

THE American Surveyor

A FOOT IN THE PAST... AN EYE TO THE FUTURE

June 2005

IRAQ

Rebuilding Infrastructure
with technology

D-Day Mapping

The greatest collaborative
mapping effort in world history

Laser Scanning

Assessing damage in a
parking garage collapse

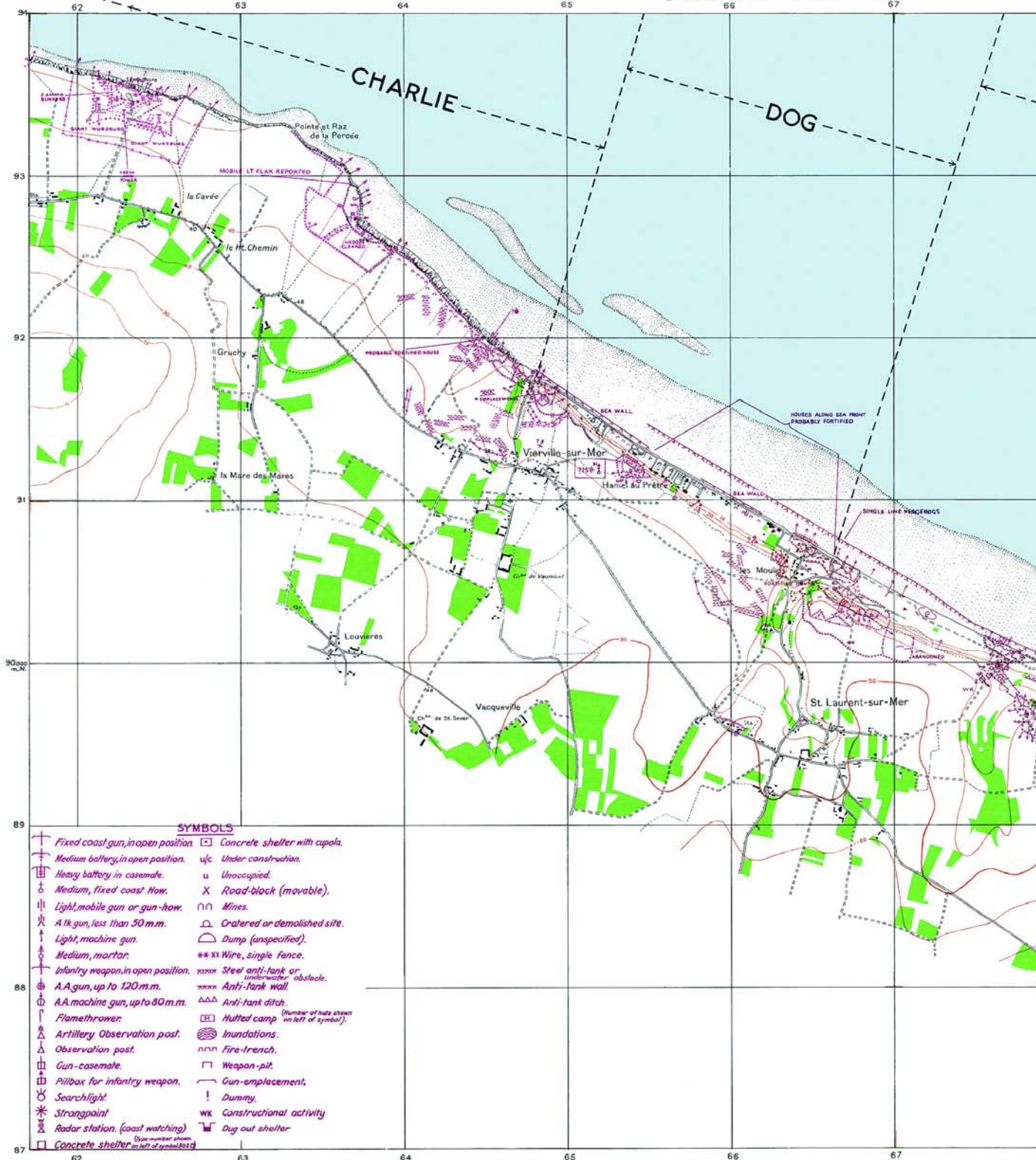
United States National Grid

To round or truncate;
that is the question



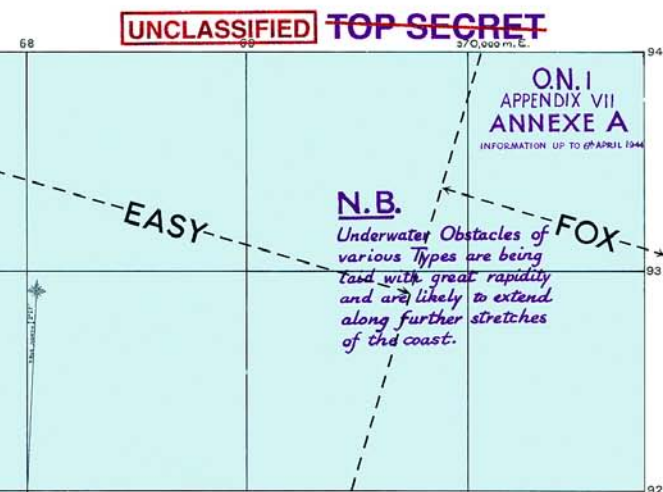
\$4.95

OMAHA AREA

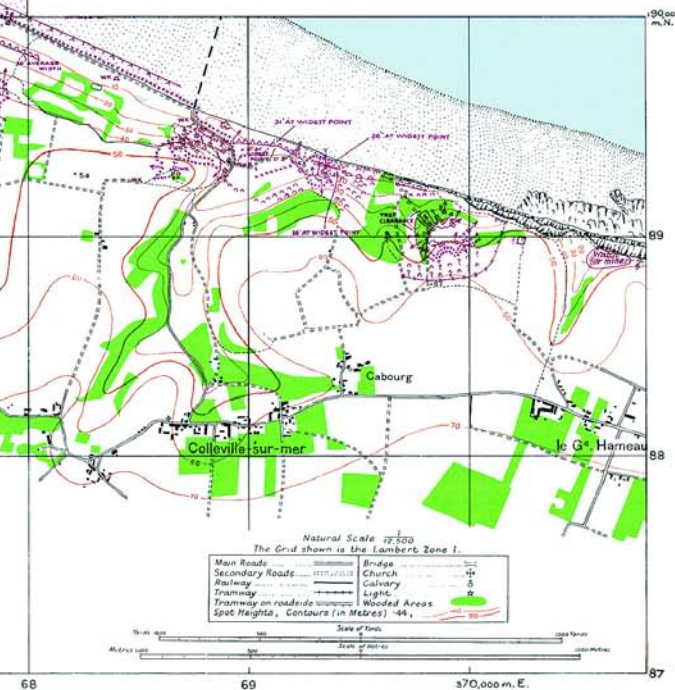


Printed under the Superintendence of Vice-Admiral Sir John Edgell, K.R.E., C.B., F.R.S., Hydrographer.

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Mapping and Charting for the Greatest Collaborative Project Ever >> By Alan Gordon



On the cold grey morning of the 6th of June 1944 the greatest armada that the world has ever seen slowly plowed its way toward the heavily defended beaches of Normandy. Known universally as D-Day, Operation Overlord, as it was then called, was an event that to most is now remote history, overshadowed by recent conflicts in the Gulf. But there is little comparison in terms of scale, complexity and collaboration. D-Day could not have succeeded without what was definitely the greatest mapping project ever. >>

An extract of the D-Day planning map of Gold Beach. The magenta symbols depicting enemy gun positions and fortifications were reproduced from hand drawings.

Left: Extract from GSGS 4490, Ouistreham Sheet showing the incredible level of intelligence on the German defenses and the beach areas.

By 1942 the Germans were well aware that the Allies would at some stage attempt an invasion of occupied Europe and as time progressed it became more certain. However, there were two great secrets. *When* would the attack come and *where* would it take place? In the case of the *where* question, among the first to know were the chart and map makers of the Royal Navy and Royal Engineers. To help maintain the secret, bogus map demands for areas other than Normandy were generated. And even unmarked maps and charts of Normandy were not to be left on the desks of the planners for, although showing no classified information, their very use would give away the secret.

Maps and Charts

As with any military enterprise, maps and charts were involved at all stages of the operation from the very beginning when they were the basic tools used in choosing the landing beaches through to the infantryman reading his map in action. This article gives a very brief overview of the production and distribution of those millions of maps and charts.

