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Mr. Chairman, distinguished commissioners and panelists, thank you for this opportunity to address the Commission on Ocean Policy. My name is Andrew Clark and I am President of the Marine Technology Society. The Marine Technology Society (or MTS) is not a trade association, but rather an international, non-profit professional organization within which marine scientists and academicians; ocean engineers and technologists; and maritime law and ocean policy makers meet to exchange knowledge and experiences, and to collaborate on major projects, programs and initiatives. The make-up of our multidisciplinary constituency is as diverse as ocean industry, technology and science itself, and closely tracks the areas of concern to this Commission. Rather than read to you all the disciplines for which MTS maintains active and prolific technical subcommittees, comprised of experts in each field, I have instead provided a list of these at the end of this testimony. In fact, the 8 tenets stated as the purpose of the Oceans Act of 2000 very nearly mirrors our Articles of Incorporation. Among our more than 2000 members are included this nation's major oceanographic research institutions and university programs includin CORE; government agencies including NOAA, the US Navy, and the US Coast Guard (as well as ocean agencies of the governments of the UK, Japan and France); and all facets of the offshore and ocean industry including several Fortune 500 firms, but also many other small businesses that comprise an important part of the ocean community. It is the charter of MTS to bring together all these ocean stakeholders. But since science, education, fisheries and the government sectors have been so well represented at these hearings by other panels, and my colleagues here on this panel from API and NOIA have done so superb a job representing the concerns of offshore oil & gas exploration and production, I would like to limit the focus of my discussion to the remainder of our vital ocean industry, both existing and emerging. First, I will note that much of the data and content of this oral testimony, as well as the written report I'll be submitting, can be found in the State of Technology Reports that are regularly published in our peer-reviewed MTS Journal. I think the Commission will find this publication, along with direct contributions from subject matter expert MTS members themselves, to be valuable resources in compiling your findings.

By some estimates, global ocean industries represent a market on the order of US$750 billion in annual expenditures. Approximately half this figure is attributable either directly or indirectly to the offshore oil & gas industry. The second largest driver, accounting for very nearly a third, is in the support of the navies of the world. I mention these two sectors for, almost without exception, the major advances and breakthroughs in enabling technologies for all the other facets of the ocean industry have come as byproducts of R&D investments made by these two components. Yet both these represent highly cyclical industries, with R&D funding among the first to be cut during periods of financial downturns. And while NOAA, within the Department of Commerce, has several offices intended to nurture ocean research and exploration, there does not appear to be any, (for want of a better term) "Office of Ocean Technology" within NOAA, to support the development of new technologies required to conduct commerce in the ocean. A sustained government investment aimed at achieving an ocean technology "prize" on the long-term horizon could foster continuity and progress in spite of the starts and stops resulting from periodic industry downturns. Prior even to the formation of the Stratton Commission, in 1963, on the heels of the tragic loss of the USS Thresher, another Presidential panel of ocean experts was convened, this one to evaluate our nation's capabilities to locate and recover large objects lost on the deep sea floor. That body, named the Deep Submergence Studies Group (or DSSG) was lead by Admiral Charles Stephan and included among its members Allyn Vine (after whom Woods Hole's ALVIN submersible was named) and Edwin A. Link (inventor of Harbor Branch Oceanographic Institution's Johnson-Sea-Link subs). In their findings, they concluded that rather than develop and try to keep "at the ready" such a deep sea search and recovery capability, that instead, the federal government should foster the development of industries wherein these capabilities would naturally evolve and reside, and thus be constantly refreshed and updated. These visionaries mentioned specifically mariculture, deep sea mining, ocean energy and they even prophetically described the blue-green laser line scanner, decades before its eventual development. They also recommended the creation of Ocean Engineering as a discipline of study, which was in fact the genesis of the Ocean Engineering Departments at Universities around the country today. Last week at our MTS Annual Oceans Conference in Honolulu, during a keynote address in which he described the salvage and recovery of the Japanese fishing vessel Ehime Maru, Admiral Fargo specifically acknowledged that the US Navy and its contractors would not have been able to raise an object so large from such a great depth were it not for the tools and techniques developed by these very, private sector ocean technology firms, many of them small businesses. But, beyond providing investment and incentives for developing new technologies to have on hand in times of national need, if the study of the oceans and the tools to undertake this study are to progress, the US must also make a continuing commitment to update, upgrade and replace the facilities that support these ocean activities. Both the NOAA and academic fleets are in continuing need of upgrade and replacement for which adequate long term funding must be committed.

Oceanographic vessels are not the only marine facilities required to expand human knowledge of the ocean environment. Ships ply the sea's surface in two dimensions with undersea vehicles and sensors providing a third, but to understand the role of the oceans in climate and global environmental change requires consideration of the fourth dimension, namely *time*. Many critical phenomena occur at decadal temporal scales and their study will require the development of an **integrated ocean observing capability**. Sophisticated unmanned systems, including moored high bandwidth telemetry buoys (for continuous retrieval of real time data) and arrays of sea floor sensors must be developed, deployed and maintained. An industry to support these systems does not yet exist, so, as was the case with space exploration, this may be an instance where our government steps-up to become the first stakeholder at the table, with others and other industries to follow. This is also an area ripe for government/industry partnerships, as many of the enabling technologies required already do exist. All that has been lacking has been the motivation (and funding) to integrate these existing systems and technologies for the purpose of sustained, long term ocean observation. A global or even national initiative to do so will in itself spawn the new industries that will be required to design, build, deploy, maintain and continually enhance such a network. Other applications and commerce opportunities for this new capability will naturally follow.

