

THE RANGER

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Strongpoint and Defences near Bernieres-Sur-Mer,
GSGS 4347 Sheet 37/18 SE GR 9985



Plymouth Sound 3D model showing integrated terrain-bathymetry surface and overlaid imagery.



Sponsored by ESRI UK and DGI

A Christmas Card From the Past

Found by Mary Robinson (wife of Lt Col (Retd) GPG Robinson) when sorting through some of her long departed father's papers. The postage was 2d!

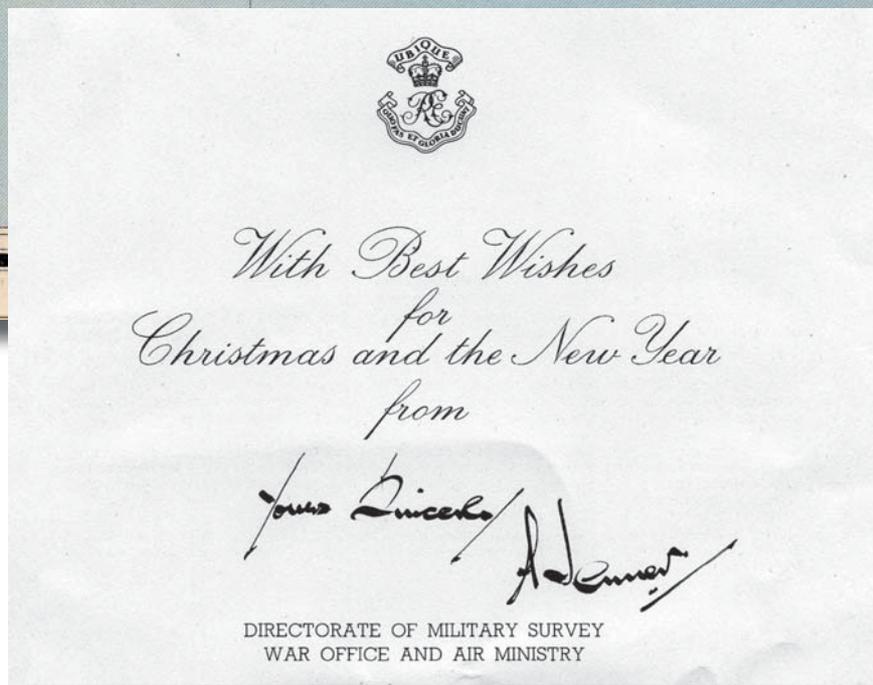
Historical Note

In 1854, at the outbreak of the Crimean War, Thomas Best Jervis, F.R.S., Major of the Corps of Engineers, offered the Government a map of the Crimea Peninsula, a part of which is reproduced on the front of the card.

The map was an English Edition, prepared by Major Jervis himself, of a map which he had acquired in Brussels earlier in the same year, which had been produced by Major General Mukhin, in 1816, for His Imperial Majesty Alexander, Emperor of all the Russias.

When the offer was declined, Major Jervis had the map reproduced at his own expense, and put to use in the theatre of operations, where it was soon found to be vastly superior to the existing mapping held by our forces. The Government, now convinced of its merit, purchased stocks on its own behalf.

These events led to the setting up, under Major Jervis, in 1855, of a "Topographical and Statistical Department", which thus became the fore-runner of the present Directorate of Military Survey.



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In this edition of Ranger...



Welcome to a new edition of Ranger. Since the last edition, Summer 2012, DSA Council has approved an Editorial Board with a new Editor to take over from Peter Walker who retired from the post. The original idea was to produce a 'soft copy' only of Ranger which would be cheaper and to that end the DSA Website was rebuilt.

However, it became apparent that 'hard copy' was still a major requirement and with sufficient advertising it would still be a viable option.

This edition covers the identification, collection and distribution of geographic intelligence over the years, from The DGC in the Great War to, Searching for the MH 370, the lost Malaysian Airliner, as well as historical and news items, all in a wide-ranging read.

There are further changes planned for Ranger but with so much going on in the Defence Geospatial Intelligence arena it was decided to produce an edition now and a new style Ranger next year. As Editor I am most grateful for Council's support in appointing an Editorial Board which is composed of a variety of ages, experience and appointments to make Ranger relevant to you, either serving or retired, military or civilian, or employed in academia or industry within the GEOINT community.

Carl Calvert



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DEFENCE SURVEYORS' ASSOCIATION

Formerly the Field Survey Association

The DSA is a registered charity which maintains liaison between officers, warrant officers and senior non-commissioned officers, both serving and retired, and civilians who are working or who have worked in the Defence domain where the focus is environmental information, hydrographic, oceanographic and geographic surveys, locating and target acquisition, navigation, and geospatial intelligence.

The Association provides a variety of services to its members which include:

- A copy of each edition of Ranger magazine, published annually.
- Visits to a technical, military and historical sites, often not available to the general public.
- Opportunities to attend technical and historical seminars, including an annual seminar run by the DSA covering both historical and current issues.
- Opportunities to attend events organised by other professional organisations working in related fields.
- Opportunities to network with senior personnel in the Defence environmental and geospatial sector.

If you would like to join the Association contact details for the Membership Secretary are given on the last page of this magazine or visit the Association's website (www.defencesurveyors.org.uk) where you can complete an application on line.

Introduction by the Chairman of the Defence Surveyors Association

Over the next couple of years the DSA will be examining and implementing how best to provide the current and future members with an association that caters to their interests; technical and social. All know that GIS enables more efficient mapping, data fusion, analysis, and distribution – with new challenges; than is possible using the traditional methods of survey and mapping. GIS, along with advances in ISR, (Intelligence, Surveillance, and Reconnaissance) has placed the military geographic soldier back very much at the heart of intelligence. Moulding our Association to interest and include those in the GIS and Geographic Intelligence must have and input from the current generation and as per our Articles they will be invited and encouraged to actively contribute to the discussions.

For 2015 the Council is putting in place an enhanced programme that will be a mix of seminars, social events and visits. The recent AGM, presentation and dinner was enjoyed by many members, their wives, partners and local dignitaries. The hugely successful June seminar will continue and in March a mini seminar with three presentations, curry lunch and visit to the Gurkha Museum will take place in Winchester. A third mini seminar at RAF Wyton is being planned and it will have a strong GIS orientation. In all our events wives, partners and friends are most welcome.

The Council is addressing a number of other initiatives that include the establishment of a photographic archive, the enhancement of the website and a review of the DSA prizes.

Ranger is again back in production and we are appreciative of the help given by the sponsors of the Journal. It has always been an eclectic collection of articles and is dependent upon individual contributions and therefore please keep your articles "Ancient and Modern" coming in.

Christopher Nash

Chairman

Opinions expressed in Ranger do not necessarily reflect those of the DSA or the editor.

3D Visualisation in Littoral Zone

Introduction

Why is it that when we exist in a 3D world, we are generally content to see, plan and operate using a two dimensional view of our surroundings? Understanding our environment from a 3D perspective provides us with a level of awareness beyond anything that can be provided by a standard map or chart. The potential benefits of 3D ‘situational awareness’ have been acknowledged by the United Kingdom Hydrographic Office (UKHO) which is seeking to understand the operational benefits for of 3D visualisations that include but should not be limited to providing improved situation awareness, visualising key navigation aids and an ability to analyse and visualise the temporal impact of the tide through improved use of existing defence and open source data.

Research by Helyx SIS Ltd, under contract to the UKHO Defence Maritime Geospatial Intelligence Centre (DMGIC), as part of the ongoing development of future maritime geospatial capability, has enabled the creation of a geospatially accurate 3D representation of the Plymouth Sound littoral zone (*Fig 1.*), using a case study based on a surface vessel port entry.



Fig 1. Plymouth Sound 3D model showing integrated terrain-bathymetry surface and overlaid imagery.

Background

The background for this research was the Defence Science and Technology Laboratory (Dstl) funded Advanced Geospatial Information & Intelligence Services

(AGIS) research programme that addressed a number of geospatial issues concerned with the provision, management and exploitation of Geospatial Information and Intelligence for the Ministry of Defence (MOD). AGIS Task 4 (Creating Urban 3D Environments) proposed a single overarching methodology for the creation of urban 3D models, bringing together defence, industry and open source technology. The need for a consistent approach between Defence environments and identification of potential benefits for 3D visualisation within the maritime environment provided an opportunity for the DMGIC to exploit the AGIS Task 4 methodology in order to identify the benefits of modelling the littoral zone in 3D.

