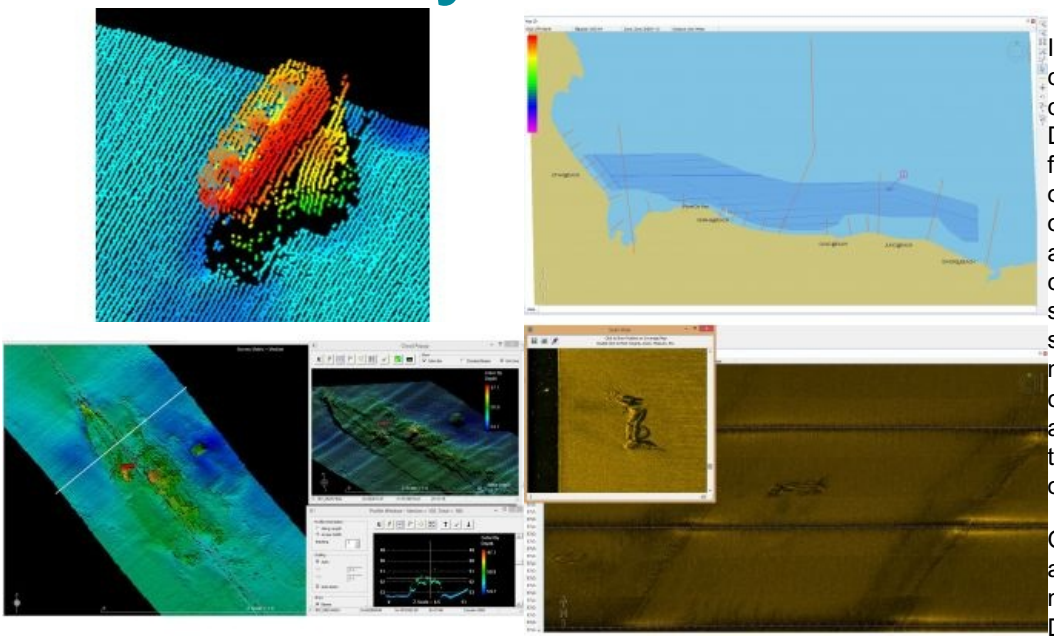
AMBITIOUS PROJECT COLLECTING TERABYTES OF HIGH-RESOLUTION BATHYMETRIC DATA

Hydrographic Survey of the Normandy Beaches



In the summer of 2013, several companies and individuals volunteered to conduct a hydrographic survey off the D-Day beaches of Normandy, France. The first phase of the survey was conducted over the course of 27 days. The purpose of the survey was to collect as much data as possible with multibeam sonar to create a map of both bathymetry and side-scan data. Throughout the survey the survey lines were adapted as the end neared to ensure that the data set was complete without any gaps. This required assessing the importance of some areas to determine if they should be eliminated or preserved.

One aspect of the survey was to locate and identify possible targets that could be missing tanks. Of the tanks launched on D-Day at Omaha beach, 27 of the 29 were lost before they reached the beach. The tanks left the landing craft in deeper water with the intention of propelling themselves to the beach, but rough water conditions resulted in many of them sinking before reaching the objective. Figure 1 is a screen capture of a tank that was discovered during the survey. Many of the planned lines running parallel to the beach were in excess of 40 kilometres long. The line spacing was 140 metres with the sonar set on an 80 metres range scale. Figure 2 shows a map of the area surveyed.

The Survey Vessel

The survey was conducted aboard a catamaran sailboat which provided a very stable platform, allowing the vessel to stay out in conditions that would have sent other vessels into port. The size of the sailboat provided a large room that was converted into a survey space for all of the equipment that was needed. The sailboat was chosen in part for the ability to provide a stable platform as well as house the number of people involved in the survey.

