REVOLUTION IN MILITARY AFFAIRS- DOES HYDROGRAPHY HAVE A PART TO PLAY?

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Abstract:

NATO is intensifying its focus on command, control and communications to better define the environment for military operators. The use of information technology is far more extensive within US forces than with European forces. This Revolution in Military Affairs (RMA) is driven by the use of information technology to gain strategic, operational and tactical advantage by networking one's forces, gaining complete knowledge of the mission space, and striking from long range with near perfect precision.

This paper will address the work in progress within NATO to develop a methodology for characterising the mission space in terms of meteorology, oceanography, hydrography and geography through the proposed concept of the Recognised Environmental Picture (REP) which is partially provided by Rapid Environmental Assessment (REA). The part played by hydrography is crucial to maritime operations and the challenge is to fuse hydrographic information in such a way that the end user has access to a seamless depiction of the mission space environment in near real time. Today's joint operations demand that the mission space across the traditional maritime/land/air boundaries be defined in a coherent fashion.

1. What is a Revolution in Military Affairs?

Military revolutions are major discontinuities in military affairs. They are brought about by changes in militarily relevant technologies, concepts of operation, methods of organisation, and/or resources available, and are often associated with broader political, social, economic, and scientific revolutions. These periods of discontinuous change have historically had significant impact on warfare, and have provided a powerful impetus for change in the military community. They occur relatively abruptly–most typically over two-to-three decades. They render obsolete or subordinate existing means for conducting war[1].

The modern period in general and the past two centuries in particular have witnessed the greatest rate of change. Since the early fifteenth century, the conduct of war has been radically altered eight times. Six of these transformations have occurred within the past 200 years alone: the Napoleonic Revolution; the Railroad, Rifle, and Telegraph

[1] Centre for Strategic and Business Assessment (www.csbaonline.org)

Revolution; the Dreadnought/Submarine Revolution; Armoured Warfare/Air Superiority; Naval Air Power; and the Nuclear Revolution.

The current military revolution and advances in military capabilities on which it is based, began to accelerate during the past decade, and are likely to continue to do so for the foreseeable future. Information technology and net centric principles are transforming the way in which the military uses information superiority to shorten the Observe-Orientate-Decision-Act (OODA) loop in order to out manoeuvre the enemy.

New classes of space, air, ship and ground-based, commercial and military sensors (Electro-optical, synthetic aperture radar, moving target indicator, SIGINT geolocation, foliage penetration, "see-through-wall" radar, unmanned aerial vehicles and unmanned underwater vehicles) and increasingly dense sensor grid will provide future forces with unparalleled information about the operating environment. The traditional platform-centric warfare is gradually being replaced by network-centric warfare.

2. Net Centric Warfare

Information superiority can be defined as " The ability to collect, process, and disseminate an uninterrupted flow of information while exploiting and/or denying an adversary's ability to do the same." This in turn leads to subsequent mission space awareness and dominance. Net Centric Warfare derives its power from the employment of reliable networks linking naval forces with diverse and distributed capabilities. The end result is an operational force afloat connected in near real-time to a network of sensors and data processors ashore and afloat resulting in shared situational awareness, close collaboration and co-ordination of capabilities, and the ability to react quickly to changing or developing situations. This will significantly improve and accelerate the operational commander's decision making process.

Net Centric principles are governed by Metcalfe's Law, which states that the 'power' of a network is proportional to the square of the number of nodes in the network. The 'power' or 'payoff' of Net Centric Warfare comes from the information intensive interactions between a large number of nodes in a network[2]. At the structural level Net Centric Warfare requires an operational architecture with three critical elements: a sensor grid to collect data; an automated processing strategy to convert data into information and knowledge; and a high-speed communications network to enable the process. This structure must be supported by value-adding command and control processes, many of which must be automated to get the required speed of command. This is fundamental to achieving information superiority; to having a dramatically better awareness or understanding of mission space, rather than simply more data. Net Centric 'power' then becomes far greater than the sum of its component parts.

[2] Naval Institute Proceedings, Jan 98. Net Centric Warfare: Its origin and future. Vice Admiral Cebrowski

A force acting with speed, precision and reach can achieve the desired massing of effects that will rapidly limit the enemy's courses of action and break his OODA loop and disrupt his strategy. The more traditional approach relies on the concentration of force[3].

