Research and Development Benefits for NOAA and U.S. Industry

The Ocean and Coastal Mapping Integration Act authorized NOAA to establish up to three ocean and coastal mapping centers, including a Joint Hydrographic Center, to serve as hydrographic centers of excellence, and for the development and evaluation of innovative hydrographic survey equipment and techniques and for the education of hydrographic surveyors. There has been significant success for NOAA from this initiative, and transfer of technology has provided an additional economic benefit for industry.

NOAA's leadership should emphasize the importance of ongoing research and development (R&D) funding to the Department of Commerce, Office of Management and Budget, and the Congress to support the efficient pursuit of the primary hydrographic and charting tasks. **They should also highlight and ensure that successful R&D can be rapidly transferred to industry to assist maintaining U.S. competitiveness and sustain economic growth.** In addition, NOAA should emphasize these successes and report annual key performance indicators on the level of technology transfer as well as the financial benefit to Industry.

BACKGROUND

The operational model and structure implemented at the Center for Coastal and Ocean Mapping/Joint Hydrographic Center, University New Hampshire (CCOM/JHC UNH) has made the rapid transfer of R&D from NOAA-funded research to industry possible. JHC is the formal cooperative partnership between UNH and NOAA, and CCOM is the complementary university center that expands the scope of ocean mapping interaction and collaboration with the private sector, other government agencies, and other universities. While improving nautical surveying and chart production has been JHC's primary goal, CCOM/JHC has been a front-runner in ocean mapping research and innovation that supports other areas of NOAA and industry. Important technologies developed at the centers include the Combined Uncertainty and Bathymetry Estimator (CUBE), a statistical algorithm for editing large spatial datasets, the Geocoder algorithm for creating sonar backscatter mosaics and analyzing seafloor sediments, and the Bathymetry Attributed Grid (BAG), an open-source format for storing digital terrain models of the seafloor.

The joint centers have also demonstrated significant success in transferring the technology results of their R&D to support U.S. industry's innovation and competitiveness. There are a number of key factors that led to the success at UNH:

- NOAA funded R&D achieved the specific goals for the Office of Coast Survey.
- A link with an independent university R&D group that had access to additional funding.
- The associated R&D group had a broader view on activity to support the ocean mapping community, and some freedom to pursue research beyond specific NOAA funding goals.
- Any R&D results were open for technology transfer to support NOAA and industry.
- The associated R&D group had a goal and structure to allow rapid transfer of technology to industry.
- Open dialogue has been developed between industry, government and academic partners.

INDUSTRY BENEFITS

One of the principal benefits that this model provides to government and industry is the ability to take R&D efforts from concept to maturity. This may be over extended R&D cycles periods that might not be economically viable for private industry, and the joint centers are able to commit to this through a combination of direct government investment, funding from academic grants and endowments and industry partnerships. When tools developed at CCOM/JHC are mature enough to be cost-effective for commercial service, these technologies may lead to billions of dollars in economic activity, directly support thousands of jobs, and directly or indirectly support the large swathes of the economy. One specific example is the latest application of multibeam mapping to seabed seep hunting exploration that benefits directly from R&D that has extended the use of multibeam sonars to integrated bathymetry, seabed imaging and full water column analysis, and now supports a growing global industry. In addition, the full scientific application of this approach to measuring natural seep activity into the oceans continues to emerge.

Early oil discoveries on land resulted from looking for naturally-occurring hydrocarbon seeps, and this has recently been applied to the oceans. R&D efforts in mapping the water column as well as the seabed provided the tools and technology to look for these seeps thousands of meters below the ocean surface, thus enabling an entire new industry of ocean exploration. An initial cost-benefit analysis of this R&D for the offshore oil and gas industry alone found that multibeam seep mapping[1]:

- has a current annual revenue of about $70M per year for U.S. companies and projects, and is expected to grow at about 25% per year,
- represents significant cost savings and safety improvements over traditional marine seismic data acquisition,
- when combined with geochemical analysis reduces risk and improves the success of drilling by determining if a reservoir holds exploitable oil, and
- data sets also provide environmental baseline data for the safe development of oil exploration and development monitoring.

CHALLENGES

CCOM established an industrial partnership program with key industry members from hardware and software companies, and service providers. However there remains a lack of industry knowledge of the extensive capabilities and R&D at CCOM that limits the transfer of technology. In addition, transferring the diverse types of technology from the R&D is complex, and managing these implementations requires dedicated resources from the Center and industry.

Every dollar invested in R&D at the joint centers: 1) Leads to reductions in loss of life and loss of property through improved safety of navigation and better coastal zone management. 2) Yields a large return of investment via transfer of technology to industry. 3) Supports economic activity related to tourism, fisheries, energy, infrastructure development, and mineral resources worth many times the initial investment. 4) Produces a better understanding to the insurance industry of the long-term risks and patterns of sea level rise. 5) Trains skilled professionals to be innovators of the future, bringing value to the U.S. government and a competitive edge to U.S. companies.

RECOMMENDATIONS FOR FEDERAL ACTION

NOAA should work with other partners and agencies to:

- Include information about the benefits of hydrographic and charting R&D in NOAA's outreach program to ensure that Congress, taxpayers, industry and all maritime users are aware of the extensive benefits from this R&D when transferred to industry.
- Undertake a more complete cost benefit analysis of the contributions that technology transferred from NOAA funded R&D makes to industry to better understand the return on investment to the economy, and annually report key performance indicators.
- Increase R&D funding with the specific goal of improving the safe, efficient pursuit of hydrographic and charting tasks, and with the parallel R&D goals in general ocean mapping technologies. Any increase should:
  - Ensure that R&D funding includes an effective structure to transfer results to industry to support U.S. competitiveness and economic growth, and
  - Include optimizing the processes to enable the rapid transfer of technology developments from R&D to industry, and ensure industry is able to leverage the opportunities to maximize technology transfer.

[1] Statement to House Transportation and Infrastructure Subcommittees on Coast Guard and Maritime Transportation and Water Resources and Environment by Edward Saade, President, Fugro (USA) Inc. September 19, 2016.