The Hydrographer of the Navy was responsible for the naval surveying and charting. The Director of Military Survey's responsibility was to provide all the land mapping, air charts and associated geodetic data necessary to support the planning and execution of the invasion whilst, of course, having no access to the ground concerned. The nautical and land products, as now, were fundamentally very different. The hydrographic chart is a monochrome

product drawn to a Mercator projection, showing predominantly soundings with only the barest of detail of the coastline and the geographic graticule used to fix position. The land map user relies on grid coordinates and wants a wealth of topographical detail if possible, shown in multiple colors. To support the needs of the naval vessels bombarding shore targets, the Hydrographer produced special hybrid "chartmaps" that combined sea and land data.

The Hydrographer's Story

The disastrous Dieppe Raid in 1942 showed that attacking a harbor was unlikely to succeed, hence the assault forces would have to land on a beach and provide their own harbors. The Hydrographer's first task was to collect

Observing was a dangerous occupation as it obviously required the observer to raise his head to the theodolite and then hold it steady!

and then present the data to allow the planners to select the beaches against criteria relating to tidal range, beach geology and gradients, etc., as well as the military considerations. Having chosen the Normandy beaches, more detailed information was required to select the areas suitable for the prefabricated harbors, known as "Mulberries." To do this, a small specialist hydrographic surveying unit was formed and equipped with landing craft converted to carry the surveyor's instruments. These vessels made a series of clandestine crossings on moonless nights and, using a ship-mounted version of the RAF's radio position fixing system (later to be developed into the Decca Navigation System), an early version of the echo sounder and a nine-mile long

taut wire measuring device, they surveyed the waters off the Normandy coast.

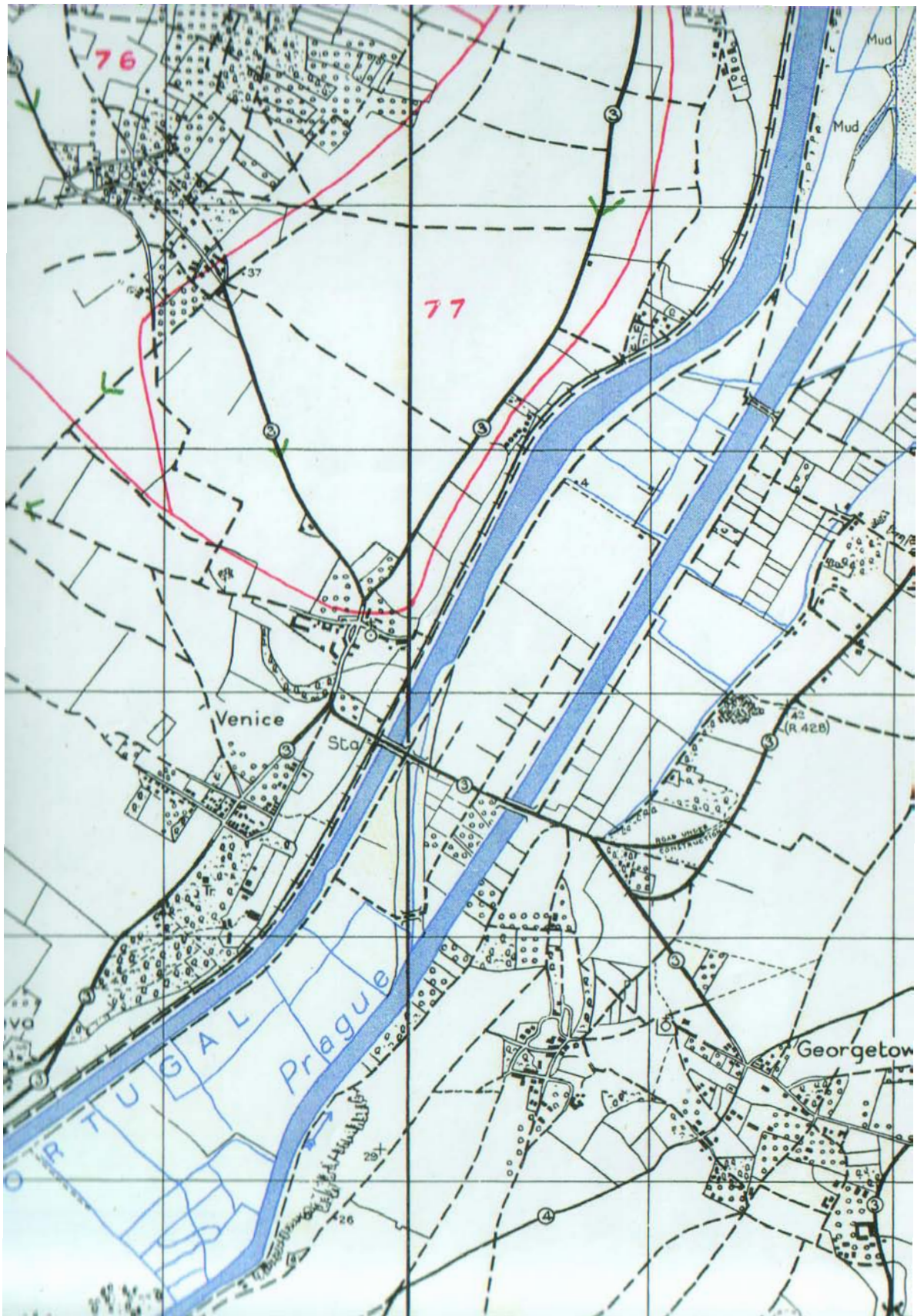
In addition to the standard charts of the Channel and the Bay of Seine, a mass of special maritime products were produced during the lead up to the invasion. These included chartmaps, beach chartlets, route and passage chartlets, berthing charts, charts for the covering and hunting screens, radar charts, fighter control gridded charts, plotting charts for the Mulberries, a special English Channel Handbook, coastal views, shoreline sketches, and tide and astronomical tables, all with a very high security classification. Packs were made up comprising the selection of products needed by each unit for the assault. In all 30,720 packs were distributed immediately prior to D-Day.