Research Aim

The aim of this research was to develop a standard process to create 3D models of the littoral zone using the AGIS Task 4 methodology and using existing UKHO resources. Work has focussed on solution development based on the challenges encountered during creation of a 3D model of the Plymouth littoral area.

Due to its wide use throughout MoD, and the availability of supported data, the research developed a Three Step workflow based around ESRI ArcGIS Desktop applications. The resulting model was visualised within ArcGlobe, an ArcGIS integrated application designed for the 3D representation of geospatial data (*Fig 2*).

Step 1 – Data Input

The availability and coverage of data such as bathymetry, imagery and LiDAR was a key challenge. Due to the vast array of bathymetric surveys over Plymouth Sound, their differing coverage, timing, method of capture and resolution, a methodology was devised to combine the datasets into a single surface.

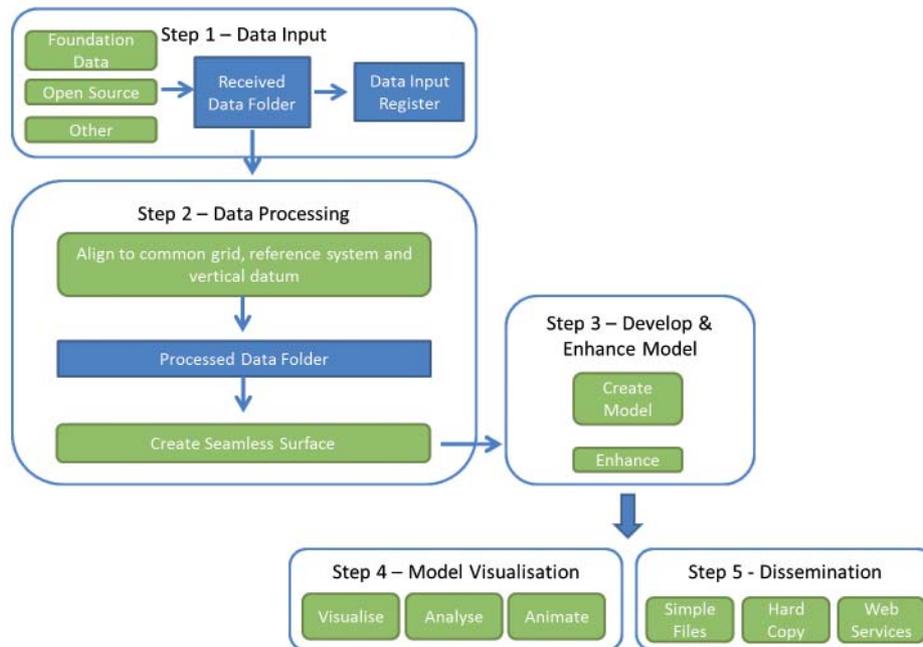


Fig 2. Key steps in the 3D model creation workflow. Other data sources include Ordnance Survey and the Channel Coastal Observatory.

Step 2 – Data Processing

A range of processing techniques was used to mosaic the datasets using a prioritisation process based on resolution and age. In order to maintain transparency and trust in underlying data and processing techniques, a bathymetry metadata log was created to show the underlying data sources, resolution and processing techniques applied across the entire model coverage (Fig 3).

A further challenge arose when attempting to create a seamless surface model comprised of bathymetric and terrain data. In order to create a seamless surface model, the land terrain surface, based on LiDAR data, was joined to the bathymetric surface. However, the terrain and bathymetric surfaces were based on different coordinate systems and vertical datums (mean sea level and chart datum respectively). The Vertical Offshore Reference Frame (VORF) model¹ jointly developed by the UKHO and University College London provided the means for converting and aligning vertical datums. All model data was further converted to a common coordinate system (WGS84 UTM Zone 30N) removing the need for transformation ‘on the fly’, and providing a consistent and repeatable methodology for other locations.

The creation of a single surface model provides the ability to visualise and understand the shape of the terrain, above and below the waterline, allowing further exploitation of the underlying data. An example of where this was used includes the production of profile graphs that spanned the bathymetric and land surfaces for detailed planning of beach landings. The single surface model also allows users to analyse and visualise the temporal impact of the tide and how it may affect the ability of a vessel to passage at any state of the tide, given the limitations of its draft (Fig 4).

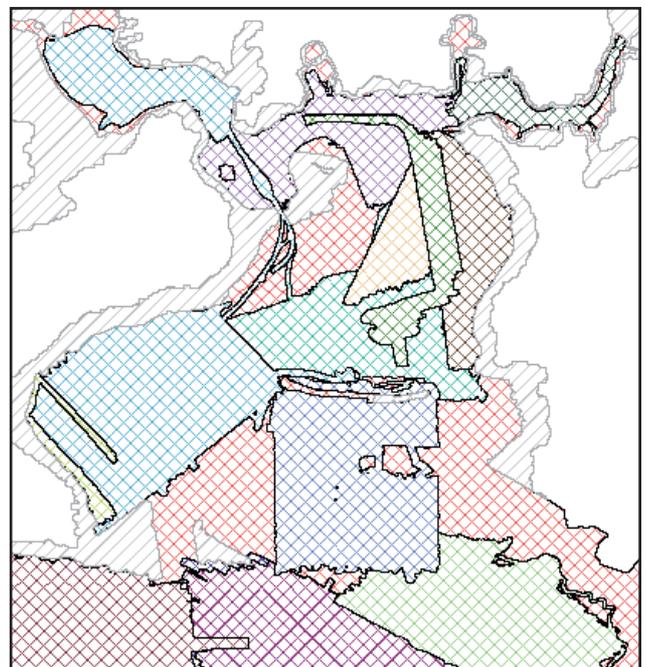


Fig 3. Map representation of the Bathymetric metadata layer, which contains a log of underlying datasets and processing techniques.

¹ <http://www.ucl.ac.uk/vorf>



Fig 4. Snapshot of an animation showing Go No-Go regions for a vessel of 1.8m draft. Animation shows Go No-Go regions for all states of tide

Step 3 – Model Development and Enhancement

Developing and enhancing the 3D model using data provided by UKHO as well as additional data from open sources was an important feature of the production methodology. Representing buildings and navigational features provides an ability to realistically visualise key navigation aids (buoys, lighthouses and prominent features) within a 3D environment. It enhances situation awareness and helps users to understand the

significance of these in relation to a port entry or beach landing scenario.

3D models of individual buildings were created using CityEngine. This is an Esri application specialising in the rapid generation of representative 3D urban environments that can be imported quickly and easily into Esri’s ArcGlobe. The availability of LiDAR data over the Plymouth littoral area, combined with accurate building footprints from Ordnance Survey data, allowed rapid generation of 3D building models with accurate elevations and representative facades and roof types (Fig 5).



Fig 5. 3D buildings generated in CityEngine and visualised within ArcGlobe.

3D models of buoys, light beacons and prominent landmarks were created within Trimble SketchUp, and a number were obtained from the open source SketchUp warehouse (Fig 6).

Unfortunately, model texturing was often lost during the import process, resulting in un-textured grey models. The research investigated a number of 3D feature model import methodologies in order to determine a working solution and the COLLADA file format was found to be the most reliable format, in terms of retention of model geometry and texturing during import and exchange. The COLLADA format has therefore been recommended by Helyx for the exchange of 3D information.



Fig 6. 3D feature models generated in SketchUp and visualised within ArcGlobe.

Step 4 – Visualisation and Step 5 – Dissemination

To enable dissemination and visualisation of the completed 3D models to end users, a number of options were considered, including the use of 3D PDF, VRML, CityEngine Web Scenes and dissemination through 3D web services. The optimum dissemination option will vary depending on the following factors:

- Model use
- Its size
- The amount of underlying data
- The hosting infrastructure, including bandwidth and network links
- The expertise of the end user.

3D PDF offers a simple but effective 3D visualisation experience in terms of display quality; however the export process is not straightforward. VRML offers a slightly improved end user experience due to better 3D model representation; however VRML viewers were not considered to be particularly user friendly. Browser-based CityEngine Web Scenes were found to offer the best end user experience in terms of visualisation, interface simplicity and functionality. Web Scene files are highly compressed (and can be as little as 4Mb), allowing dissemination in bandwidth and connectivity constrained environments. 3D web services were found to be at an early stage of development and not yet mature enough for implementation.

