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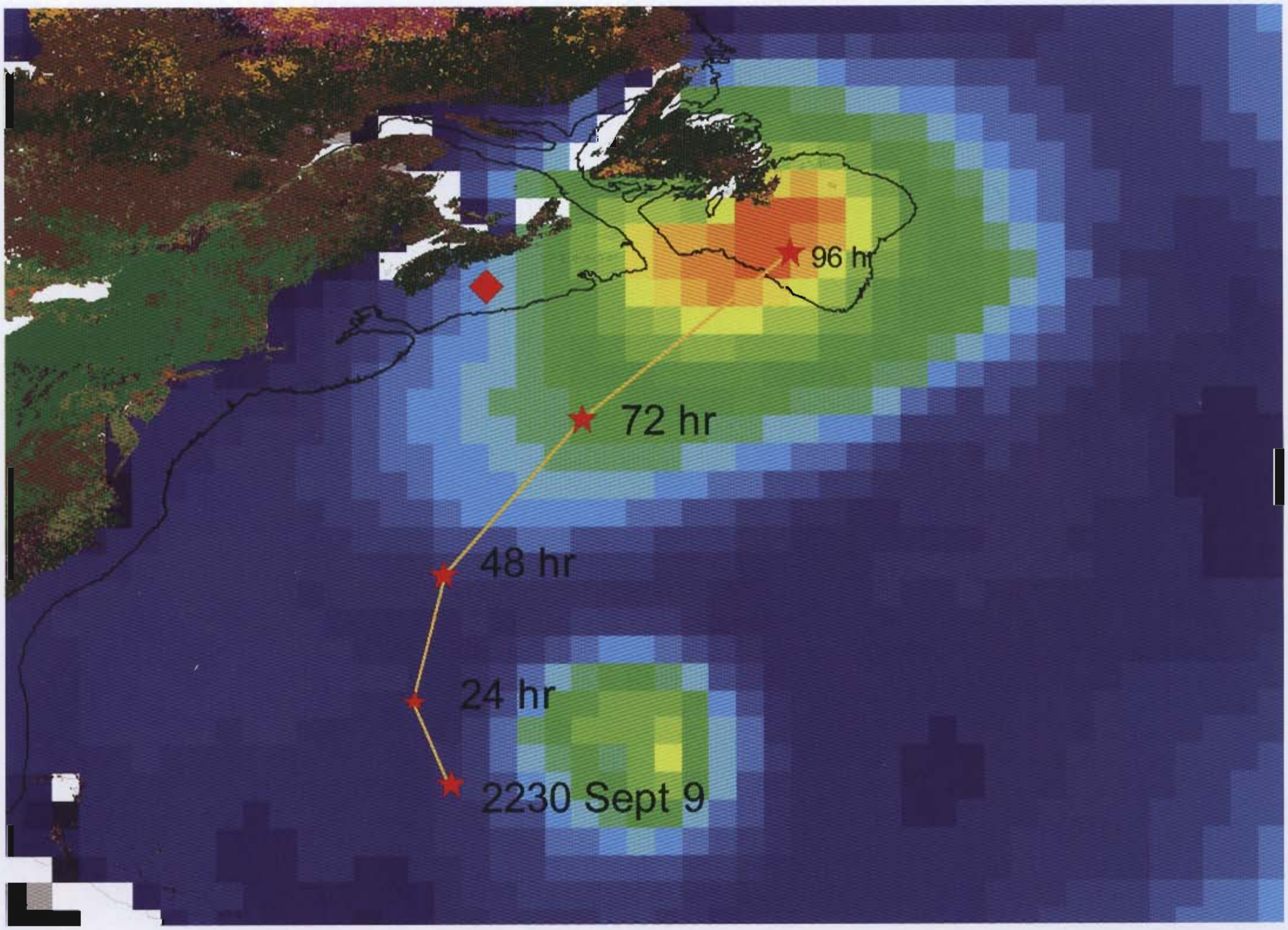

The Utilization of Web Services while at Sea

by Anthony W. Isenor and LCdr Robert A. Stuart[1]

