Battlespace on Demand

Over the past seven years, natural disasters have highlighted the importance of marine geospatial information in support of humanitarian assistance and disaster relief operations. The Boxing Day tsunami, Hurricane Katrina, the Myanmar cyclone, the Haiti earthquake, the Chile earthquake and subsequent tsunami, and the recent earthquake and tsunami in Japan are the most significant examples of natural disasters affecting coastal states and their inhabitants. All told, over 750,000 lives were lost and damages were in the billions of dollars.

Tsunamis and storm surges create unique problems for disaster management personnel. High resolution measurements of topography, hydrography and bathymetry are critical components of the foundation data needed to support precise forecasting of the impacts of these natural disasters. In situ and remote sensors are also needed to provide near real-time input since predicting the magnitude and extent of inundation is a difficult problem that we are only just beginning to address. Our ultimate goal is to provide accurate warnings and timely decision support to government authorities that prevent loss of life and minimise risk.

The US Naval Oceanography programme uses an operational concept called ‘Battlespace on Demand' (BonD) to provide these services. It guides and informs our operational and technical domains, and drives our investment strategy. It enables us to keep our forces safe while enhancing warfighting effectiveness through decision superiority. This operational concept, although tailored to warfighting effectiveness, can be applied to any situation requiring decision making.

BonD consists of four tiers, beginning with the Data Layer or Tier 0, where data from various in situ and remote sources are collected, assimilated and fused to provide initial and boundary conditions that accurately describe the current state of the ocean and atmosphere.

Next is Tier 1, the Environment Layer, where data from satellites, altimetry, ocean gliders, buoys, and other collection methods are analysed to initialise computations. High performance supercomputers run complex, full physics numerical prediction models to continually forecast and verify the future state of the ocean and atmosphere.

Tier 2, the Impact Performance Layer, indicates how the environment modelled in Tier 1 will impact sensors, platforms and people, providing opportunities and restrictions for operations and warfighting. Tier 2 determines the influences on planning, force structure, targeting, timing, manoeuvre, tactics, techniques and procedures. The result is a 'performance surface' that accounts for both the predicted environment and the capabilities and behaviours of the force.

Tier 3, the Decision Layer, is where performance surfaces are applied to specific decision-making processes to quantify risk and opportunity at strategic, operational and tactical levels. We provide actionable recommendations on force allocation and employment that directly enhance safety and warfighting effectiveness.

If BonD is applied to a natural event, such as an underwater earthquake, the simplicity of the concept and its significant results can be displayed. At the moment of the earthquake, geological sensors (Tier 0) determine its magnitude and location, as well as, the potential for tsunami generation. Assuming a tsunami is generated, DART buoys (Tier 0) measure the change in sea level, providing critical real-time input to tsunami forecasting models (Tier 1). These pre-forced statistical models attempt to match the observed data against a forecast propagation database (Tier 1), which provides accurate tsunami wave characteristics to site-specific models (Tier 2) that are used to determine the extent of inundation in an affected area. Disaster management personnel can then use the output of the site-specific model, combined with other information such as infrastructure, population distribution, emergency shelter locations, evacuation routes, etc., to make an informed decision (Tier 3) to mitigate the impact of the tsunami.

Most of us are familiar, and focused on, Tier 0 collection efforts to support safety of navigation. However, hydrography provides foundational data for many applications and purposes, which the International Hydrographic Organization (IHO) has explained in the February 2011 release of IHO Publication C-17, Spatial Data Infrastructures,"The Marine Dimension," Guidance for Hydrographic Offices. C-17 highlights the importance for governments to develop a national SDI strategy that will provide critical data and information to address ever increasing geospatial requirements, such as the disaster response management scenario outlined above.