Regionally-Deployed Adaptive Platforms for Ocean Research Technologies

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Recent reports in the science literature[1] have discussed two major trends impacting oceanographic research: the rapidly increasing utilization of automated, remote sensing, and continuous in-situ monitoring technologies for gathering ocean and atmospheric data; and the impact of fiscal constraints on sustaining high-cost infrastructure such as research vessels, resulting in diminishing numbers of platforms for conducting traditional research at sea. There is a tendency to link these two trends as reflecting a qualitative shift in the way oceanographic research can or should be conducted - for example that the need for conducting research aboard vessels at sea is diminishing.

The emerging use of more autonomous and remote technologies, however, is a natural and unsurprising evolution in methodologies which favors the acquisition of specific types if data more cost effectively over manned platforms; primarily larger data sets, time series and geographically distributed physical and aggregated biological observations. The use of manned platforms in this context should therefore be viewed as a *realignment* of how and which research is conducted from ships.

Rather than a diminishing need *per se*, the rationale for manned platforms is in our view becoming more focused and defined, and the need for an increased understanding of the oceans will require more research globally overall, including from ships. Despite growth in the use of remote sensing and autonomous technologies, the utilization of fully functional manned platforms will continue to be driven by a significant body of complex, process-driven and experimental research, sampling methods and in-depth site-specific work – much of which requires controlled on-site vehicles and instrumentation. The deployment and operation of autonomous vehicles, including AUVs, surface vehicles and buoys, will also require continuing and adequate availability of ocean-going platforms, ideally research vessels.

In response to this growing need, Global Oceans has developed a research expedition management model which leverages a global supply chain network within the commercial sector to provide an adaptable and scalable research vessel capacity independent of existing dedicated R/V fleets. Global Oceans is currently developing an expert management support team and engaging with the global science community and others to align and leverage this capacity with existing projects and new research initiatives.

The differentiating operational strategy for achieving this objective is the selective mobilization of commercial maritime assets, including offshore service vessels (OSVs) for short-term use as oceanographic research platforms; together with installed, project-defined modular laboratories and instrumentation on deck; and remote logistics support. This network model optimizes the configuration and planned use of distributed, outsourced assets for research. It creates an alternative infrastructure paradigm which eliminates the significant capital investment and annual operational costs associated with

owned vessels, together with the geospatial limitations of fixed-point dedicated assets and long transits to deployment ports.

The temporary conversion of non-research vessels for science and the use of "vessels of opportunity" are not new concepts; however the unique aspect of the Global Oceans approach is the standardization and cost-optimization of this method and the alignment of high quality supply partners across the commercial field to ensure routine, predictable availability of research-configured vessels in response to project needs. This approach leverages access to over 4,000 offshore service vessels from multiple vessel fleets, ranging from 100' to 300' and widely distributed globally, for short-term time-charter and mission configuration.

Modular laboratories, workshops and auxiliary accommodations are acquired from a distributed global pool, shipped to the departure port for installation, and instrumented for each science mission. Remote local logistics are supported by a global port services partner providing project management offices in 290 ports worldwide, for pre- and post-expedition operations and secure receipt of advance shipments of science assets. Vessels can be mobilized in a relatively short timeframe, within the region of study, and adapted specifically to support the scientific objectives of each expedition.

As more AUVs and their enabling technologies which have potential for scientific research and data acquisition emerge on the market, the challenge for developers of gaining visibility within the large, decentralized and multidisciplinary ocean science community; aligning with appropriate operational platforms; and successfully integrating into funded projects, will become increasingly complex. Global Oceans is seeking to collaborate with the AUV community in addressing some of these challenges in two important ways.

As the requirements to support AUV operations become more diversified, together with their integration with multidisciplinary projects and other enabling technologies such as GIS-enabled mapping software and communication gateway surface arrays, a greater diversity of vessel support options will become necessary. Global Oceans can align platforms and research support for project-specific AUV operations on a demand basis; and together with AUV manufacturers and service providers is interested in offering configured, turnkey AUV/deployment systems to the science community, especially for larger vehicles, multi-vehicle projects and cruises in remote and open ocean regions requiring global class vessels.

Communication and integration of AUV performance capabilities and technical data into the research planning process is a second challenge within the academic user base. Global Oceans is developing a secure online planning tool for marine scientists worldwide to explore and define ways that research assets and new technologies can best be integrated into field work. This tool provides a GIS-enabled system that will facilitate expedition research planning with geospatial mapping and modeling of in-field activities; an interactive forum for work scheduling and collaborative resource sharing among science teams; and a technical resource database. AUV suppliers will be invited to host their

technical product and support data within the planning tool for access by scientists in the planning phases of their research.

As a nonprofit 501c3 organization, Global Oceans' role in catalyzing, aligning and operating commercial resources for scientific research is also enhanced by its efforts to partner with corporate and other private sector partners to financially support expedition costs and capacity development. These future partnerships will also contribute to the ability of scientists to more fully employ newly emerging AUV technologies and other cutting-edge resources.

[1] Science 8 March 2013: A Sea Change in U.S. Oceanography, Vol. 339 no. 6124 pp 1138-1143 DOI: 10.1126/science.339.6124.1138.

Roemmich, Dean, et al. "Integrating the ocean observing system: mobile platforms." *Community White Paper, OceanObs* 9 (2009).

Global Oceans is a new 501c3 nonprofit organization designed to develop and operate innovative infrastructure solutions to the challenge of sustaining and expanding ocean science capacity globally within an increasingly resource constrained research environment. Developing partnerships with private-sector organizations that can integrate current and emerging technologies with the Global Oceans model will provide greater and more cost-effective access to these tools worldwide for ocean science.

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