Ocean Mapping Blindsided by Rocket Science?

There remains much work to be done in mapping the Earthâ€™s oceans and a wealth of vital information to be gained. Yet this work seems much less attractive to the public and decision makers compared with space exploration â€“ as evidenced by the huge disparity in budgets for these endeavours.

It's a tired refrain, but one has to marvel at how readily space-oriented investigators are able to mobilise tremendous resources in order to explore remote extraterrestrial bodies. For instance, the Cassini-Huygens Mission to Saturn is now sending back all kinds of detailed imagery from Saturn and its moons, with NASA proclaiming the significance of that information for understanding the mysteries of planetary formation and evolution.

Hello? The floors of the Earth's oceans also serve as an important repository of information that could help us better understand the geological history of our own planet, not to mention the significant – and at times life-threatening – processes that occur along the margins of its tectonic plates. In an era of heightened concern over climate change, environmental degradation, and threatened biodiversity, ocean scientists are severely hampered in their investigations by the paucity of fine-scale portrayals of seafloor roughness and topography. Among other things, these parameters are needed to establish a context for understanding climate change and rising sea levels, to predict the transport of water through deep, intermediate and shallow regions, and to explain the occurrence and distribution of bottom-dwelling species. Yet the global effort to acquire this information on a sustained, systematic basis pales in comparison with the effort and resources that are poured into space exploration.

A NASA website (1) proclaims that the price tag for Cassini-Huygens is nearly US$3.3 billion. It also describes how the spacecraft had to travel for nearly 7 years before it reached its destination, where it began a 4-year mission to scan Saturn and its moons, and to transmit its observations back to Earth.

Reading those numbers, one can only dream about the potential achievements of the world's ocean mappers if they were handed US$3.3 billion and told they had 11 years in which to spend it wisely. Assuming daily operating costs of US$ 40,000 and annual deployments lasting 300 days, that amount of money could pay for more than 250 years of ship-time. This is comparable to the 225 ship-years that would be required to map all parts of the world's oceans that are deeper than 500m, as envisaged by the proponents of the Global Ocean Mapping Project (GOMaP) (Vogt et al., 2000; Vogt, 2000). To complete the task in the 11-year Cassini-Huygens time frame would require the annual mobilisation of 23 ships. Under present circumstances, the early realisation of such an ambitious programme would be manifestly impracticable, but its magnitude illustrates graphically the wealth of resources that are at the disposal of space explorers.

A big part of the problem, of course, is that space exploration is being oversold. While ocean mappers face a continuing struggle for support to improve mankind's knowledge of global bathymetry, space agencies seem to have no trouble maintaining large PR budgets for trumpeting their successes. It should come as no surprise therefore that space exploits register so vividly in the minds of the tax-paying public and political decision-makers who continue to support the endeavour. This is not meant to downplay the accomplishments of space exploration, but it does suggest that aggressive PR programmes could be skewing important societal priorities.

The space programme has another distorting effect, which is to foster the widespread illusion that the Earth's oceans have been thoroughly mapped by satellite. Global maps of synthetic bathymetry derived from measurements of satellite altimetry have their purpose and are useful for many things, but they cannot match the accuracy and detail of acoustic surveys, be they conducted for the safety of navigation or for other applications that require high-level resolution. Yet this truth remains lost in the unending parade of brilliantly coloured maps of altimetric bathymetry that adorn magazine covers and scientific posters, with little or no acknowledgement of the technique's limitations.

Another significant difference between space exploration and ocean mapping on Earth is that, in space, there are no irksome issues concerning national jurisdiction and sovereign rights. If only life could be as uncomplicated here on this planet, where coastal states jealously guard against incursions into their zones of jurisdiction – even in situations where international interests would clearly seem to trump national concerns (for example, where detailed continental slope and rise maps could lead to better forecasts of tsunami propagation and improved preparedness in anticipation of catastrophic flooding). Beyond their exclusive economic zones, few national governments seem willing to commit resources to mapping the seabed unless they perceive a substantial political or economic return for themselves. This situation speaks of a need to channel international diplomacy into a more productive direction, i.e. promoting the common good of mankind instead of protecting the individual interests of states.

Finally, the Earth's oceans lack an effective and unified voice that can call for detailed seabed mapping on a global and systematic basis. This is an area where the international ocean mapping community needs to assume an effective advocacy role in order to convince the world's national governments that, collectively, they must do a better job of describing the seabed. Does an organisation exist with the expertise and energy to articulate such a message, and to then to play a leadership role in orchestrating its realisation?

In a world that is bedazzled by space exploration and distracted by the clamour of events and circumstances that have so far dominated

this century, any voice that calls for a global seafloor mapping programme will have a difficult time making itself heard. But the truth is that better information is desperately needed for understanding the processes that affect the health of the oceans, which is crucial for the survival of this planet's inhabitants. The world's oceans need more attention and they deserve better treatment.

References

-Vogt, P., W-Y. Jung, and D. Nagel, 2000: GOMaP: a Matchless Resolution to Start the New Millennium. EOS, Transactions of the American Geophysical Union, 81(23), 254-258.
-Vogt, P., 2000: Endorsement of Global Mapping Project. EOS, Transactions of the American Geophysical Union, 81(43), 498.

Textbox:
Tithonium Chasma on Mars, photographed on April 29, 2005 by the Mars Express spacecraft which was launched by the European Space Agency on June 2, 2003. A primary objective of the Mars Express mission was to map the entire surface of Mars at a high resolution of 10 metres per pixel, and selected areas at a super resolution of 2 metres per pixel. This image encompasses an area that measures about 75 by 110 km, with a ground resolution of approximately 13 metres per pixel. This level of detail allows investigators to identify processes that have shaped the surface of the planet. Meanwhile, back on planet Earth, few if any oceanic areas deeper than 500 metres have been mapped in comparable detail and over a similar extent. Earthbound investigators are thus deprived of a valuable tool for examining the geological record that is embedded in the seafloor. (Source: Website of the European Space Agency, 2)

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