Résumé: Au début de septembre 2006, le NAFC Quest se trouvait sur la Plate-forme Scotian pour mener des essais d'ingénierie dans le cadre du Projet de démonstration de technologies pour la guerre sous-marine en réseau. Pendant que nous étions en mer, nous avons eu la chance d'avoir accès aux services Web offerts par deux ministères fédéraux, soit Pêches et Océans et Ressources naturelles Canada. Un système commercial installé à bord constituait une solution à faible coût offrant une connectivité Internet standard. Grâce à un logiciel commercial, on disposait d'un outil de cartographie et de géolocalisation qui permettait aussi d'accéder aux services de cartographie Web. Vu la facilité avec laquelle on a obtenu l'information et la géolocalisation du contenu des services, il faut considérer que l'utilisation de services Web en mer est une méthode plausible de cueillette d'information.

The first storm of the 2006 season to influence Eastern Canada was hurricane *Florence*. *Florence* had its greatest impact on Newfoundland on September 13. For the most part, Nova Scotia residents escaped its influence.

The above is a very 'land centric' view of *Florence's* influence. Those at sea typically have a much different perspective. For ship personnel, both the wind and sea state resulting from such weather systems are a concern.

On September 5th 2006, DRDC Atlantic's Canadian Forces Auxiliary Vessel (CFAV) Quest[1] departed Halifax for an engineering trial in Emerald Basin on the Scotian Shelf. The cruise was in support of the Networked Underwater Warfare (NUW) Technology Demonstration Project. Essentially, our sea time was intended to test communications equipment and application software in support of network-enabled operations (NEOps). The NEOps concepts revolve around the sharing of disparate pieces of information from all platforms within an operational force. In other words, data collected by a particular platform is shared and then combined with similar data collected by other platforms.

Of course, present military operations utilize shared information among the participants. However, the present sharing is largely based on voice communications or specialized data streams. In terms of data, the sharing is conducted over very specialized networks which only support specific message structures unique to that network. As well, these message structures only support the sharing of verified content. In other words, the structures support the sharing of content which has known accuracies. Voice communications are then utilized to share non-verified information content that allows collaboration between operators on the platforms.

NEOps effectiveness is greatly enhanced by the ability to share non-verified digital information. In a way, it is similar to a voice communication that would consist of someone saying "My sensors are picking up something of interest over there. Do your sensors detect anything in that area?"

In concept, the sharing of such information may sound like a rather straightforward operational goal. However, the complexities of establishing data-sharing links between software applications that were independently developed for the various platforms, is not a trivial task. As well, the existing network does not support distribution of such non-verified digital information.

The NUW engineering trial tested four networked nodes placed on two platforms, the CFAV Quest and the National Research Council[2] (NRC) Convair 580 airplane. The NRC Convair has an established record of collecting data in extreme conditions (e.g., they sometimes intentionally fly into hurricanes). In this trial, an Internet Protocol (IP) based network was created between the platforms. The network utilized military communication radios and sub-network relay hardware developed in Canada (i.e., Rockwell Collins, Inc., formerly IP Unwired Inc.). This allowed the formation of an ad hoc network that could transmit non-specific message content.

The NUW engineering trial was planned for September 5th to 15th. *Florence* passed by eastern Canada from September 11th to 14th. Although we didn't know it at the time, a CFAV Quest mechanical problem on the evening of September 10th would result in an early termination to the trial. We returned to Halifax on the morning of September 11th.

During the six days we were on the Scotian Shelf, we were very cognisant of the approaching storm. Of course, we were trying to obtain as much weather, wind and wave information as possible. Such information is useful for the planning of the daily operations including airplane arrival times, and the deployment and recovery of ship-based sensors.

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[1] Defence Research and Development Canada – Atlantic
Dartmouth, NS, Canada

Traditional means provide weather and sea information through text based weather reports obtained from Environment Canada web pages. In this particular trial, CFAV Quest also had access to a Department of National Defence (DND) secure network. This allowed access to the DND Meteorological and Oceanography (MetOc) office in Halifax. The MetOc provides an assortment of environmental products, some produced at the MetOc office and others obtained from sources such as Environment Canada. These products are typically text or image based.