The hydrographic vessels, HM Ships *Scott* and *Franklin* and fourteen smaller craft, played a vital role during the assault and the follow-up period. Their first task was to lay buoys to mark the assembly areas for the huge fleet and then to mark the mine-swept channels leading to

Normandy. As soon as troops landed, rapid surveys of the beach areas were carried out to identify uncharted dangers and to assist the beachmasters in determining the best places for the follow-up landings. At the same time detailed surveys were made of the areas planned for the two Mulberry harbors, and the positions of the piers and breakwaters buoyed.

As each Channel harbor was in turn liberated, a survey vessel would immediately carry out a detailed survey so that it could be used by Allied shipping to land vital stores and equipment, no mean task when you realize that Boulogne alone was blocked by 26 sunken ships.

The revision of charts continued as ports were cleared, keeping pressure on



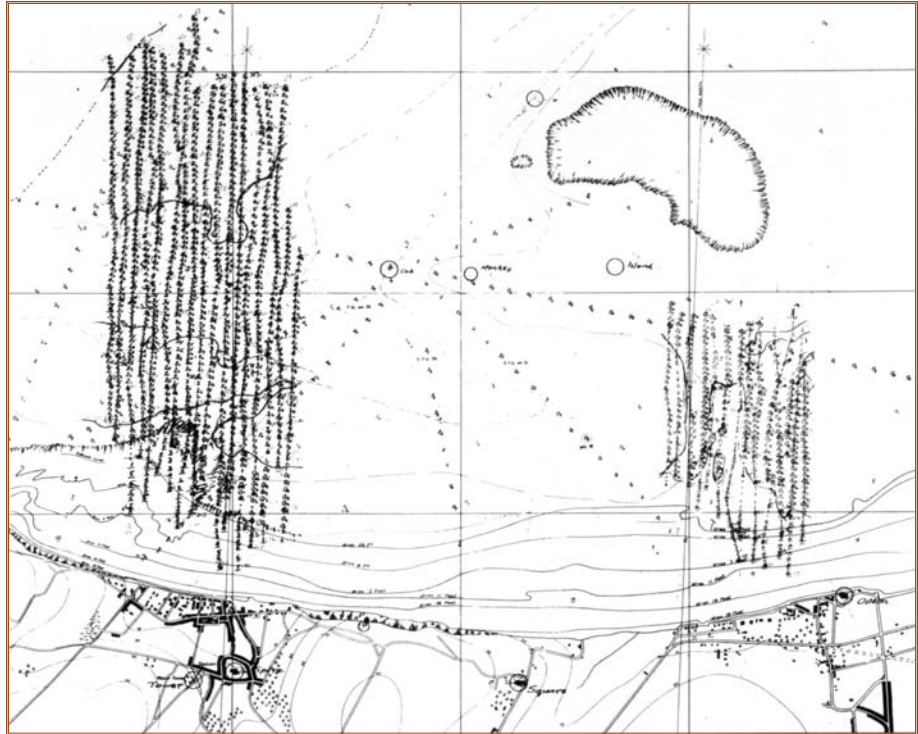
Left: Bogus mapping showing Pegasus and Horsa bridges: Bénouville west of Pegasus Bridge is renamed "Venice."

both the civilian draftsmen and printers and the surveyors at sea.