Future work

UKHO and Helyx are developing the model and methodology in order to further exploit its benefits with research focussed in the following areas:

- Identification and visualisation of additional data sources in 3D.
- Investigation and incorporation of live data feeds, such as weather, Automatic Identification System, and tide.
- Investigation of light and shadow portrayal capabilities, including the effect of terrain and buildings.
- Standardised 3D object symbology including buoys and beacons, their portrayal and scaling.
- Assessment of the methodology and resulting 3D model in data sparse areas.

A number of these aspects will continue to be challenging due to data volume, computer processing power and data complexity, including; representing live data feeds such as AIS and weather information; and representing of light and shadow within a 3D environment. Working in partnership, UKHO and Helyx hope to overcome these challenges through ongoing research including an initial assessment of simulated AIS data within ArcGlobe to represent temporal data in 3D (Fig 7).

Conclusion

Defence users are beginning to understand the operational benefits of visualising the environment in three dimensions and are coming to appreciate the benefits of utilising geospatially accurate 3D models to enable improved situational awareness, particularly in complex environments such as the Littoral Zone. Improvements in hardware and software will improve the ability of specialists to create 3D environments within existing workflows whilst exploiting current and emerging data sources.

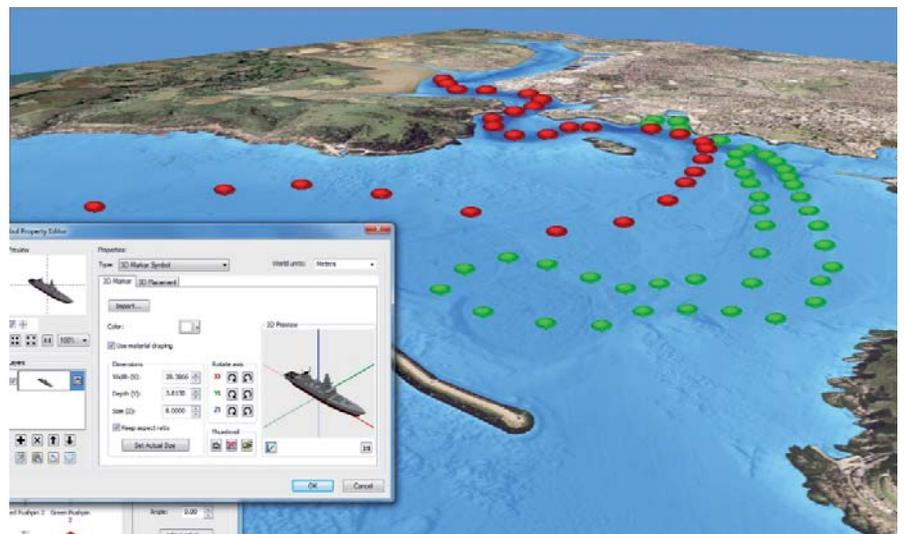


Fig 7. Snapshot of simulated AIS feed within ArcGlobe (inset shows 3D vessel symbol).

In due course, remote collection techniques such as satellite derived bathymetry and unmanned vehicles are likely to provide access to crucial information within constrained environments, however the availability of data with sufficient coverage and resolution to meet all use cases, is still a challenge, that may be partly overcome through greater exploitation of open source data.

This research has shown the feasibility of creating a 3D model of the littoral zone within a data rich area, it specified the data sources required, levels of detail that could be achieved, the processing and visualisation steps, and a number of dissemination options available. The continuing work shall build upon these foundations and utilise emerging technologies as they become more stable.

Prize Awards for 2013/14

The following prizes were awarded at the DSA Annual Maps and Surveys Seminar held at Hermitage on 20th June 2014 and presented by the President, Major General Roy Wood

Royal Navy personnel in the Hydrographic and Meteorological Service

Recommendation - Petty Officer (Survey Recorder) Kerry Collins

HMS Protector, is the Royal Navy's ice patrol capability. *HMS Protector* has three core roles: to act as the UK's sovereign presence and discharge the Nation's Treaty obligations within the British Antarctic Territory and the South Atlantic Overseas Territories; to conduct hydrographic survey operations; and to provide operational and logistic support to the British Antarctic Survey.

Petty Officer (Survey Recorder) Kerry Collins has served in *HMS Protector* for two years and has proven to be one of the most professional and effective survey specialists, undertaking her duties with an abundance of enthusiasm, drive and determination. PO(SR) Collins is a consummate professional. She actively seeks to enhance and improve her knowledge and understanding of new equipment, technology and processes to further her own personal development and give the best support to *HMS Protector's* Survey Department. In the harsh Antarctic environment she has displayed the ability to generate enthusiasm and high morale during periods of arduous tasking and environmental adversity. She has built a close knit and successful team through her personal commitment, humour and exceptional leadership.

On her own initiative PO(SR) Collins programmed and managed a Magnetic Observation campaign during the Antarctic 2012/13 season when she personally ensured that field observations were conducted wherever practicable within the Ship's busy programme.

Royal Engineers (Geographic)

Captain Patrick Snow RE

Captain Snow was deployed to Afghanistan from February to September 2013 and was the lead geospatial officer for UK forces within Helmand Province. During his time there he oversaw a number of major changes and developments in geospatial delivery within Helmand that required considerable leadership and planning backed up by a deep understanding of their technical implications. There were significant improvements in the update and management of the vector layers which are vital to information provision through the geospatial web viewer. Known as the Highways and Arterial Routes Theatre Study (HARTS), it transformed the way units planned movement and significantly helped to protect and save lives by defeating the highways threat. Maintaining the same levels of data management and server provision during the move of the personnel and equipment was a significant problem to resolve which involved negotiation with multiple agencies and then the technical planning to see it through. During his tenure, geospatial capability delivery was both enhanced and changed beyond recognition within a very busy operational context.

On his return from Afghanistan, Captain Snow assumed the appointment of Regimental Operations Officer and was immediately tasked with planning the integration, training and deployment of Royal Engineer (Geographic)'s new deployable capability. This is known as Field Deployable Geoint (FDG) and is a complex system of deployable geospatial analyst workstations, servers, survey eqpt, vehicles and numerous ancillaries. His task concerned both the deployment of the equipment to operational theatres, particularly Afghanistan and the training within the Regiment. He then went on and delivered the planning for a Regimental level exercise that was focussed on the integration of the systems and required appropriate scenarios, technical tasks and system development exercises; all had to be designed from first principles, again requiring an in depth understanding of the technical equipments. Capt Snow is nominated for the Royal Engineer (Geographic) Prize for his outstanding contribution to the development of military geospatial capability both in the operational environment and with new capabilities within the home base.

Royal School of Military Survey

Mr Keith Pegram

Mr Keith Pegram is employed as the System Manager in the Royal School of Military Survey, Hermitage. His role is to support geospatial education and training by providing IT and audio-visual resources across RSMS.

Mr Pegram has demonstrated an outstanding level of service and dedication to the School. His responsibility to manage, configure, maintain and troubleshoot complex problems is significant. Together with his small team of two, Mr Pegram looks after in excess of 230 high end workstations connected to the RSMS training network, along with the infrastructure that enables the delivery of information services to all staff and students.

Impressively, he also has responsibility for delivering audio-visual support across Hermitage Station.

Despite the demands of his post, Mr Pegram freely gives his own time to the benefit of the RSMS and wider station. Mr Pegram's unselfish commitment to RSMS, Hermitage Station is worthy of recognition.

He is strongly recommended to receive this year's DSA prize.

Royal Air Force Air Cartography

Corporal Wayne Lee

Cpl Wayne Lee has served at the Number 1 Aeronautical Information Documents Unit (No 1 AIDU) for over 13 years and is responsible for the processing, production and fault investigation and rectification of digital files for up to 80% of AIDU's products. These are critical to flight safety products which are required in all MOD aircraft for safe flight.

For the last 2 years, Cpl Lee has been involved in the Prepress Department, which is responsible for the processing, production and delivery of all paper products and digital data. Attending Project Boards as the Star Apic Software Environment subject matter expert, his contribution to developing bespoke and complex coded programs has completely exceeded his remit. Due to continual changes in requirement, this project was started on numerous occasions and Lee's enthusiasm and dedication never faltered. He produced 18 different coded programs, with the initial program taking 2 weeks to write with each subsequent program taking a day. However, each one of these programs required extensive testing and subsequent coding adjustment due to changes in source data from Ordnance Survey, in addition to changing requirements from the Low Flying Department. He raised complex issues with current procedures and provided extensive, detailed feedback to the Low Flying and Innovation & System Support Departments to improve the outputs of this new system. Cpl Lee's initiative, diligence and personal research into programming was fundamental to the success of the ESRI Project. His accomplishments have recently enabled the ESRI system to go live without issue, successfully delivering the benefits first envisaged at its inception.