Text or image based products provide limited usability due to the static nature of the product. Text and images can be printed or viewed but manipulation or combination with other products is difficult. Now, the emerging trend is to provide products through web services over the Internet. Fortunately, we also had internet access through commercial satellite links, at a cost of about $7 Cdn per megabyte.

The internet connection combined with a commercial Geographical Information System (GIS) or mapping software, provided access to the web mapping services. The user simply directs the software to the provided services, expressed in a fashion similar to an HTTP address. The software then queries the address and obtains a list of available services, which are based on the web mapping service (WMS) standard. The Open Geospatial Consortium[3] (OGC) has established the WMS standard, and it is compliance with this and related standards that make the disparate services act as one integrated system.

The specific service of interest to us was the wave forecasts offered from Fisheries and Oceans. Wave conditions have obvious importance to the general comfort on-board a ship but they are also important for estimating noise levels in the water. As well, wave conditions are important during the launch and recovery of our sensors.

The wave forecast service was accessed through an established internet connection. The web service infrastructure automatically provides a list of available products – in this case a list of one hour forecasts over a 48 hour time period. The specific forecast time was then selected from the available list.

The wave forecast model output is offered as a service from Fisheries and Oceans[4] (Bedford Institute of Oceanography). We also accessed land-based overlays from the Canada Centre for Remote Sensing (Natural Resources Canada). The land overlay provided the necessary spatial context. The total process, from sitting down in front of the computer to printed product, took about four minutes.

So how is this better than simply downloading images from the web? The answer is the geo-referencing. Although the answer appears simple, the implications are immense. Images downloaded from web pages typically show a coastline and thus can be geo-referenced by the human eye - in a sense they are “visually” geo-referenced. However, the web mapping service provides the geo-referencing in the software environment. This provides one with the capacity to link multiple mapping services, and interact with these overlays in a geo-referenced manner. Of course one can still create visual products; but the strength is within the software environment. Mapping software also allows the user to create customized overlays which can also be added. An example of a customized overlay is the digitized storm track. While at sea, we were digitizing text-based messages of the predicted storm track and overlaying this with web mapping service content (see Figure 1on next page).

Many software applications provide access to web mapping services. We were using a demonstration version of a commercial off-the-shelf mapping tool. Since the obtained information is geo-referenced and seamlessly loaded into the mapping tool, other functions available in the tool can be used to provide additional information. For example, closest approach distance between the predicted storm track and the ship’s operating area is a matter of three mouse clicks; or, the ship’s track can be added from data feeds from a Global Positioning System input. Bathymetry can be automatically added as another overlay, thus providing context with bottom features.

The software environment allows the user to easily provide value-added products and information. The distributed nature of the services means the products remain under the control of the originating organisation and the local expertise that generated the product. As well, the services used here represent the combination of information from two separate government departments. It is very unlikely these departments were aware the other had complementary products available through web services. This is truly the power of web services - the combining of independently designed and built applications into a single system.

Summary

In early September 2006, CFAV Quest was on the Scotian Shelf conducting engineering trials in support of the Networked Underwater Warfare Technology Demonstration Project. While at sea, we were fortunate to have access to web services available from two government departments, Fisheries and Oceans and Natural Resources Canada. An on-board commercial system provided a low cost solution enabling standard internet connectivity. Commercial off-the-shelf software provided a mapping and geo-referencing tool which also enabled access to the web mapping services. The ease of obtaining the information and the geo-referencing of the service content makes the use of web services while at sea a plausible method of information gathering.