Mapping Occupied France

Among the first tasks of the planning staff were the definition of the geographical limits within which it would be feasible for the invasion to take place and the probable time frame necessary to prepare for the assault. Armed with this information the Director of Survey, Colonel Archie Clough, carried out an evaluation of the mapping that would be needed to support the planning, preparation and implementation of the assault. As a result of this study a huge mapping program was put into effect to revise the mapping produced for the operations in France at the beginning of the war: producing new 1:250,000, 1:100,000 and 1:50,000 series; extending cover at 1:25,000 far to the south and west; and producing 1:12,500 scale sheets of the immediate invasion area. This huge program was to fully occupy all the Royal Engineers survey units in the UK and the Ordnance Survey from mid-1942 until the end of the war.

As there was no existing mapping available to assist in the production of the 1:25,000 and 1:12,500 sheets, a major survey flying program was initiated to acquire the survey-standard imagery necessary to produce *ab initio* mapping by air survey methods. This project was code named *Benson* after the airfield from which the photo reconnaissance Spitfires and Mosquitoes flew. Production was carried out solely by graphical methods until Canadian, and later US, survey units arrived in Britain bringing with them the slotted template method of extending ground control and Multiplex machines to plot the detail and contours. The *Benson* sheets provided the base mapping for a range of different overprints, some showing incredible intelligence detail of German



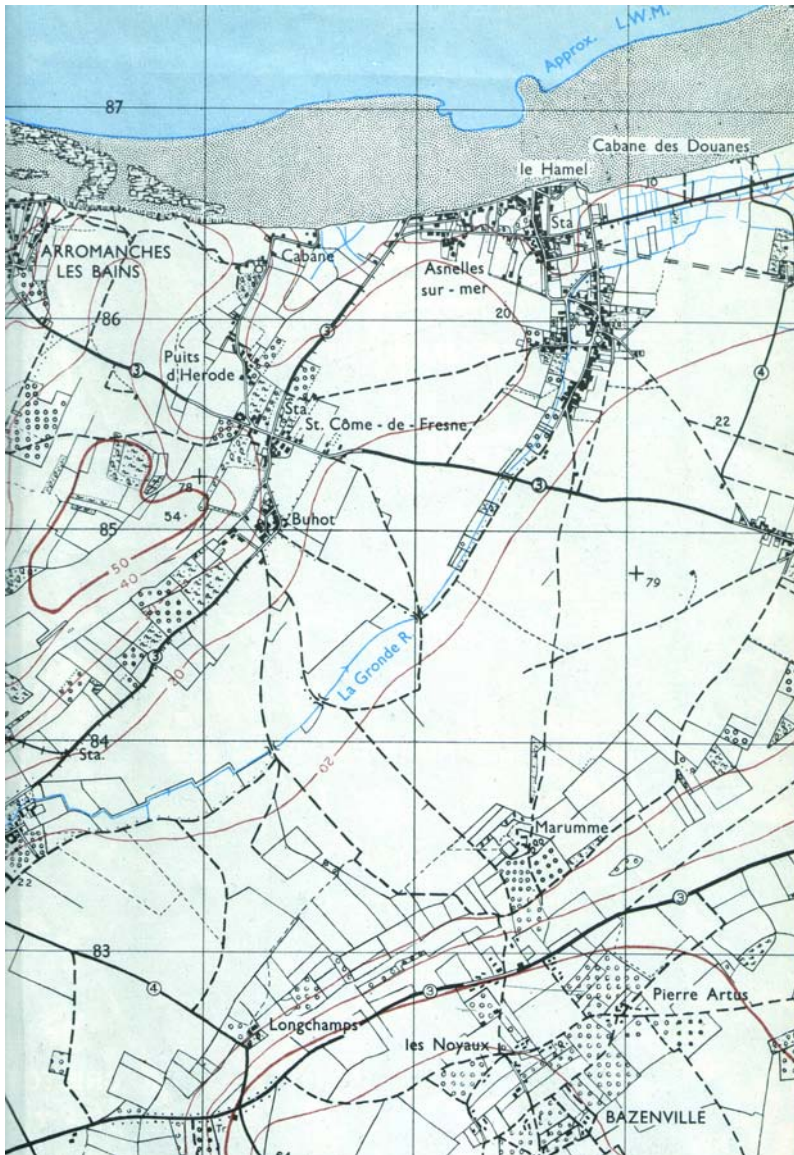
The central radial soundings were carried out during clandestine surveys in 1943 and used to plan the Arramanches Mulberry harbor. The two sets of parallel were Lieutenant Commander Ritchie's boat soundings made on D+2.

