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House Committee on Science, Space, and Technology

Subcommittee on the Environment

Chairman Franklin and Ranking Member Amo,

Thank you for the opportunity to participate in today's hearing on advancements in the ocean industry. I am here as the Chief Technology Officer of XOCEAN, a global ocean data company, but I spent the majority of my career serving the American people as a commissioned officer with NOAA, and I will use that time to provide context in my remarks.

When I began my career at NOAA in 1993, the Office of Coast Survey, which is responsible for nautical charting for the US, was fully vertically integrated-the whole value chain from surveying to printing charts was done by government employees. By the time I retired from NOAA as the director of Coast Survey, NOAA had integrated the private sector into all parts of the operation, retaining for federal employees the inherently governmental functions, such as assessing risk, setting priorities, and quality control. NOAA is a global leader in contracting for hydrographic services with the very capable US survey industry, and most of the world's major hydrographic offices have since followed NOAA's lead. NOAA also led the way in development and adoption of new technology through its own internal work as well as partnerships with the commercial and academic sectors. Congress has supported this integration though authorization and appropriation.

NOAA maintains three complementary programs for commercial engagement in their ocean mapping enterprise. The Hydrographic Surveys contract administered by Coast Survey gives task orders to a panel of pre-qualified commercial companies, primarily for specialized surveys to update nautical charts, but increasingly serving other NOAA programs as well. The Uncrewed Maritime Systems program under OMAO buys data from a panel of pre-selected providers for data needs across NOAA programs (excluding hydrography). The Ocean Exploration Cooperative Institute (OECI) receives a grant from NOAA which is then used through university, not-for-profit, and commercial operators for mapping and exploration, primarily in deeper water. All three of these programs have

additional capacity above what has been appropriated in recent years. All ocean mapping across NOAA and government-wide is coordinated through the small Integrated Ocean and Coastal Mapping (IOCM) program hosted at NOAA. This ensures that synergies are maximized between programs, and duplication is avoided. These are all well-run and efficient programs worthy of additional investment.

I would also like to call the subcommittee's attention to a number regional mapping campaigns under way and planned, in the Great Lakes, Florida, Alaska, and New England. Lakebed 2030, for example, has assembled a broad coalition of regional players and stakeholders to plan a comprehensive campaign to map the least-mapped coastal region in the U. S.

NOAA also supports research and development in ocean mapping through grants to the University of New Hampshire and the University of South Florida. These programs contribute to technological advancements both directly for NOAA and for the commercial companies that support NOAA. In recent years, there has been an increased focus on use of uncrewed systems and the technology needed to use these platforms in support of NOAA missions. There is valuable work to be done in years ahead in AI/machine learning for artificial vision and hearing for hazard detection in the chaotic marine environment, data processing efficiency, and automation of quality-informed adaptive mission planning.

One of my last acts as a public servant in 2020 was to co-chair the interagency NOMEC team (National Ocean Mapping Exploration and Characterization) charged with developing a strategy to fully map all U.S. waters, the deeper part by 2030, and the shallower parts by 2040. The reason for the longer time horizon was that the technology was not yet mature to efficiently survey the vast unmapped areas of US Continental Shelf and the Great Lakes. The estimates we made of the cost using conventional ships were unreasonably high, and the U. S. simply didn't have the capacity in the national fleet to meet the goal. Instead, the NOMEC implementation plan called for acceleration of development and rapid adoption of emerging ocean technologies that could scale to the scope of the challenge, particularly the use of autonomous and remotely operated platforms.

When I completed my term as director of Coast Survey, I remembered this unmet technology challenge and sought out a role in a company that I thought had the best chance to meet it. XOCEAN stood out from other Uncrewed Surface Vessel (USV) companies in that it did not just build the hardware, but had built an entire company around operating a fleet of USVs to conduct the full operations themselves. I had seen first hand at NOAA how difficult it is to adapt an organization designed around conventional ways of working to efficiently operate USVs. At XOCEAN, I saw a company with great technology, and a vision for scaling it quickly into the ocean mapping marketplace. I have

now been with XOCEAN for half of the life of the young company, serving as the chief technology officer.

