data is well-documented and easily interpretable. • The format records data as a trajectory, capturing the entire mission of the glider from deployment to recovery. This includes a series of dive cycles representing the glider's path and activities. • The development of OG1.0 involved extensive collaboration within the OceanGliders community, helping to ensure that it meets the needs of various stakeholders and can be widely adopted.	Coordination action to promote engagement with the OG1.0 working group. University of Washington testing multidimensional data's alignment with OG1.0, and socializing findings using the Slack Data Management Chanel to reinvigorate this. Provide access to acoustic ERDDAP server to test/ingest acoustics data products	Strategy for implementation of OG1.0 at the NGDAC Refine data pathway for near real time active acoustics data/ multidimensional data sets for NGDAC net CDF and OG1.0 data format. --

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Breakout Sessions

DATA MANAGEMENT (TWO-PART SESSION)			
FOCUS AREA	**DISCUSSION/OUTCOME**	**ACTION: NEAR-TERM**	**ACTION: LONG-TERM**
Data Integration	Discussion of techniques for combining data from underwater gliders with other oceanographic data sources to create comprehensive datasets. Josh Hill and Simone Marino, representing University of Southern Mississippi, introduced the Data Assembly Hub for Uncrewed Systems. These discussions aimed to improve the efficiency and effectiveness of data management practices, ensuring that the valuable information collected by underwater gliders can be fully utilized for scientific research and environmental monitoring.	Jennifer Bowers and Josh Hill - launch soft testing of DAH from Slack	--
Unexplored: **Real-Time Data Processing**	Advances in processing data in real-time to provide immediate insights and support decision-making during glider missions.	--	--
Unexplored: **Multidimensional data**	Solutioning for multidimensional data sets was left unresolved - but acknowledged.	--	--

Oral Presentations & Posters

Oral Presentations

The following workshop presentations are listed in order of their appearance in the Workshop Agenda.

EMERGING SCIENCE	
PRESENTATION TITLE	**PRESENTERS**
Sampling High Dynamic Shallow Waters, Using an Oceanscout Glider, to Observe Boundary Layers	**Kevin M. Martin**, Olivia Braswell, Senam Tsei, Stephan Howden: The University of Southern Mississippi, School of Ocean Science and Engineering
10 Years of Glider Operation for Hurricane Applications in the Caribbean Region	**M. Le Henaff**, UM/CIMAS-NOAA/AOML; F. Bringas, NOAA/AOML; U. Rivero, NOAA/AOML; G. Rawson, NOAA/AOML; J. Morell, UPRM; P. Chardon-Maldonado, UPRM; W. Leo, ANAMAR; N. Higgs, CEI
Biogeochemical Responses to a Turnover Event in the Central Basin of Lake Erie	**Panditha V.S.L. Gunawardana**, Trent University; Nolan J.T. Pearce, Marguerite A. Xenopoulos
ECO-Gliders: An Autonomous-based Oceanographic and Ecological Mission to Inform Offshore Wind Development	**Josh Kohut**, Rutgers University

Oral Presentations & Posters

DATA MANAGEMENT & TRAINING

PRESENTATION TITLE	PRESENTERS
Using Community Collaboration to Build the Next Generation of GANDALF	**Currier R**, Texas A&M/GCOOS; Xiao Q
Enhancing Processing and Management of Multidimensional Glider Sensor Data	**Rob Cermak**, UW; John Horne, UW; Mark Yamane, UW; Hank Statscewich, UAF; Seth Danielson, UAF
Glider Data in WOD23 — the Major Contributor	**Alexey Mishonov**, CISSES/UMD & NCEI/NOAA; Ricardo Locarnini, NCEI/NOAA; Tim Boyer, NCEI/NOAA; Patrick Hogan, NCEI/NOAA
Building an Ocean Technician Workforce Using Microcredentials	**Liesl Hotaling**, Marine Technology Society; Josh Kohut, Rutgers University; Hans VanSumeren, Northwestern Michigan College
PLOCAN Glider School — A Decade of Training and International Engagement on Ocean-Glider Technologies	**Carlos Barrera**, PLOCAN; Eduardo Caudet, Joaquin Hernandez-Brito