defensive positions and the make-up of the beach areas. Revised editions of these overprints were being produced right up to the time of the loading of the landing craft.

In addition to series mapping, Military Survey was involved in many other tasks such as calculating beach gradients by measuring the height of incoming waves, identifying from air photographs the potential sites for forward airstrips and printing the Top Secret documents needed by the planners. Perhaps one of the more unusual products was the *Bogus* map series which comprised *Benson* sheets of the operational area but with the real place names replaced by others (e.g., "Ouireham" was renamed "Oslo"). This series allowed the assault troops to become familiar with the terrain but still not know the real operational location.

Distributing the maps presented the Director of Military Survey with the same problem as the Hydrographer had with his charts. The millions of maps needed by the assault forces had to be assembled and packed into the

unit-specific map packs and distributed whilst still maintaining the great secret of "where" the invasion would take place until the very last moment. This was achieved by sending the maps immediately after printing by the survey units to a central Map Depot in Hanwell. Here they were rolled into bundles, wrapped and labeled with the series and sheet numbers in code. The rolls were then distributed between four other map depots and stored to await the final preparation stage of D-Day. In early April 1944 small map depots, stocked from these four large depots, were set up in all the many marshaling and concentration areas and the individual unit bundles made up, wrapped in hessian [burlap] and labeled, again in code. Several weeks before the 6th of June the first assault units moved into the concentration areas which were then immediately sealed off from the outside world. Here they were issued their map packs and commenced their final detailed briefings before boarding the landing craft and sailing for France.



Extract from GSGS 4347 Sheet 37/18SE: an example of standard 1:25,000 Benson mapping.

Military Survey Ashore in France

As well as supporting the planning for the operation, hundreds of Royal Engineers military surveyors took part as members of the Survey units that formed part of the invasion force. The four principal headquarters all included survey directorates who controlled the field survey companies that put in the field survey control networks, and map reproduction sections and map


depots that produced, printed, stored and distributed the endless flow of maps needed as the army moved from the beaches of Normandy towards Berlin.

The first surveyors landed on D-Day itself and others followed on the successive days, each with a specific task or role. Early to land were field surveyors whose job was to provide the survey control points necessary for the Royal Artillery to fix the position of their guns so they could bombard

an enemy unseen but at a known grid location. Observing was a dangerous occupation as it obviously required the observer to raise his head to the theodolite and then hold it steady! To provide some element of safety, tripod legs were spread so that the instrument was barely off the ground.

The field survey companies were completely mobile with all their map production equipment mounted in trucks. Their role was to rapidly produce new sheets and revised editions which were then passed to the map depots for immediate distribution. As the battlefield moved east, so these mobile “map factories” followed close behind.

A Monumental Survey Enterprise

The statistics of D-Day are all superlatives and those relating to maps and charts are no exception. In just under two years 170 million maps were produced—an astonishing achievement given the technology and material constraints of the time. However, as in all conflicts, much of the stock was never used. The “total-war” nature of the conflict meant that the detail depicted on a map changed as the battle progressed thereby generating a constant need to produce revised editions that made the previous sheets obsolete. With print runs of each sheet well into the thousands, the production figures soon became astronomical. However, the superseded maps were chopped to a smaller size and the paper then distributed to units who used the reverse for their own documents, thereby saving the need to use scarce cargo space to transport paper across the Channel. 

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Alan Gordon is Editor of *The Ranger, Journal of the Defence Surveyors' Association*. The Summer 2004 issue of *The Ranger* commemorated the 60th anniversary of D-Day. For more information, visit www.defencesurveyor-sassociation.org.