HYDROGRAPHIC SURVEY COMMEMORATES 70TH ANNIVERSARY OF D-DAY

HYPACK at Normandy Beach
A team of international scientists has surveyed the Normandy coast to reveal how the greatest naval invasion in history unfolded. Utilising the latest technologies and the world's most advanced software, the team surveyed 511 km$^2$ of sea floor, producing an enormous 11 TB of data. Employing HYPACK hydrographic surveying software, the team was able to assimilate over 4 billion soundings from multi-beam sonar to produce very high resolution colour 3-dimensional images of the seabed, including many remaining artefacts from the D-Day landings.

“The Normandy seabed is effectively a massive archaeological site,” explains Harold Orlinsky, General Manager, HYPACK, “However, the sunken items left behind by this momentous event are starting to disappear, and the D-Day landings took place on an enormous scale, resulting in the deaths of thousands of troops, so the surveying project was undertaken to honour those that passed, and to explore the wrecks before they disappear forever.”

BACKGROUND
On 6th June 1944 the largest, most complex amphibious landing in history took place on the beaches of Normandy, France. The military operation began the liberation of German-occupied northwestern Europe and contributed to the Allied victory in World War II. Operation Overlord was the codename for the Allied invasion and the assault phase of Operation Overlord was known as Operation Neptune.

The term 'D-Day' is a military designation used to indicate the start date for specific operations; but the Allied invasion of Northern France is by far the most famous D-Day. Operation Overlord took three years to plan and involved military tacticians, scientists and engineers; working together to develop equipment and methods capable of transferring an army across the English Channel. Many of the innovations that were employed were previously untested in warfare, and the Normandy seabed offers an insight into the ingenuity of those involved.

The invasion fleet of almost 7,000 vessels was comprised of warships, minesweepers, landing craft, ancillary craft, and merchant vessels.

Aerial support was provided by nearly 11,000 planes and by the end of 11th June over 300,000 troops, over 54,000 vehicles and over 100,000 tons of supplies had been landed on the Normandy beaches.

In anticipation of the invasion, the Germans had heavily fortified the Atlantic coast over a number of years

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and the Allies suffered heavy losses. As a result, the seabed is littered with an enormous number of wrecks and other military assets including those that were developed in the 3-year operation that led to D-Day.

The Germans believed that Calais would be the most likely invasion point because it has a port and is the closest point in continental Europe to Britain. Calais was therefore the most heavily fortified region. Nevertheless, Field Marshal Rommel believed that the Normandy coast could be a possible landing point, so he built concrete gun emplacements at strategic points along the coast, and to counteract landing craft and impede tanks, he placed wooden stakes, metal tripods known as hedgehogs, mines, and large anti-tank obstacles on the beaches.

Five beaches were targeted by Operation Neptune: UTAH and OMAHA were the code names for the most westerly beaches which were the location for an amphibious assault by American troops. British troops formed the assault at GOLD and SWORD beaches, and Canadian troops stormed JUNO beach.

As the Supreme Allied Commander of the Allied Expeditionary Force, General Eisenhower was under enormous pressure to launch the invasion. With vast numbers of troops ready for action and every day that passed further risking German discovery of the plan, extremely poor weather conditions meant the invasion was delayed. Lower tides were also a factor in the determination of the invasion date because a lower tide extends the period in which landings are possible. Eventually a ‘col’ (interval of calm weather) was identified and a final and irrevocable decision was made: D-Day would be 6th June 1944.

ALLIED INGENUITY

Despite the col, sea conditions were extremely difficult during the landings and resulted in a significant loss of military assets. For example, the hydrographic survey revealed sunken tanks in otherwise ‘good’ condition that had sunk before reaching the shore. These DD or Duplex Drive tanks, nicknamed ‘Donald Duck tanks’ had been fitted with folding floatation screens that were supposed to make them buoyant, and they had a propeller powered by the tank’s engine to drive them in the water. The survey showed that many had sunk and this has been attributed to the rough sea conditions and because some were launched too far out to sea. It has been noted that some of the tanks which successfully made it to shore were manned by troops with peacetime sailing experience which meant that they were able to navigate effectively whilst minimising the effects of the waves and water ingress.

The DD tanks were just one of a group of tanks that became known as ‘Hobart’s Funnies’ after Major General Percy Hobart. A wide range of tanks were developed from existing models to undertake specific functions. For example, the ‘Crocodile’ was a Churchill tank modified by fitting a flame-thrower in place of the hull machine gun and another was adapted to be able to launch 40 pound mortars known as ‘flying dustbins.’