LOGISTIC/MISSION PLANNING & SUSTAINED OBSERVATIONS

PRESENTATION TITLE	PRESENTERS
The California Underwater Glider Network: Nearly 20 Years of Sustained Coastal Ocean Observation	**Daniel Rudnick**, Scripps Institution of Oceanography
Gliding into Action: Exploring the OSU Glider Research Group	**Jace Marquardt**, Oregon State University; Brian VerWey, John (Jack) A. Barth, Kai-Fu Chang, Jesse Cusack, Anatoli Erofeev, Jessica C. Garwood, Chad D. Gibson, Fucent Hsu, Otavio Mendes, Stephen D. Pierce, R. Kipp Shearman, Pat Welch
Advanced Operating Techniques for Underwater Gliders: Buoyancy Pump Settings, Thruster Usage and Battery Life	**Hank Statscewich**, Seth Danielson, Tyler Hennon: University of Alaska Fairbanks
Using a Digital Twin to Bring Researchers Closer to Ocean Glider Observations	**Justin Buck**[1] , Alvaro Lopez[1], Nick Hawes[2], Jeff Poulton[1], Charlotte Williams[1], Ashley Morris[1], Bruno Lacerda[2], Alexandra Kokkinaki[1] *[1] National Oceanography Centre, UK; [2] Oxford Robotics Institute, University of Oxford, UK*

ACOUSTICS	
PRESENTATION TITLE	**PRESENTERS**
NOAA Fisheries' Strategy for Passive Acoustic Gliders	**Shannon Rankin**[1], Christian Reiss[1], Erin Oleson[2], Selene Fregosi[3], David K. Mellinger[4], Erik Norris[5] *[1] NOAA Fisheries, Southwest Fisheries Science Center [2] NOAA Fisheries, Pacific Islands Fisheries Science Center Cooperative Institute for Marine and Atmospheric Research, University of Hawai'i at Mānoa [3] Ocean Associates, Inc. contracted to NOAA Pacific Islands Fisheries Science Center [4] Cooperative Institute for Marine Ecosystems and Resources Studies, Oregon State University and NOAA Pacific Marine Environmental Laboratory (PMEL) [5] Cooperative Institute for Marine and Atmospheric Research, University of Hawai'i at Mānoa*
Matching Synoptic Oceanographic Data and Baleen Whale Detections inTime and Space	**Katherine Gallagher**, Lesley Thorne, Maha Alnajjar, Charles Flagg, Jack McSweeney, Joe Warren: Stony Brook University; Travis Miles, Josh Kohut: Rutgers University; Julianne Wilder, NOAA; Mark Baumgartner, Woods Hole Oceanographic Institution
Northern Gulf of Mexico Passive Acoustic Reconnaissance with the Slocum G3 Glider	**Natalia Sidorovskaia**, UL Lafayette
Adding to the Picture: Optic and Active Acoustic Data Product Transmission for Near-Real-Time Ecosystem Monitoring	**MT Yamane**, University of Washington; JK Horne, University of Washington; H Statscewich, University of Alaska Fairbanks; S Danielson, University of Alaska Fairbanks; R Cermak, University of Washington

Posters

The following workshop posters are listed in alphabetical order by presenting author's last name.

POSTER TITLE	PRESENTERS
Risk Assessment of Underwater Glider Turbine Collision	Julia Engdahl, **David Aragon**, Kaycee Coleman, Travis Miles, Grace Saba, Josh Kohut: Rutgers University Center for Ocean Observing Leadership
Glider-Derived Bathymetry for Coastal Shelf Mapping	**Sean Beckwith**, Chad Lembke, Mark Luther, David Naar, Matthew Hommeyer, Garrett Miller, Alex Silverman, Heather Broadbent: University of South Florida College of Marine Science

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Oral Presentations & Posters