Defence Geographic Centre

Mr Kevin Willcocks

The nomination for the award of the 2014 DSA prize for a DGC Geospatial Analyst is Mr Kevin Willcocks, a Band D civilian who is the lead subject matter expert within the recently created integrated Task Team 5 in the DGC's Foundation Division specialising in the management, processing and geopositioning of satellite imagery.

Mr Willcocks is responsible for generating imagery either as a source for the production of geospatial information or for creating derived imagery products to satisfy both national and international Defence requirements.

Kevin's knowledge and expertise is instrumental in the supply of positionally accurate imagery in support of the co-production of image based products including Controlled Image Base (CIB), Diamond, Stereo Airfield Collection, Northern Ireland Town Plans and a range of Operational outputs in support of HERRICK. He has demonstrated exceptional initiative and application of his deep photogrammetric skills working with the Five Eyes community and in particular with the National-Geospatial Intelligence Agency (NGA) in ensuring consistency of processes to optimise the quality and accuracy of imagery.

He has provided the technical lead for DGC on the sustainability of existing capability and the development of new photogrammetric and image processing procedures and has been highly proactive in the training of other Geospatial Analysts.

Over the past year, Kevin has led for the UK on the development of a new Controlled Image Base (CIB) capability which exploits commercial satellite imagery. To gain the necessary accreditation from NGA for the production of this new product, Kevin played a significant role in technical liaison with NGA partners and mastered the highly technical and complex procedures required to a high level of expertise. These procedures are now fully documented and he has completed the training of other members of the team. On his own initiative, he worked closely with BAE and RSMS photogrammetric experts to overcome technical and support data issues, resulting in a new capability to support a wide range of programmes of work, particularly over the United Kingdom where availability of alternative stereo sources is limited. Again, Kevin has fully documented and trained colleagues in this new capability.

Kevin is considered a very worthy recipient of this year's award.

UK Hydrographic Office

Mr Jon Hine, Mr Lee Betts, Ms Sara McGourty

This year, the Beach Intelligence & Survey Dataset (BISD) team have made a significant change in the way they deliver Environmental Information - primarily to the Littoral Manoeuvres community but also to the RN Surface Fleet. There has been a significant increase in the use of GIS to deliver data and products that can be manipulated by these customers. This submission describes a number of ways in which the team have moved from delivering primarily analogue (hard-copy and pdf) products to delivering digital data and products that can be manipulated by the GEO community, or interrogated by the user community using open source software. Working together, and using others in DMGIC and Operations for support, they have delivered the following:

In order to progress BISD product generation and geospatial data delivery, the BISD team had to migrate the beach data metadata holdings from the legacy systems and Oracle database to an ESRI GeoDatabase. Comment from UKHO Business Change Manager, Brian Parish: *"it demonstrates exactly the innovation CE is demanding and the sort of mutually supportive team dynamic we value so highly in DMGIC"*. This new GeoDatabase has enabled more efficient data retrieval, by caveat, classification and geographical extent, of bespoke datasets. These datasets are then delivered in a Beach Intelligence Geospatial Summary (BIGS) as a layered, ESRI ArcReader or ArcMap project to UK and foreign forces.

In response to both the limiting copyrights placed on web-sourced imagery, and a Royal Marine request for a night ops planning product showing buildings and skyline features, the BISD team have been exploring 3D visualisation. The team have been testing the in-house capability and feasibility for generating 3D infrastructure for use with 3D visualisations that support situational awareness for beach landing operations. Using ESRI ArcScene, a 3D visualisation tool, virtual landscapes can be generated which allow the defence user to "fly through" and navigate their 3D battle space. This 3D product has been issued, to Littoral Manoeuvres customers, on laptops supplied by the UKHO.

The emerging UKHO-wide use of satellite derived bathymetry has allowed the production of beach gradient profiles in support of Ex Cougar 13. Furthermore, using Exelis ENVI algorithm tools to analyse the same remotely sensed multispectral imagery, has enabled the BISD team to analyse the vegetation density to establish troop cover, land type and trafficability and deliver in a hard-copy Special Tactical Operational Information Chart (STOIC). Other analysis techniques have been identified by the team and in combination with ESRI spatial analyst tools will be used to determine water saturation, terrain categorisation, slope, anomaly detection and line of sight. Hydrographic Port Assessments (HPA)s have been developed to provide Situational Awareness to in-theatre commanders at the planning stage of an operation. Traditionally, HPAs have been delivered as a Powerpoint presentation. However demand is now for an interactive layered product that will allow the end user to interrogate information and switch on/off individual layers. Using ESRI ArcGIS tools, the BISD team now deliver charts, imagery, mapping and other vector layers using the open source ArcReader software. This year the team have delivered 27 HPAs that included 2 Philippines HPAs that required a very rapid turnaround in order to help the relief effort following Typhoon Haiyan.

For their continued effort and commitment to development of Beach Intelligence techniques the BISD team are recommended for the UKHO DSA prize.

The Bit Between:

Defence Geographic Centre analyses the littoral zone from a land-lubber's perspective

By Robert Thorn and Dr. Giray Ablay - Defence Geographic Centre, London

'A military, naval, littoral war, when wisely prepared and discreetly conducted, is a terrible sort of war. Happy for that people who are sovereigns enough of the sea to put it into execution! For it comes like thunder and lightning to some unprepared part of the world.' (Lt. Col. Thomas More Molyneux: *Conjunct Expeditions*, 1759).

Ever since the Sea-Peoples first appeared over the horizon of the Mediterranean Sea, the 'Great Green', and onto the shores of Anatolia, Syria, Levant and Egypt in the 13th century BCE, the ability of maritime nations to conduct military operations from the sea has brought anguish to their more-continently-focused adversaries. As noted by B.H. Liddell-Hart in *'Deterrence or Defence (1960)'*: *'Amphibious flexibility is the greatest strategic asset that a sea-power possesses'*. Conductors of war and military historians, especially those of maritime nations, have always seen the effectiveness of and promoted amphibious warfare. Churchill, a staunch advocate, intoned in a note to the Chiefs of Staff in 1940: *'It is a crime to have amphibious power and leave it unused'*, while J.F.C. Fuller, in *'The Second World War (1946)'*, considered modern amphibious assault operations; *'in all probability...the most far-reaching tactical innovation of the war, and MacArthur, planning for Inchon in 1950, stated: 'The amphibious landing is the most powerful tool we have'..*

Notwithstanding their utility, however, it is a painful truth that amphibious operations, notably the assault, are among the most difficult to conduct successfully. Nothing is recorded by those ancient sea raiders of the 13th century BCE but Demosthenes, Athenian admiral of the 5th century BCE, commanding ships that played havoc along the coasts of his Spartan-led enemies, said to his squadron in 425 BCE: *'You are Athenians, who know by experience the difficulty of disembarking in the face of the enemy'*, words echoed by Sir Ian Hamilton, in his Gallipoli Diary, 1920: *'The question of landing in the face of the enemy is the most complicated and difficult in war.'* Thus, it behoves Geo-Intelligence (GEOINT) providers, such as Defence Geographic Centre (DGC), UK, to ask what might be done for those of our customers considering or attempting such a feat, to mitigate the problems that this most difficult of military operations might present.

Let us establish, then, the scope and responsibilities of the undertaking for those tasked with providing GEOINT support. Amphibious landings take place in the littoral zone (Latin: *litus*, shore), encompassing from just below mean low water, through the fore- and back-shore, and up to the start of the hinterland. The key implication of this is the need for cooperation between agencies plying their trades on different sides of the water-line. In terms of GEOINT provision, on the 'dry' side, above mean high water, DGC has the responsibility for supplying map products, either made in house, or acquired from allied or commercial sources, while on the 'wet' side it is the UK Hydrographic Office (UKHO) who, with their detailed, large-scale Special Tactical Operational Information Charts (STOICS) in hand, also charge purposefully across the shore and some small way onto the *terra firma* of the hinterland.