One such potentially beneficial "knock-on" effect that could result from an integrated ocean observing system may come in the form of **improved homeland security**. When taken into account all the Hawaiian and Aleutian Islands, the Florida Keys and islands of New England, the west coast and so forth, our nation has over 80,000 miles of coastline. So immense a border cannot be protected by fences, barricades or posted sentries, but ocean technology will play a major role in its defense. Perhaps systems designed to conduct long term monitoring of ocean phenomena may also be able to serve double-duty as homeland sentinel systems. But in order to monitor and defend our borders, we must first know where they are. Upon **ratification of the Convention of the Law of the Sea** (which we believe could and should occur soon) our nation will be faced with yet another dilemma; one in which ocean technology will play a role in solving. Much of the area which we will have claimed, will be unmapped – indeed, we will not know the actual location of our own territorial borders. Under the CLOS, we will claim the continental shelf extending seaward to the greater of either the outer edge of the continental margin (to a maximum of 350-miles) or to the 200-mile limit of the EEZ.. Extending our claim pursuant to Article 76 of the CLOS could result in an additional 500,000 square miles of US territory. Yet, **only a small fraction of our coast has been adequately mapped sufficient to confirm the outer edge of the extent of our continental shelf**. Rectification of this lack of bathymetric data employing existing assets and techniques may require an unacceptable amount of time, particularly in such critical regions as the arctic where more than one country has an interest in the same territory. **This situation may represent an ideal application for Autonomous Underwater Vehicles (AUVs),** an emerging technology that has just been waiting for a major commercial application in which to mature. AUVs have already begun to demonstrate marked improvements in efficiency when compared with conventional ship-based bathymetric surveys. Major efficiencies will be required in the face of such a daunting challenge, and undoubtedly, both the fields of bathymetric charting and AUV technology will benefit by this marriage of necessity.

Telecommunications is another major (and recently quite cyclical) industry representing on the order of 15% of the overall global ocean market expenditures. It is estimated that there may be as many as 3 billion people on our planet today who have never heard a dial tone; and while wireless technologies are quickly bringing phone service to undeveloped areas of the world that have never been (and now may never need to be) "wired with copper", it is still ultimately **submarine transoceanic cables that connect our continents and that allow the "world wide web" to be world-wide.** Satellites simply cannot match the bandwidth provided by optical fibers. While there is a momentary lull in the previously frantic rate at which fiber was being laid around the globe, Moore's law dictates that demand will soon outpace supply and the rate and depth at which these cables can be laid will once again become burning issues in terms of advancing the state of technology. Further, with the dependence our nation and its economy has developed upon the reliable and secure transmission of data, these cables and their security now represent yet another "border" that must be protected in our homeland defense efforts. We have witnessed viruses perpetrated by ham-fisted hackers and teenage pranks that have had devastating effects on the conduct of our daily commerce. The vulnerability of sea floor cables to such crude (but potentially disastrous) terrorist acts as deliberate anchor or grappling drags are all threats we must now consider. Some existing cable routes may need to be surveyed and undergo remedial work such as post-lay burial or armoring. Government-sponsored investment in R&D might result in tools and techniques that facilitate rapid sea floor repair and splicing vs. the present time-consuming and costly technique of cutting the damaged cable and bringing it to the surface to repair. Shallow water approaches and shore-landings of cables must also be protected against malicious attack. Obviously, ratification of CLOS is of equal importance here also, as the very nature of each and every intercontinental communications cable represents an international, bilateral agreement with all the attendant difficulties and ramifications.

Finally, while none of them alone comprise a substantial portion of the global ocean market, there are a number of smaller enterprises and emerging industries that together account for over US$50 billion per year in expenditures, among them **marine biotechnology, marine minerals mining, mariculture, marine survey and undersea vehicles**. Some enterprises that have been proposed, evaluated and rejected over the past 10, 20 or 30 years must periodically be reevaluated to reassess their relevancy. Some examples include **Sea floor Mining** and **Ocean Thermal Energy Conversion (OTEC).** If the same evaluation criteria once used were to be applied again at today's (or tomorrow's) cost of energy and cost of money, the subsequent result may begin to indicate plausibility in some applications. And it is difficult even to begin to put a price on something like a cure for cancer, which may well come as the result of **drug discoveries from the deep sea,** perhaps facilitated by technology whose very development was enabled and encouraged by this Commission. These discoveries are likely to occur in areas outside US territorial waters, once again pointing to the need for an international agreement.

In closing, I would once again like to offer to this Commission the assistance of our entire organization. In addition to the expertise described at the end of this testimony, we may also be of some help in your charter to convene your meetings at venues around the country, as MTS is comprised of Regional Sections and Local Chapters, all of which we make available to you for this purpose. We wish this Commission the most favorable conditions in its efforts to return a substantive and effective product. Again, thank you on behalf of the Marine Technology Society and good luck.

Marine Technology Society Divisions and Technical Subcommittees

Advanced Marine Technology Division • Autonomous Underwater Vehicles • Dynamic Positioning of Vessels • Ocean Energy • Manned Submersibles • Remote Sensing • Remotely Operated Vehicles • Underwater Imaging	**Marine Policy & Education Division** • Coastal Zone Management • Education • Marine Law & Policy • Marine Recreation • Marine Security • Merchant Marine • Ocean Economic Potential
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