POSTER TITLE	PRESENTERS
OOI Glider Operations in the Mid-Atlantic Bight	**P. Brickley**, C. Dobson, D. Wickman, A. Robinson, and A. Plueddemann: Woods Hole Oceanographic Institution
Glider-based Nitrate Observations on the West Florida Shelf	**Heather Broadbent**, USF; Chad Lembke, Alex Silverman, Garrett Miller, Sean Beckwith, Randy Russell, Karen Dreger, Edmond Hughes
Overview of the Use of the Acoustic Zooplankton and Fish Profiler (AZFP)	**Jan Buermans**, Steve Pearce: ASL Environmental Sciences Inc.
An Overview of the Australian Ocean Glider Program	**Cailin Burmaster**, Chari Pattiaratchi: University of Western Australia
Using Gliders to Measure Biologically Generated Turbulence in the Sargasso Sea	**Jonny Chapman**, Ruth Curry, BIOS; Rolf Lueck, RSI
"Best Data Possible": Dynamic Corrections for RBR CTDs and Oxygen Optodes	**Matthieu Dever**, RBR
Analyzing 10 Years of Battery Data from OOI Glider Deployments	**Collin Dobson**, Peter Brickley, Al Plueddemann, Diana Wickman, Andrew Robinson: Woods Hole Oceanographic Institution
Not-So-Straight Glider Trajectories near Cook Strait	**Cassandra Elmer**, Alain de Verneil, Eleanor Haigh, Jasmin McInerney, Alice Overend, Craig Stevens, Phil Sutton: NIWA
Impact of Space-Time Sampling: Gliders vs. Profiling Floats	**P.J. Hogan**, NOAA/NCEI; T. Boyer, A. Mishonov, J. Reagan
Using Seagliders to Understand Influences of Tidal Mixing on Estuarine Circulation in Puget Sound (Washington, United States)	Catherine Kohlman, **Lydia Kelley**, Jackson Page-Roth, Caleb Flaim, Fritz Stahr, Charles Eriksen, Rick Rupan, Sasha Seroy: University of Washington
Dolphin – Glider Interaction in the Southeast Gulf of Mexico	**John J. Langan**, Mote Marine Laboratory and Aquarium
Sensor Tracker: An Open-Source Metadata Management Tool	Adam Comeau, Ocean Tracking Network; Richard Davis, Ocean Frontier Institute; **Xiang Ling**, Ocean Frontier Institute
Slocum Glider Data in R Shiny	**Garrett Miller**, Alex Silverman, Heather Broadbent, Randy Russell, Sean Beckwith, Edmund Hughes: USF CMS; Karen Dreger, Catherine Edwards: UGA SkIO; Chad Lembke, USF CMS

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Oral Presentations & Posters

POSTER TITLE	PRESENTERS
The Glider Rodeo: NOAA Fisheries' Passive Acoustic Underwater Glider Comparison	**Erik Norris**, CIMAR; Shannon Rankin, Erin Oleson, Christian Reiss, Selene Fregosi, David K. Mellinger
Using Glider-Based Acoustic Telemetry to Inform Fish Movements in the Great Lakes	**Lydia Paulic**, RAEON, University of Windsor; Todd Hayden, Center for Systems Integration and Sustainability, Department of Fisheries and Wildlife, Michigan State University; Russ Miller, University of Michigan, Cooperative Institute for Great Lakes Research; Katelynn Johnson, RAEON, University of Windsor; Hayden Henderson, Michigan Technological University; Aaron Fisk, RAEON, University of Windsor
OOI In-Air Oxygen Calibration Adjustments and Improved Oxygen Sensor Mount	**S. Pearce**, J. Whitefield, E. Dever, R. Desiderio: Oregon State University
Fake Animals: Using Underwater Gliders to Foster the Development of Animal Biologging Technologies	**Pinti J**., Wiernicki C., Oliver M.: University of Delaware
Extrema in Dissolved Oxygen in the California Underwater Glider Network	**J. Xavier Prochaska**, UC Santa Cruz; Daniel Rudnick
Sensor and Behavior Frameworks for Implementing Backseat Driver on a Slocum Glider	**Sophie Scopazzi**, Travis Miles, Joe Gradone, Dave Aragon, Alex Lopez: Rutgers University, Center for Ocean Observing Leadership, New Brunswick, NJ
New Collection of High-Resolution Observations from the California Underwater Glider Network	**Jennifer Sevadjian**, Daniel Rudnick: Scripps Institution of Oceanography
Gliders Used to Investigate Ocean Variability at Mesophotic Coral Reefs of the US Virgin Islands	**Cole Sheeley**, Doug Wilson, Travis Hamlin, Tyler Smith: University of the Virgin Islands, St. Thomas, USVI
Automated Detection and Classification of Low-Frequency Whale Acoustics Using Pam-Equipped Slocum Gliders in the USVI and Puerto Rico	**Joshua Soll**, Doug Wilson, Travis Hamlin: University of the Virgin Islands
pH Sensors on Underwater Gliders in the California Current System	**Yui Takeshita**, MBARI; Daniel Rudnick, Miguel Cubillas, Kyle Grindley, Irene Hu, Jacki Long, Ben Reineman, Jeffery Sherman, Joseph Warren
Intensification of Hurricane Laura over Freshwater Plume	**Senam Tsei**, University of Southern Mississippi
Enhancing Biogeochemical Data Quality in Spray Gliders: A Robust Pipeline for Adjusting pH, Oxygen, and Chlorophyll Measurements	**Benjamin Werb**, Yui Takeshita, Jacki Long, Joseph Warren: MBARI affiliated