Like the ancient Egyptians, DGC always has had a terrestrial focus in its provision of GEOINT. On one occasion only, assaulting the Al Faw peninsula of Iraq, 2003, has DGC worked in liaison with UKHO to produce operational products for littoral tasks. Recent crises, including humanitarian operations, and a new emphasis on an expeditionary posture, however, would suggest a change in requirements, as recognised in parallel by the US Marine Corps (USMC) and product developers at their Marine Corps Intelligence Activity (MCIA). Of course, it is fair to say that a standard (1:50,000-scale) topographic map-sheet is as good in a coastal area, as it is inland. However, it is also true that the level of analysis and detail required is greater for littoral zone-operations, so standard series mapping will only partially meet the war fighter's requirements.

The level of GEOINT required for an operation's success is related to the level of threat posed to its implementation by geographic and other factors. Amphibious landings being amongst the most hazardous, by historical experience, implies the need for more detailed GEOINT for this zone. On a landing operation, the threat is greatest at the surf line, troops concentrated in craft, disembarking,

and getting ashore. The threat then gradually lessens once established on the beach, and then into the immediate, and distant, hinterlands. Thus, measurements and assessments of geographic features as obstacles must be at their most precise around the surf zone and disembarkation point. Here, for example, incorrect assessment of water-depth may result in assault troops leaving their craft further out than expected, or possibly their assault being truncated by an offshore sand bar or kelp, requiring troops to assault a deeper expanse of exposed beach - the second most vulnerable zone. Beach composition, gradients, and off-beach exits and obstructions must all be assessed and measured as accurately as possible. As the back of the beach is reached, and the hinterland is entered, up to perhaps 10 km inland, more-generic GEOINT cover is required, before Standard Series Mapping (SSM) can provide the primary GEOINT cover for the wider area of interest. The dangers of missing some ostensibly small geographic feature of the littoral zone is shown by the Dieppe operation, 1942, where incorrect assessment of both gradient and composition of the beach set the scene for a Canadian disaster; the chert cobbles were just the wrong size, and wedged between the bogey wheels of the Churchills, immobilising them into stationary targets (*Fig 1*).



Fig 1. Canadian Churchill heavy tank immobilised by cobbles and knocked out by AT weapons, Dieppe beach, 1942.

Dipping our toes

DGC currently is developing an image-based GEOINT product using ArcGIS that partially overlaps the UKHO-produced STOIC in nature and coverage, but will also continue inland; but how far into the hinterland to go? In Demosthenes' time, the enemy was a spear-throw away, whereas today indirect artillery fire might contest a landing from many tens of kilometres. Consulting the NATO Standardisation Agreement (STANAG) 2263 (1976) – Coastal Areas and Landing Beaches (6.e. Hinterland) - suggests that a description of the hinterland is required 'up to approximately 10 km or to the nearest good road, if less than 10 km.' However, the first good road is not always a good point to reduce GEOINT coverage, since a coast road, running parallel to and close to the shore, commonly is present. STANAG 2263 is also somewhat old, and the scope of amphibious operations, including Non-combatant Evacuation Operations (NEOs) and humanitarian crisis support have greatly expanded their immediate area of interest, mainly owing to the advent of rotary airmobility.

The USMC is developing a high-level littoral-hinterland planning product that covers 200 km inland, while airmobile UK forces staged from shipping have an operational radius, of some 250 km. Areas of Interest (AOIs) of such dimensions cannot realistically be analysed comprehensively; such detailed analysis can realistically only be done over a depth of the order of 10 km. This is especially true since demand for such products may materialise over the short time-frame typical of opportunistic or event-driven operations. It is felt that 10 km will cover the most vulnerable areas of the putative amphibious operation, the surf zone, immediate beach, and sufficient of the hinterland to contain a small bridgehead. Of course, the AOI could be increased or decreased to meet specific GEOINT and/or time requirements.

The DGC and UKHO will probably not produce a combined product. Instead, mutually supporting products will be made, by the exchange of information over the beach zone. The DGC product will display UKHO data and symbology, e.g. for nautical navigation, as a layer option to provide product continuity. DGC's product will also display elevation- and vertical obstruction-data in vertical datums both for the land and maritime domains, since the air-picture is another area whose importance has only increased since Normandy. In addition to detailed mission products, DGC and UKHO have also developed a methodology to combine medium scale terrestrial map data with hydrographic charts to yield an operational-scale littoral planning product at 1:50k-scale.

But what to show

Anyone who has seen the operational planning maps for the D-Day landings of 1944, the Bigot plans (*Fig 2*), has been impressed by the level of geographic information (GEOINF) and GEOINT therein, and its contemporary currency; they were updated with photo-intelligence and other sources only two weeks before the decision to go. The Bigot maps cover the initial zones of high-risk: landing area, beach crossing, and exiting the beach. Close inspection reveals that the GEOINT and GEOINF contained thereon, ignoring copious details of enemy dispositions, is mainly concerned with obstructions and ways through or around them. In some ways, information and analysis of this quality and comprehensiveness would be difficult to achieve today, even with modern photo-intelligence and remote-sensing methods. Hopefully, the scale of the Overlord landings, and the quality of the opposition in Normandy, make this level of preparedness unlikely to be required again.

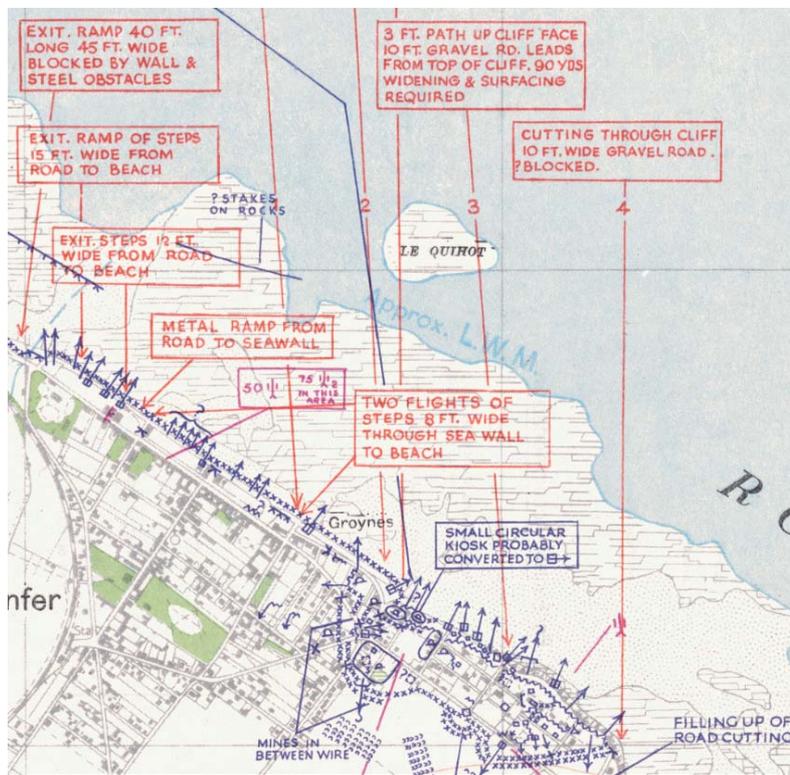


Fig 2. Excerpt from the Bigot maps of the Normandy assault beaches, 1944. Note the beach composition is mapped, while the red boxes give information about obstacles and routes. The blue layer shows enemy dispositions.

relevant scientific knowledge (e.g. of geology) and/or widely-recognised civilian metrics (e.g. grading systems for hiking, slope angle) have been used.

Fig 3. Some of the GIS layers collected over Faylaka Island, Persian Gulf, for Exercise Cougar 14. The coloured areas show movement restrictions for wheeled vehicles in the wet. The red (very restricted/impassable) areas include areas of sabkha mud and scattered archaeological sites. Note additional layers showing street lights, obstructions, routes, oblique ground photography, and hydrographic symbols for shore features.



These types of GEOINT, particularly where the area is remote and not studied directly beforehand, provide probabilistic information (i.e. these beach sediments are coarse pebbles unlikely to allow firm traction, or these soils are likely to mire when wet, or; these trees will likely be bare of leaf cover in winter) that gives the user the essential implications of the local geography and terrain for landing, movement, and concealment. Imagery, including multi-spectral scenes having IR-bands for ground- and vegetation characterisation, a good quality Digital Elevation Model (DEM), and experienced analysts, are essential to the completion of the product. The DEM, produced either in-house, or obtained from available sources, is central to producing various other of the layers, giving the shape of the ground (morphology, roughness, gradient, etc.) and constraining the geologic composition of the substrate (ground surface).