A number of other innovations were still evident on the Normandy seabed. Evidence of wooden boats no longer exists, but a wide variety of metal vessels were identified in the survey. For example, the Allies were aware of the need to reduce the time for troops to disembark and Jackson Higgins, a boat manufacturer from New Orleans, designed a range of boats that were employed extensively on D-Day. Higgins’ boats were able to deliver large quantities of men and equipment quickly from ship to shore, without the need for established harbours. His various boats included the LCVPs (Land Craft, Vehicle, Personnel), special craft designed to carry infantry platoons and jeeps to shore. With a front ramp, Higgins’ boats were able to reduce unloading time which saved many lives.
Consequently, years later, General Eisenhower said “Higgins won the war for us.”

Churchill believed that Operation Overlord would be unable to deliver large quantities of heavy equipment without access to a port, so he instigated the development of two artificial harbours that became known as Mulberry Harbours. Following trials with initial designs, the components of the harbours were manufactured in the UK, towed across the English Channel and assembled off the coast of Normandy. Mulberry A, was constructed at Omaha Beach and Mulberry B (nicknamed ‘Port Winston’), was constructed off Arromanches at Gold Beach.

At 25 meters long and 12m wide, the catamaran was large enough to enable 24/7 operation over a survey period that ran over 6 weeks. Water depth varied up to 100 metres and the catamaran sailed back and forth, scanning ‘swaths’ 40 miles in length.

In contrast with conditions during the D-Day landings, the weather conditions during the survey were relatively calm and the onboard team even managed to turn the engines off and survey under sail at one point. In the first phase of the work, 350 separate wrecks and debris were marked, and in the second phase 50 specific targets were scanned to create highly detailed 3D images. For example, the wreck of the USS Susan B. Anthony was scanned. This was a 483ft. troop transport ship that sunk when it struck a mine in a ‘swept’ channel on 7 June 1944. However, in this case, all 2,689 people aboard were saved.

The survey team did not find any unexploded devices, but did scan many items that had been the victims of such explosions. In addition to British and American equipment, the survey also found the German U390 submarine, which was sunk on 5th July 1944 by depth charges.

The HYPACK software combines tools for planning the survey lines to be run, collating all the data from the multi-beam system, motion reference unit and GPS, plus a powerful post-processing and display package. The end result is the 3D images, such as those collected during this survey, that make it possible to ‘see’ underwater. It is even possible to create animations to give the viewer an impression of being able to fly above the seabed.

Describing the work to handle the enormous quantities of data produced by the 4 billion soundings gathered by the survey, HYPACK’s Jerry Knisley says: “The Log Backup Time was set to 15 minutes to limit the size of the recorded files – this started a new file every 15 minutes in HYSWEEP. However, each HSX file was still around 260 Mbytes, which meant that we were handling 1 Gbyte of data per hour.
SUMMARY

HYPACK provided a number of key tools to complete the survey, providing full support and onsite assistance. Their Harold Orlinsky says: “We were immensely proud to be involved in this project; not only because it demonstrated the enormous power of HYPACK software to manage vast amounts of data, but also because there are very few eye-witnesses left from D-Day, and the project provided a unique opportunity to reveal the detail of this underwater graveyard.”

Today, twenty-seven war cemeteries hold the remains of over 110,000 dead from both sides: 77,866 German, 9,386 American, 17,769 British, 5,002 Canadian and 650 Poles.

Emphasising the importance of remembering D-Day, Harold says: “Operation Overlord represents a vital moment in the history of the free world, and it was an honour to be part of the team that commemorated the 70th anniversary by documenting the remaining artefacts of this epic event.”

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Xylem Analytics UK manufactures environmental monitoring instruments and systems. Formerly known as YSI, the group is a market leader with a reputation for high levels of accuracy and reliability. The company’s water quality measuring instruments are designed for both laboratory and field use. In addition to bench top and hand-held instruments, Xylem Analytics also builds monitoring systems and wireless networks that are able to operate in remote locations and challenging environments. The company’s water quality monitoring sondes can be fitted with a wide variety of sensors including dissolved oxygen, PH, temperature, turbidity, conductivity, salinity, ORP, chlorophyll, open-channel flow, vented level, ammonia, chloride, rhodamine, depth photo synthetically active radiation.

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