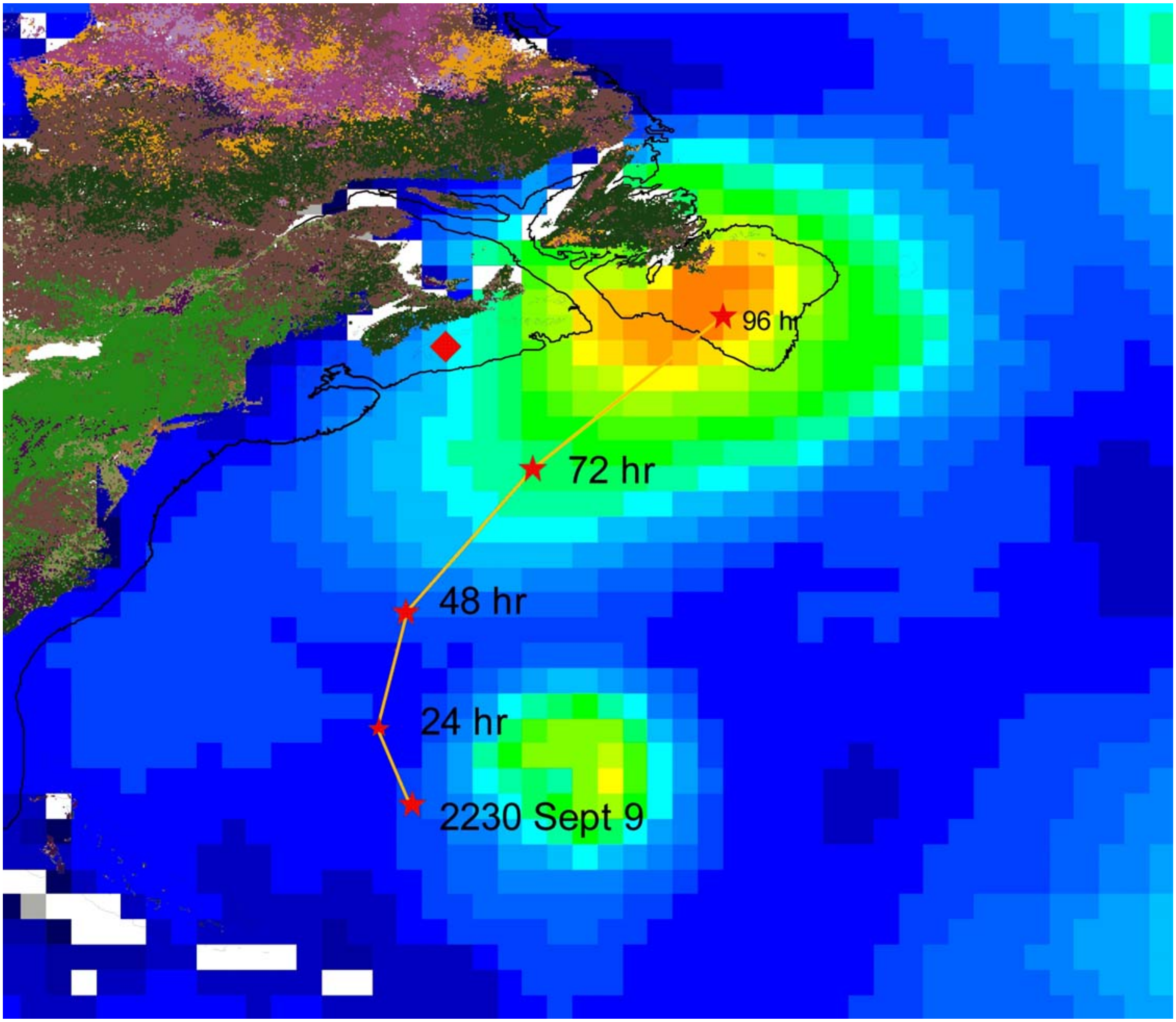

Figure 1. An example of combining two web service products. The coastal overlay was obtained from the Canada Centre for Remote Sensing; the coloured significant wave height forecast from Fisheries and Oceans; and the storm track of *Florence* (orange line) is based on a weather report from September 9, at 2230 Z. The operating area of the CFAV Quest is denoted with a red diamond. Maximum wave heights south of Newfoundland are about 8 m. The wave forecast was generated at midnight on September 12. The wave forecast corresponds to September 13, 2200 Z. A partial 200 m isobath is shown as a black line. The elevated wave heights east of Florida are the influence of hurricane *Gordon*. Also shown in colour on cover page.

References

1. For information regarding CFAV Quest, see http://www.drdc-rddc.gc.ca/ .

2. See National Research Council website at http://www.nrc-cnrc.gc.ca/ .

3. See Open Geospatial Consortium website at http://www.opengeospatial.org/ .

4. For a significant wave height forecast example, point your web mapping service to:
http://bluefin.mar.dfo-mpo.gc.ca/wmsconnector/com.esri.wsit.WMSServlet/ofcast_c_hs?