Equipment Used to Survey

All of the equipment and software used on the project was supplied through each vendor as a donation to the overall project. The Trimble GPS provided positioning with RTK precision via satellite corrections and also post processed using a land base station centrally located to the survey in the Normandy region. The sonar used in phase one was an EDGETECH 4600, with a R2Sonic 2024 used in phase 2. The motion reference unit was a Coda F-175. All of the data was collected using Discover software recording JSF files and the HYPACK®'s HYSWEEP® software recording the HSX files.

The Collection of Data

There are many challenges in dealing with surveying such a large area. There were over 176 planned lines of data that were collected during the survey. With the survey being conducted on a sailboat, the weather played an important part in running the lines. A line that is

over 40 kilometres long takes between 5 and 6 hours to run at a decent survey speed. With the tidal changes in the Normandy region, this caused the survey to turn in the middle of a line on many occasions, returning later to finish the section of line that was missed. The section that was missed may have been surveyed many hours later or even days later in some cases.

The Data

The data was recorded in several formats with as much emphasis on recording raw sensor input as possible so that each piece could be post processed to produce the best possible map of the bathymetry and side-scan information. The overall dataset consists of files that amount to more than 11 TeraBytes of data. The files that were used to create the side-scan mosaic amount to more than 414 GigaBytes of HSX files. The amount of raw JSF files recorded fills up most of the 11 TeraBytes stored. During the survey, the files were broken up into 15-minute files automatically to maintain a size suitable for editing. Every hour online resulted in approximately 10 million soundings with 1Gb of recorded side-scan and bathymetry files. Even with this time limit per file the size of each HSX file was roughly 250 MegaBytes. The total number of soundings per day equaled around 240 million on days when the boat surveyed 24 hours straight. When phase one was complete the data covered an area of approximately 511 kilometres square.

The Processing of the Data

The data is still being analysed and processed. A complete mosaic was generated that consists of over 600 individual geo-referenced images. To make the mosaic, the files from four adjacent lines were processed together. By using four lines at a time, the overall size of the mosaic tiles could be kept relatively small while still allowing the programme to use a high resolution of 0.1m per pixel. To put that into perspective, if the mosaic was in a single image, there would be 1,022,000,000 pixels. When the total bathymetry is processed, a contour map will be created at 1x1 metre resolution. Figure 3 is a screen capture of the mosaic that was generated showing a section of the American Harbour, which was destroyed in a storm shortly after D-Day. During the processing it was possible to utilise post-processed position and motion data to enhance the results. With 240 million soundings a day over the course of 27 days the goal of collecting as much data as possible in the area was achieved. Figure 4 shows a destroyer that was lost during the invasion being processed.

Diving Operations

When a target was located and determined to be of particular interest, the dive team would be deployed on a Rigid Inflatable Boat to go and investigate. On several occasions the lead diver would consult with the survey team prior to planning the dive. The survey data was displayed in both side-scan and 3D so that the divers could get an idea of the location of items of interest. This is similar to looking at a map before going somewhere in that it provides landmarks for the divers to reference underwater.

Documentary

The overall project was funded as part of a documentary that will air on the PBS channel and is a NOVA special. At various times during the survey, a camera crew would ride along documenting the work as well as the diving operations. Information about the documentary can be found by following link 1.

Jerry Knisley has worked for HYPACK, Inc. for 16 years as a member of the technical support staff. He is currently the manager of the Technical Support department. Prior to joining HYPACK he was a sonar operator in the US Navy Submarine Service.

Andy Sherrell received his BSc degree in Ocean Engineering from the Florida Institute of Technology and has over 15 years of experience in the oceanographic community. Andy's work includes being first on scene to locate an airplane's 'black box' to working with film crews to find and document historic shipwrecks.

Damon Wolfe is a product line sales engineer with EDGETECH. Damon spent four years with the US Army Corps of Engineers (USACE) where he worked on a variety of surveying and remote sensing projects including hydrographic surveying, topographic surveying, geodetic surveying and photogrammetry.

More Information

http://bit.ly/1hHz4KU