3. Seamless Characterisation of the Mission Space

The mission space has traditionally been compartmentalised as Ground, Air, and Maritime. We have cupboards full of military doctrine based on this convenient division of the operational environment and until the latter part of the twentieth century it didn't really matter. Today the world looks very different; we now conduct the majority of military operations using Joint, and often Combined force structures in the littoral. Weapons are expected to be precise and clinical, often being fired from maritime or air based platforms over great ranges at small ground targets. Marines need to transition from over the sea horizon to well inland. Airmen need to navigate with as much ease over the water as over the ground. In executing operations the ability to visualise where the forces are at any one moment is achieved via the Recognised Air Picture(RAP), Recognised Maritime Picture(RMP) , and Recognised Land Picture(RLP). These recognised pictures are displayed, geo-referenced against an appropriate map or chart. In order to combine or fuse these pictures together we need to depict a transparent joint between land and sea in order to produce a seamless geographic characterisation of the mission space.

NATO is currently working closely with the nations on a proposal to produce an additional recognised picture needed to compliment the above triad. This is the Recognised Environmental Picture (REP) which will provide a full environmental spectrum backdrop against which force manoeuvres are displayed. The REP concept brings together meteorology, oceanography, geography, and hydrography with the aim of allowing the commander to fully understand and exploit the mission space environment.

4. Building the Recognised Environmental Picture

NATO has developed the capability to build the maritime segment of the REP through a new capability known as Rapid Environmental Assessment (REA)[4]. This technique provides the operator with a high resolution, near real time depiction of the environment by collecting and fusing sensor data with historic data to produce the best possible nowcast of the area. This is the starting point for modelling and simulation techniques aimed at providing the highest fidelity forecast of changes within the mission space, and subsequent impact on the mission, over the next 5 days.

The dynamics of the three media are significantly different, meteorology generally having the highest rate of change and hydrography the lowest. Hydrographic data, however, is the most difficult of the three to collect and process for a variety of reasons:

[3] Allied Joint Publication 3.1 – Principles of War
[4] Experimental Tactic 777 - REA

multi-beam and side scan sonar data is slow to collect; the resulting data sets are large; survey data from different systems is not interchangeable; the assets are overt and vulnerable; aerial remote sensing only delivers reliable results to a depth of about 30 meters; and UAV technology doesn't yet offer an acceptable alternative.

In an area where the historic data is old or non existent REA provides a military capability to quickly assist military planners in selecting potential areas for amphibious and other operations. High-resolution bathymetry is collected by a mix of traditional survey techniques and, for very shallow water, employment of airborne lidar. These data sets are merged or fused with larger area, lower resolution bathymetry and topography to generate a seamless depiction of the mission space. Various GIS systems are now capable of geo registering a multitude of data sets, allowing fusion at the boundaries, to produce a product that is ideal for situational awareness but not yet acceptable for navigation. NATO is acquiring a Cartographic Workstation that will have the ability to ingest and manipulate vector, raster, matrix, and a range of other data products for this purpose[5].

5. Net Centric approach to the REP

When the amphibious or mine warfare commander arrives in the area of operations he needs mission space knowledge for the situational awareness necessary to support his decision making process. Speed will be essential, remember the OODA loop. This can best be achieved through a robust processing system and data handling capability ashore and afloat. By coupling sensors and support structure together with a capable communications architecture, a steady stream of timely and accurate data can be passed, processed, and fused to provide mission space knowledge thus enhancing situational awareness. The sensor grid to achieve this sampling consists of depth sonar data from all military units in the area, survey ships, airborne lidar, and eventually AUVs. This data should automatically be tested for quality before being processed, passed to a suitable GIS, fused into a product suitable for providing situational awareness, and then passed back to the afloat commander as part of the REP.

6. The challenge to the Hydrography community

The technology is available to achieve this 'in-stride' capability to sense the environment, process the data, characterise the mission space seamlessly, and increase situational awareness in a timely fashion. The military requirement for situational awareness is different from the hydrographic requirement for navigational quality; one major difference is time to produce an IHO product. The military commander needs the highest quality information consistent with situational awareness in the shortest time possible. The challenge is to address the standardisation and interoperability issues necessary to allow fusion of data from different sources, to pre-process data afloat in order to reduce digital file size, and to utilise communications that will allow near real-time transfer of data in a true Net Centric fashion. Hydrography can then claim its rightful place in the current Revolution in Military Affairs.

[5] NC3A GIS User Requirements Document. Jan 01