Appendix A: Registrants

Adam Comeau – *Dalhousie University*

Alex Silverman – *University of South Florida*

Alexey Mishonov – *NOAA/NCEI*

Ashin Kuriakose – *Indian National Centre for Ocean Information Services (INCOIS)*

Ashley Hann – *NOAA, Uncrewed Systems Operations Center*

Axel Diederik Boonman Morales – *Monmouth University*

Barbara Kirkpatrick – *GCOOS/TAMU*

Ben Allsup – *National Oceanography Centre*

Benjamin Werb – *MBARI*

Bill Lingsch – *NOAA IOOS*

Brian Buckingham – *Rutgers University Center for Ocean Observing Leadership (RUCOOL)*

Brian VerWey – *Oregon State University*

Cailin Burmaster – *University of Western Australia*

Calvin Lwin – *Sea-Bird Scientific*

Candace Smith – *Rockland Scientific*

Carl Gouldman – *NOAA/NOS/IOOS*

Carlos Barrera – *Oceanic Platform of the Canary Islands (PLOCAN)*

Cassandra Elmer – *National Institute for Water and Atmospheric Research (NIWA)*

Cassie Wilson – *UCAR Center for Ocean Leadership*

Catherine Edwards – *Skidaway Institute of Oceanography, University of Georgia*

Chesna Cox – *NOAA Office of Marine and Aviation Operations*

Chiara Monforte – *University of Hamburg*

Chris Mackenzie – *Hakai Institute/CPROOF*

Christian Reiss – *NOAA*

Clara Hulburt – *Teledyne Webb Research*

Clara Loureiro – *UAc/IICM-Okeanos*

Cole Sheeley – *University of the Virgin Islands*

Collin Dobson – *Woods Hole Oceanographic Institution*

Cordie Goodrich – *Teledyne Webb Research*

Daniel Rudnick – *Scripps Institution of Oceanography*

David Aragon – *Rutgers Department of Marine & Coastal Sciences*

Dawn Petraitis – *NOAA/NWS/ National Data Buoy Center*

Devon Carothers – *US Navy*

Doug Wilson – *University of the Virgin Islands*

Eduardo Vaz – *RBR*

Edward Dever – *Oregon State University*

Ella McNeece – *University of Delaware*

Emily Brown – *Michigan State University*

Erica Fruh – *NOAA OMAO UxS Operations Center*

Erik Norris – *CIMAR, University of Hawai'i at Mānoa*

Eugene Burger – *NOAA/OAR/PMEL*

Evan Price – *Nortek*

Francis Bringas – *NOAA/AOML*

Garrett Miller – *USF College of Marine Science*

Georgia Coward – *UCAR Center for Ocean Leadership*

Grant Rawson – *NOAA/AOML*

Greta O'Dea – *Teledyne Technologies*

Hank Statscewich – *University of Alaska Fairbanks*

Hayden Henderson – *Michigan Tech - Great Lakes Research Center*

Heather Broadbent – *University of South Florida*

Heloise Frouin-Mouy – *University of Miami / NEFSC*

J. Xavier Prochaska – *University of California, Santa Cruz*

Jace Marquardt – *Oregon State University*

Jack Slater – *Virginia Institute of Marine Science*

Jacqueline Long – *MBARI/Submarine Scientific/Carbon To Sea*

Jamarirs Moore – *NAVY*

James Pegg – *CPROOF*

Jan Buermans – *ASL Environmental Sciences Inc.*

Appendix A: Registrants

Jay Austin – *Large Lakes Observatory, UM-Duluth*

Jennifer Bowers – *NOAA NCEI*

Jennifer Sevadjian – *Scripps Institution of Oceanography*

Jerome Pinti – *University of Delaware*

Jessica Leonard – *Rutgers University Center for Ocean Observing Leadership*