Let us consider the layer themes, in turn. Beach layers will contain both DGC and UKHO data. They will show the composition of the beach (rock, sediments), near-shore and on-shore obstacles preventing entry or exit to/from it, beach gradients and profiles, and an option to display UKHO hydrographic symbols that show landmark navigation features when viewed from the sea such as water towers and masts. Tagged oblique ground photographs are included. The layers for CCM analysis are assessed from all available data, notably the DEM, and geology and vegetation layers,

Notwithstanding that equipment capabilities have improved since 1944, notably in the ascendance of airmobility, the realities for the humble foot-soldier have not. Moreover, modern landing vessels and terrestrial military vehicles continue to face the same limitations to their mobility presented by geographic obstacles, restricting or channelling their movement into vulnerable areas, as they did seventy years ago. Currently, therefore, DGC is exploring five themes for our littoral-hinterland GEOINT map product. These are: (a) Beach; (b) Cross Country Mobility (CCM); (c) Routes; (d) Rotary aviation, and; (e) Mission Specific (customer defined). Each theme encompasses various layers, which the user of the GIS-product may choose to display (Fig 3). Results are given based on NATO parameters for such factors as trafficable gradients, and size of helicopter landing zones. Where guidance is limited,

to provide a mobility grading, which distinguishes tracked- and wheeled vehicles, and dismounted personnel, under both dry and wet conditions.

Colour-coded (four-colour) ‘traffic-light’ systems highlight various degrees of potential terrain mobility, from ‘unrestricted’ (in green), through ‘unrestricted-slowed’ (yellow) and restricted (amber), to ‘very restricted/impassable’ (in red). These analyses subjectively combine all available relevant factors; gradient, land-cover, surface and substrate type, humidity (wetness), etc., and are displayed transparently over the image base or DEM. CCM layers also include an analysis of linear barriers such as water courses, ditches, and scarps. The Route layers are primarily to show road/track surface-type and width according to NATO standards. Other layers in the Routes theme include: bridge and culvert data, choke points and canalisation of roads, where movement is predicted to be slowed or halted. A rotary aviation theme is included to show preferred landing zones, based upon surface gradient, ground cover, and air obstructions.

Power lines and other obstructions may also be displayed together with obstruction height buffers of various widths. Additional layers in the aviation theme show areas of unconsolidated sediments prone to producing dust plumes causing ‘brown out’, contouring with height options for relevant datums, dark areas and night light visibility for navigation. The layers within the mission-specific theme will include any required ad hoc by the user such as non-combatant evacuation assembly points and line-of-sight from specified locations. Typically it will also show: no-hit locations, including schools, religious buildings, medical facilities and heritage sites, other important buildings, military and paramilitary facilities, 3D-models, and tagged oblique ground shots of features and buildings.

What next?

The STOIC chart is a standard product for UKHO whereas for DGC, the littoral-hinterland analysis is only yet a proposal and demonstration. We have developed two proof-of-concept examples, for UK-amphibious training areas, and by this article’s publication we will have received user feedback; including additional requirements. We will therefore continue to develop the littoral product, creating guidance notes and digital specifications for production use by DGC personnel. We will also continue to strengthen links with UKHO for exchange of data, whilst keeping a keen eye of what the USMC and MCIA are doing, for future collaboration.

The Guns of 6 A.G. R.A

In the Summer 2012 issue of *Ranger* was published a sketch entitled “Eyes Of The Guns” with a request for comments. None were received.

A further four images from “The Guns of 6 Army Group Royal Artillery” below give some insight into the conditions in Italy in World War Two and aspects of the Gunners’ work which have some bearing on survey at that time.

They were taken from a copy formerly owned by Major J.E. How R.A., but it is believed a copy is also available in the National Archives, Kew at CAB 106/768.

Additional pictures on page 45.



Regimental Office



Eyes of the Guns

Beach Intelligence Support

from the Defence Maritime Geospatial Intelligence Centre, DMGIC, at the United Kingdom Hydrographic Office, UKHO.

By Rob Southwell and Ben Drinkwater

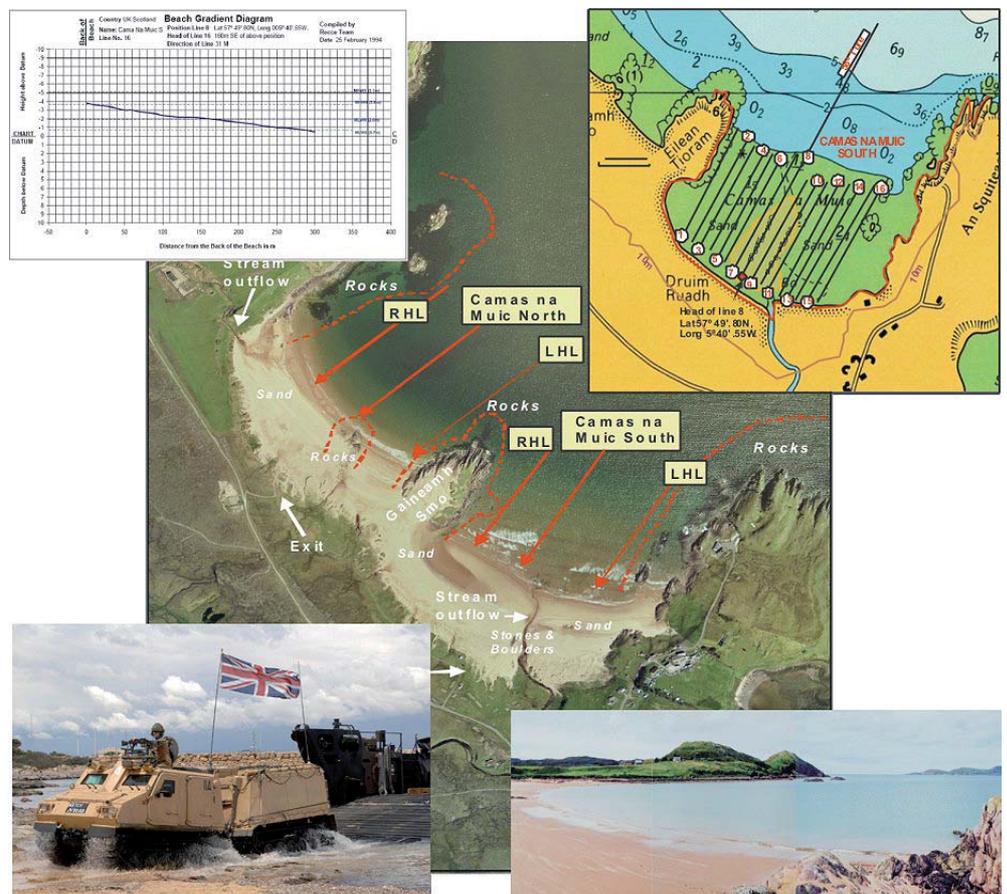
The Beach Intelligence team is a small team of three staff, providing the Royal Navy (RN) and Royal Marine (RM) customers with professional advice and a range of products providing Littoral Situational Awareness information to support amphibious operations and exercises. To meet this need the Beach Intelligence team acquires, analyses and integrates information from internal and external sources to produce beach/country reports, exercise support data and products in response to ad-hoc requests. The team also maintains the Beach Intelligence and Survey Database (BISD) and produces Hydrographic Port Assessments.

Who are our customers and what do they need?

Our customers are mainly Royal Marines but can be any user who is operating in the littoral environment. We support both planners and operators; from pre-deployment, recce phase, Task Group ship support, landing craft coxswains and assault craft personnel. Littoral support to other NATO nations and Allied partners is also provided on a regular basis.

An effective beach landing needs awareness of a whole host of environmental factors including, but not limited to:

- Beach name and location
- Description
- Approaches –
Offshore and nearshore
- Landmarks
- Anchorages
- Bathymetry
- Sea and surf
- Tides and tidal streams
- Beach Gradients
- Dimensions
- Composition - Description, features and trafficability
- Back of beach - beach exits
- Communications Inland/
Hinterland



What type of work do we do?