XOCEAN is now building its thirty-first USV. We have been able to adapt our vessels over the years as we have learned from our own high-optempo operations. This year we are planning for over 2500 days at sea in Europe, Australia, and North America. Our clients are offshore energy, grid operators, government, and science institutions. We are on the contract framework for hydrographic services in the UK, Canada, and Australia, as well as NOAA's IDIQ for data buy from uncrewed maritime systems. We have operated in 23 different jurisdictions around the world.

The USVs use electric thrusters for propulsion, powered by a hybrid solar power that includes a micro generator to permit continuous operation with active sonar payloads and precise positioning. The licensed master and officers-of-the-watch remotely operate the vessels from our distributed remote operations center (ROC), where they monitor the cameras, radar, AIS, and VHF radio, much like watchstanders on a conventional vessel. The surveyors monitor the survey data for quality in real time and upload the data to the cloud for processing. We have a very small footprint in the field, just enough to launch and recover the USVs and perform basic maintenance.

This staffing model allows us to use both our USVs and expert staff very efficiently. For example, when the weather is too rough for surveying in one area, the watchstanders and surveyors can be assigned to a different vessel in a different location where the weather is good. Our technical experts can remotely resolve most problems at sea, so our reliability and uptime is world class. XOCEAN's operational model scales well from fast mobilization short projects with a single boat to huge projects with multiple boats at sea for months on end.

XOCEAN's safety record is superb, and our clients value the fact that we dramatically reduce exposure of personnel to hazards by not having personnel offshore. We use less than 1% of the energy of conventional vessels, with a commensurately small carbon footprint. Our vessels are fully compliant with MARPOL and have zero discharge for operations in sensitive environments. The small size and relatively slow speeds of our vessels all but eliminate the risk of injury to marine mammals as a result of a strike. We were proud to be awarded a prestigious safety award by bp last year, since they are one of the global leaders in offshore operations.

Some NOAA programs are seeking to take advantage of new observing technology, by purchasing equipment and operating it themselves or by contracting for its operation. XOCEAN has chosen not to sell its USVs, since we have found that the technology itself and

the ways of working needed to be successful are closely coupled. We have developed deep experience and honed our operations using the experience we have developed with our systems operating them 100-150 days at sea per year. We can deliver better results for our clients at a lower cost by operating the USVs ourselves, maintaining them meticulously, and keeping the whole fleet up to date with our latest technology. Since our way of working is so unique, we prefer to operate on a data buy, fixed price contract. We take all the risk, and deliver the data the client needs to their specifications.

While this hearing is focusing on ocean mapping, many of NOAA's at sea observation missions could benefit from autonomous systems for their routine or dangerous work. XOCEAN has supported other clients in habitat mapping and seabed characterization, fisheries, carbon capture and sequestration, and security of underwater infrastructure.

In this testimony, I have mostly been using XOCEAN as the primary example. However, there are other companies with complementary technology to ours, such as Saildrone, which offers high endurance offshore meteorology, oceanography reconnaissance, and ocean mapping on the same data as a service business model as XOCEAN. Many of these companies are on NOAA's framework for Uncrewed Maritime Systems, which has data buy as a core component.

NOAA maintains a database of all publicly available bathymetry, and a gap analysis. This year's report card shows that 46% of US waters are still unmapped. Of this gap, I estimate that proven, scalable, and affordable USV platforms could efficiently meet around one third today. With the technology now in early demonstration phase, that could rise to two thirds within just a few years. However, there is still a requirement for highly capable vessels for the more complex exploration and characterization work.

There are two potential policy changes that Congress could consider to accelerate the adoption of new technologies into NOAA's ocean mapping programs. First, this technology and industry is advancing very quickly, and NOAA is not scheduled to reconsider participants in its hydrographic services contract until 2029. A mid-cycle review with the potential to add additional capacity with new capabilities could allow NOAA to access the latest technology earlier while leaving its existing panel in place.

Second, by excluding hydrography from the UMS IDIQ program administered by the Office of Marine and Aviation Operations, NOAA is limiting the breadth of opportunity to help NOAA mapping programs gain experience with established autonomous survey companies and align these mature operations to NOAA's missions.

I appreciate the opportunity to meet with the subcommittee today, and would be happy to answer any questions.