Launch Forth into the DEEP

The mystery and allure of the deep has intrigued and haunted humankind since the beginning of time. From the legends of mermaids, the physical and technological challenge of Challenger Deep, to the phenomena of the Bermuda triangle, there have been many wonders that intrigue society and continue to romanticize ocean exploration. As romantic the concept of a mysterious ocean, humankind has in the 21st century made mapping the deep ocean a priority, and in more recent years, significant financial commitment by many countries has renewed interest and enabled advances in the deeps. This renewed focus will help reshape the direction of science, spawn innovation, enable discovery, and perhaps unlock many of the mysteries held tight by the deeps.

I refer back to a recent editorial (JOT V10N3) where we ask the question, "How much do we actually know about the ocean?" We hear the statements that we know more about the dark side of the moon and the surface of Mars than we know about the ocean. According to a recent article in *Scientific American* we have mapped less than 0.05% of the ocean floor to a level of detail useful for detecting items such as an airplane wreckage or the spires of undersea volcanic vents (i.e., to a resolution of a few metres). No matter the statement, or statistic, we can all agree that despite covering more than 70% of the Earth's surface, we know very little about the ocean, and even less of the deep ocean.

Modern technology and mapping efforts have primarily focused on the navigable portions of the ocean and the parts that would cause concern for surface ships. That 0.05% we have mapped well are the shipping channels and ports and harbours that humankind use for trade and commercial shipping. We have mapped comparatively postage stamp areas for resource extraction and ribbons of seafloor representing the routes of subsea cables and pipelines; we have mapped a portion of the deep ocean in search of MH370, but we have not systematically mapped large swaths of the seafloor in the deep ocean.

A fundamental question is why have we (humankind) not done this? Does the technology not exist to do it; does the international will exist to do it? While the answer is complex and in my opinion yes to both, there is a "BUT." But it's too expensive, but it's too vast, but we must do it.

It is evident that the will does exist internationally to begin the task at hand. On June 6, 2017, Yohei Sasakawa, Chairman of the Nippon Foundation, made a commitment to the world that will change the way we look at the ocean. An excerpt from his speech is below.

Understanding the bathymetry of the global ocean is imperative in not only improving maritime navigation, but also in enhancing our capacity for climate change projection as well as monitoring marine biodiversity and resources. Not only will it promote the

"International Decade of Ocean Science for Sustainable Development" of IOC-UNESCO but also contribute to the Sustainable Development Goal 14. Considering these critical benefits, the Nippon Foundation is partnering with GEBCO, the General Bathymetric Charter of the Oceans, to uncover one hundred percent of the ocean floor by year 2030. (https://seabed2030.gebco.net/)

Countries are supporting ocean exploration and embracing the need to commit the finances required. Trilateral agreements like the Galway Statement shows that international collaboration is healthy in the pursuit of deep ocean mapping. The world is committed to making a difference.

When there is a will there is a way, but it is understood that with current technologies the will, no matter how strong, may perhaps fall short. Current technology will fall short. Innovation and new technologies will enable us to challenge the deep, and begin to adequately characterize it. Traditional sonar technology can reach the bottom of the deep ocean and characterize it better than ever seen before in mapping. Vehicle and sonar technologies have driven science and technology further and further into the deep in hopes of mapping the previously unmapped. But as can be seen from the lessons learned in the MH370 search, traditional ship technology does not provide adequate resolution to characterize the seafloor; other technologies are required to map with appreciable levels of detail. Autonomous mapping platforms – both sub surface and surface – have been changing the approach to mapping over the past decade, with new innovations in this type of technology pushing the envelope and the possibilities of reaching the goals of Seabed 2030.

Technological advances in autonomous systems, subsea communications and positioning will enable considerable advances in mapping the deep. To accelerate this innovation cycle, the Shell Ocean Discovery X-prize inspired a group of innovators to become focused on the task of the deep. The prize identified a need for investment and accelerated innovation, and the need to create technology that is affordable, effective, and able to withstand the deep while collecting data that serves the purpose of the mission. These innovations aim to allow humankind to map the previously unmapped.

The will of nations and the insatiable thirst for innovation will enable us to uncover what we have not been able to uncover. What will the new technologies look like that will map the deep? Robotic, artificial intelligence, swarm technology, autonomous, self-learning, environmentally aware, adaptive, and self-healing. These terms and adjectives appear in the literature that is focused on the technological innovation applied to this problem – the technology that will enable us to begin to reach the goals of mapping the deep. *Proviheto in Altum*.

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