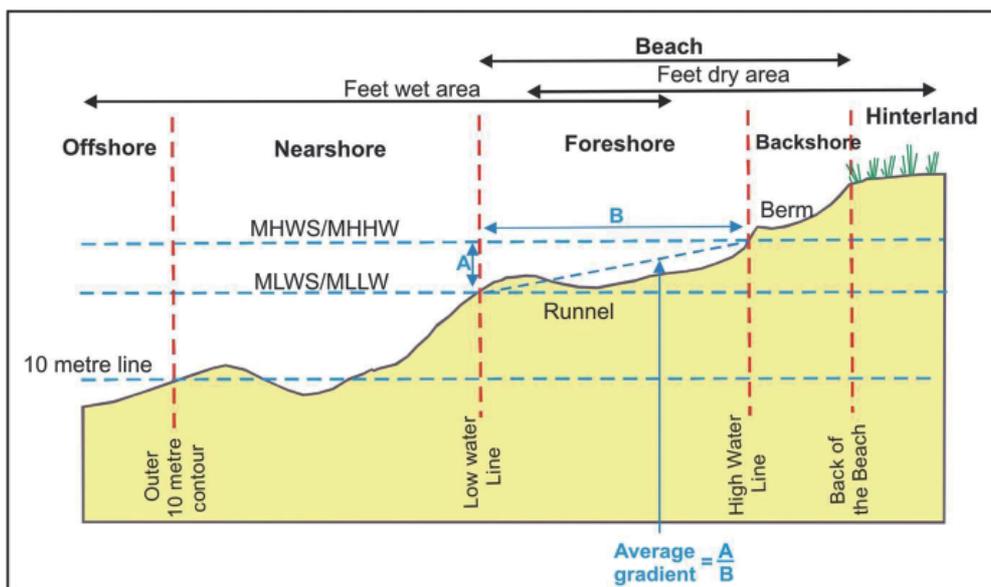
There are 5 strands of work that the Beach Intelligence team are contracted to deliver to the RN, they are:

- Conduct Beach Intelligence Country Analysis - Following lessons learnt in WW2 and the formation of the Combined Operations Assault Pilotage Parties (COPPs). UK forces carried out numerous beach recces, on an almost world-wide scale, in the 1950's and 60's. Since 1998 the UKHO has been responsible for updating these Beach Intelligence reports.
- Provide support to Exercises and Operations - Provide Beach Intelligence exercise planning products to major exercises and operations that identify the landing possibilities and broad environmental issues that could be encountered within the amphibious exercise area.
- Maintain currency of Littoral Manoeuvres - The objectives being:
 - a. To keep abreast of developments in the practical application of Beach Intelligence products.
 - b. To improve customer awareness of beach intelligence products and services.
 - c. To improve customer awareness of the need to render beach recces & surveys to DMGIC.
 - d. Attend validation exercises (such as Joint Warrior).
 - e. Provide instruction to RM units.
- Deliver Ad Hoc requests - Produce bespoke products on request.
- Deliver Hydrographic Port Assessments.

The Beach Intelligence team's area of responsibility includes the outer 10 metre bathymetric contour line and either 10 kilometres inland or to the first major communication route. The graphic below shows a beach profile and common terminology.

Products

Recently, the Beach Intelligence team have made a significant change in the way they deliver Environmental Information - primarily to the Littoral Manoeuvres community but also to the RN Surface Fleet. There has been a significant increase in the use of GIS to deliver data and



products that can be manipulated by these customers. The team have moved from delivering primarily analogue (hard-copy and pdf) products to delivering digital data and products that can be manipulated by the embarked GEO specialists, or interrogated by the user community using open source software.

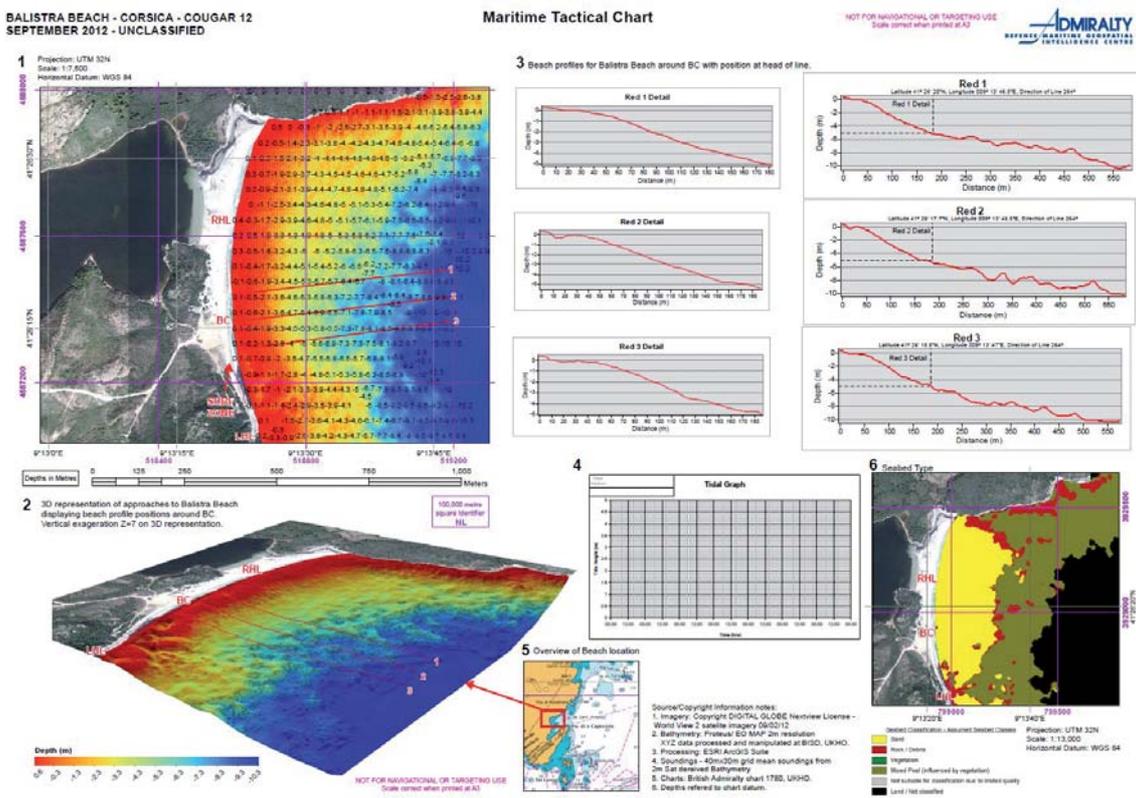
Country reports - Country reports, which are delivered in pdf, are made up of area reports and individual beach reports which are compiled in accordance with a NATO STANAG and are updated using the following sources:

- UKHO resources/information
- Aerial photography and satellite imagery
- Defence Intelligence data
- Military mapping from Defence Geographic Centre
- New beach reports
- Allied partners, via Defence Exchange agreements
- Public domain data

STOICs - Since 2008 the Beach team have been developing the Special Tactical Operational Information Chart (STOIC) product. The STOIC is an A0 size composite product containing a user-defined variety of data types including maps/charts, images, gradient diagrams, tidal information etc.

In 2012 we produced a variant, called a Maritime Tactical Chart (MTC), which used satellite derived bathymetry for the first time resulting in a potential new family of remote sensing products and capabilities. The MTC's were physically smaller, at A3 size, being specifically aimed at the small craft user.