John Horne – *University of Washington*

John Langan – *Mote Marine Laboratory and Aquarium*

Jonathan Chapman – *Bermuda Institute of Ocean Sciences*

Jonathan Whitefield – *Oregon State University*

Joseph Warren – *MBARI*

Josh Kohut – *Rutgers University*

Joshua Hill – *The Institute for Advanced Analytics and Security*

Joshua Soll – *University of the Virgin Islands*

Justin Buck – *National Oceanography Centre, UK*

Karen Dreger – *Skidaway Institute of Oceanography*

Katelynn Johnson– *University of Windsor - RAEON*

Katherine Gallagher – *Stony Brook University*

Kathleen Bailey – *NOAA/U.S. IOOS Office*

Kevin Martin – *University of Southern Mississippi*

Kevin O'Brien – *UW/CICOES, NOAA/PMEL, GOOS OCG*

Kimberlee McHugh – *Teledyne Marine*

Kristen Rosier – *NOAA*

Kyla Drushka – *Applied Physics Laboratory, University of Washington*

Lacey Mason – *NOAA GLERL*

Laurent Beguery – *Alseamar*

Leila Baghdad-Brahim – *Tetratech RPS North America*

Liesl Hotaling – *Marine Technology Society*

Lisa Clough – *US NSF / IOOC*

Lydia Kelley – *University of Washington*

Lydia Paulic – *University of Windsor - RAEON*

Mackenzie Meier – *Woods Hole Oceanographic Institution*

Mark Yamane – *University of Washington*

Mathieu Dever – *RBR/WHOI*

Matthieu Le Henaff – *University of Miami/CIMAS - NOAA/AOML*

Max Schlereth – *Williamson & Associates Technologies, Inc.*

Melissa Rossi – *Teledyne Webb Research*

Michael Fraser – *Teledyne Marine*

Michael Marsik

Natalia Sidorovskaia – *Department of Physics, University of Louisiana at Lafayette*

Natalie Zielinski – *Sea-Bird Scientific*

Nicholas Rome – *UCAR Center for Ocean Leadership*

Nicolai von Oppeln-Bronikowski – *Rockland Scientific International Inc.*

Nicole Waite – *Rutgers University*

Olivia Braswell – *University of Southern Mississippi*

Panditha Gunawardana – *Trent University*

Patrick Hogan – *NOAA/NCEI*

Peter Brickley – *Woods Hole Oceanographic Institution*

Piper Priddy – *University of Delaware*

Rebecca Walsh – *University of Delaware*

Richard Davis – *Ocean Frontier Institute*

Richie Enzmann – *Ocean Robotics Planet Magazine*

Rob Cermak – *University of Washington*

Rob Millsap – *Williamson & Associates Technologies, Inc.*

Robert Currier – *Texas A&M/GCOOS*

Russ Miller – *University of Michigan CIGLR*

Salvatore Fricano – *Teledyne Webb Research*

Sarina Mann – *ISS - NOAA NOS*

Sean Beckwith – *University of South Florida*

Senam Tsei – *University of Southern Mississippi*

Shannon Rankin – *NOAA Fisheries*

Shannon Searing – *Teledyne Marine*

Shea Quinn – *Teledyne Webb Research*

Shelby Brunner – *Great Lakes Observing System*

Appendix A: Registrants

Simone Marino – *University of Southern Mississippi*

Sophie Scopazzi – *Rutgers University Center for Ocean Observing Leadership*

Steve Ruberg – *NOAA / GLERL*

Stuart Pearce – *Oregon State University / Ocean Observatories Initiative (OOI)*

Tom Hollenhorst – *EPA Office of Research and Development, Great Lakes Toxicology and Ecology Division*

Travis Hamlin – *University of the Virgin Islands*

Travis Miles – *Rutgers University*

Uchenna Nwankwo – *Texas A&M University*

Xiang Ling – *Dalhousie University*

Yui Takeshita – *MBARI*

Yuleny Gomez Rodriguez – *University of Delaware*

Zach Viva – *Ocean Tracking Network*

Appendix B: Committees

Primary Organizing Committee

The organizing committee would like to thank the community for coming together to highlight the successes of the national and international Glider Community and for taking the time to tackle the difficult challenges we face. The organizing committee includes:

Jennifer Bowers – *UxS Data Enterprise Project Manager, NOAA*

Shelby Brunner – *Observing Technology Manager, Great Lakes Observing System*

Patricia Chardón-Maldonado – *Technical Director, Caribbean Coastal Ocean Observing System*

Georgia Coward – *UG2 Coordinator, Center for Ocean Leadership (UCAR)*

Karen Dreger – *Research Professional, Skidaway Institute of Oceanography at the University of Georgia*

Erica Fruh – *Program Specialist, NOAA Uncrewed Systems Operation Center*

Joe Gradone – *PhD Candidate, Rutgers University*

Barbara Kirkpatrick – *Senior Advisor, Gulf Coast Ocean Observing System*

Bill Lingsch – *Glider Contractor, National Oceanic and Atmospheric Administration*

Russ Miller – *Observing System Engineer and the Observing Systems Theme Lead for the Cooperative Institute for Great Lakes Research (CIGLR) University of Michigan*

Jennifer Sevadjian – *Data Systems Analyst, Scripps Institution of Oceanography*

Cassie Wilson – *Program Specialist, Center for Ocean Leadership (UCAR)*

Doug Wilson – *Director, UVI Ocean Glider Laboratory*

Yui Takeshita – *Monterey Bay Aquarium Research Institute*

Appendix B: Committees

UG2 Steering Committee and COL support staff, from left to right: *Russ Miller, Nick Rome, Erica Fruh, Doug Wilson, Jennifer Sevadjian, Bill Lingsch, Jennifer Bowers, Carl Gouldman, Georgia Coward, Hank Statscewich, Kathy Bailey, Kevin Martin, Karen Dreger, Patricia Chardón-Maldonado and Barb Kirkpatrick. Missing: Yui Takeshita, Cassie Wilson, Joe Gradone, Jorge Brenner, Lisa Clough, Katherine Zaba, David Legler, and Victor Turpin.*

UG2 Steering Committee 2023-2026

Georgia Coward – ***UG2 Coordinator****, Center for Ocean Leadership (UCAR)*

Kathleen Bailey – *Glider Program Manager, U.S. IOOS, National Oceanic and Atmospheric Administration*

Jennifer Bowers – *UxS Data Enterprise Project Manager, NOAA*

Jorge Brenner – *Executive Director, Gulf Coast Ocean Observing System*

Patricia Chardón-Maldonado – *Technical Director, Caribbean Coastal Ocean Observing System*

Lisa Clough – *Deputy Division Director, U.S. National Science Foundation*

Karen Dreger – *Research Professional, Skidaway Institute of Oceanography at the University of Georgia*

Erica Fruh – *Program Specialist, NOAA Uncrewed Systems Operation Center*

Carl Gouldman – *Executive Liaison, U.S. IOOS, NOAA*

Joe Gradone – *PhD Candidate, Rutgers University*

Barbara Kirkpatrick – *Senior Advisor, Gulf Coast Ocean Observing System*

David Legler – *Executive Liaison, Global Ocean Monitoring and Observing, NOAA/Oceanic and Atmospheric Research*

Bill Lingsch – *Glider Contractor, National Oceanic and Atmospheric Administration*

Kevin Martin – *Senior Marine Instrumentation Specialist – Ocean Observing Manager, University of Southern Mississippi*

Russ Miller – *Observing System Engineer and the Observing Systems Theme Lead for the Cooperative Institute for Great Lakes Research (CIGLR) University of Michigan*

Jennifer Sevadjian – *Data Systems Analyst, Scripps Institution of Oceanography*

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Underwater Glider User Group

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