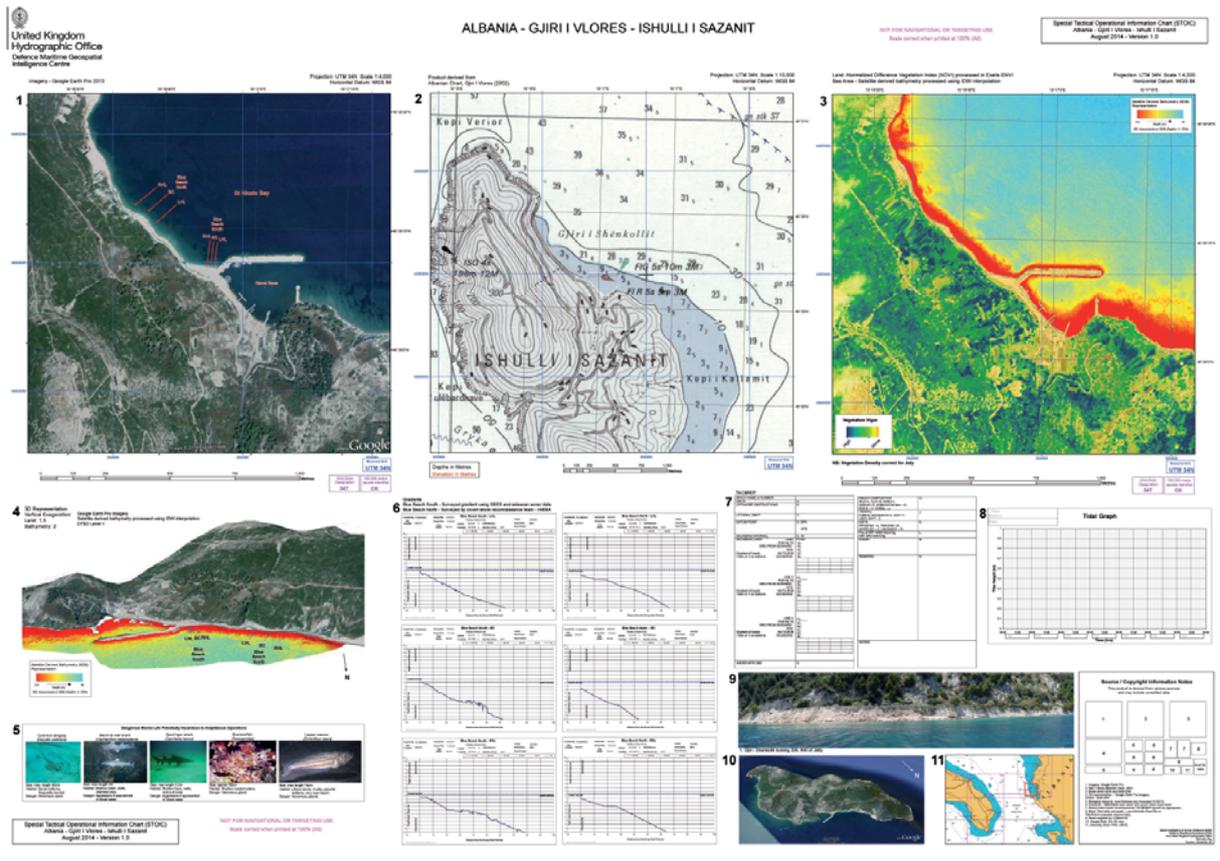
The STOICs created for Cougar 13 were a hybrid of the previous STOIC format and the Maritime Tactical Chart (MTC), from Cougar 12, resulting in comprehensive littoral products for Albania, Egypt and UAE.



Extra features in the new STOIC:

- 3D visualisations, through ESRI ArcScene, which give the user a clearer understanding of the battle space environment.
- Graphics showing satellite derived bathymetry, and the beach gradients derived from it. These portray the extent of potential area for a beach landing which increases the user's confidence in areas where access is denied.

- The vegetation vigour graphic shows potentially the type of vegetation i.e. grassland, shrubs or forested areas and is used to assist with predicting ground cover and trafficability for troop movement.
- Other analysis techniques have been identified by the team and in combination with ENVI's advanced spectral image processing tool, and the ESRI spatial analyst tools, will be used to determine water saturation, terrain categorisation, slope, anomaly detection and line of sight.
- Google Earth Pro 3D visualisation graphics.
- Dangerous Marine Life.

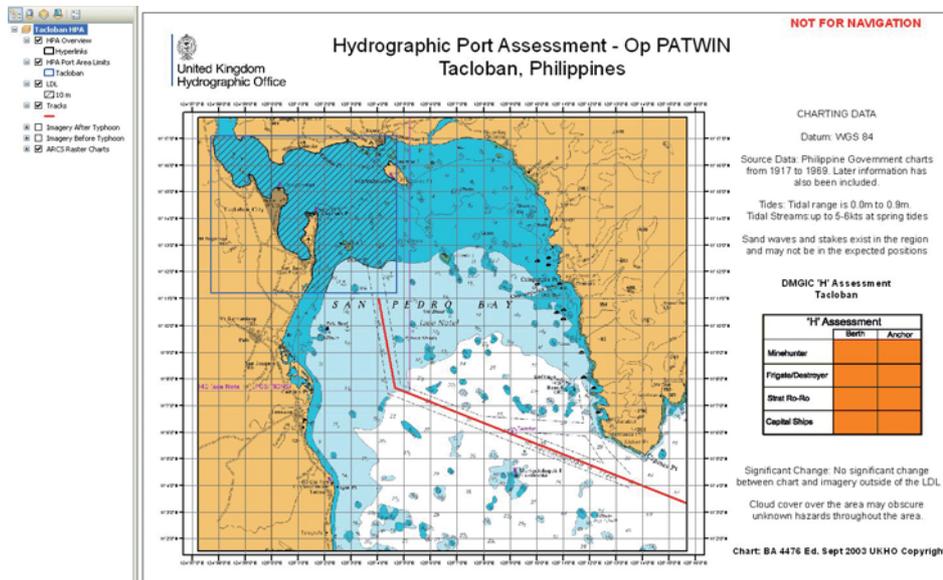


ArcGIS Projects – These projects are made up of various layers that could include, but not restricted to, raster and vector navigational charts and maps, seabed environmental information, bathymetric contours, either oblique, aerial or satellite imagery and hyperlinks to 3D fly-throughs, beach gradient diagrams, beach reports and associated publications.

Hydrographic Port Assessments (HPA) – HPAs were developed to provide Situational Awareness to in-theatre commanders at the planning stage of an operation. Traditionally, HPAs were delivered as a Powerpoint presentation. However, demand is now for an interactive layered product that will allow the end user to interrogate information and switch on/off individual layers. Using ESRI ArcGIS tools, we now deliver charts, imagery, mapping and other vector layers to the customer using the open source ArcReader software.

Customer Requirements Collection

Customer engagement is critical in order to provide the RN with what it wants, when it wants it and to deliver value for money. Opportunities are taken to engage with the lead customer, visiting RM units, deploying afloat during exercises, providing acquaint visits and delivering training courses whenever possible. This not only enables us to collect clear requirements, but provides valuable feedback that will improve the next generation of products. In order to provide the customer with increased value for money, the team collaborate with the Defence Geographic Centre (DGC), Feltham, and Allied partners to gain access to additional information or products.



UKHO produced HPA which forms part of a Port Infrastructure Vulnerability Assessment (PIVA).

New innovations

In response to a RM request for a night ops planning product showing buildings and skyline features, the team have been exploring 3D visualisation. The team have been testing the in-house capability and feasibility for generating 3D infrastructure for use with 3D visualisations that support situational awareness for beach landing operations. Using ESRI ArcScene, a 3D visualisation tool, virtual landscapes can be generated which allow the defence user to “fly through” and navigate their 3D battle space. The 3D concept has been well received by the customer and allied partners and we now routinely provide 3D data in support of exercises wherever we have sufficient data to support this. The 3D data allows.



- Realistic environment visualisations to support planning of exercises/operations.
- Potential to use for other areas of RN planning and support. E.g. Helo ops and land forces Generation of beach landing gradients with 3D Analyst.
- Line of sight.
- Visualisation of key offensive ranges (threat domes).

Enduring Support

The Beach Intelligence team at the DMGIC continues to evolve and innovate its products to match the needs of its end-users. It is continually exploring new ways of delivering geospatial data, including collaborative ways of working with other Specialist Geospatial Centres and Allies, in order to ensure enduring support to Littoral Manoeuvre operations.

On a Filming Mission for D-Day

By Chris Howlett

This article was originally published in the November 2013 issue of the UK Hydrographic Office's in-house magazine "Compass Point".



Chris Howlett during filming.



June 2014 is the 70th anniversary of the D-Day landings and the UKHO's hydrographic expertise has been called on to help with a joint Franco-American project to survey the area for TV documentaries. Chris Howlett has been helping with the filming out in Normandy.

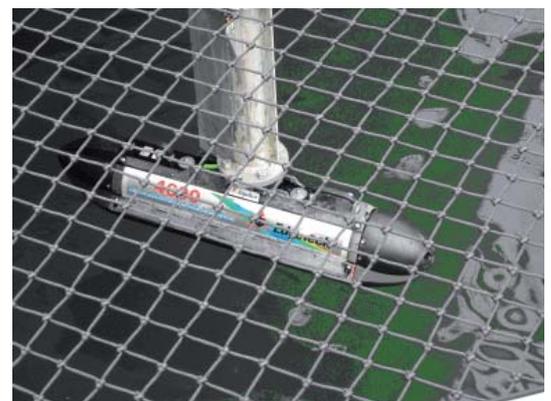
'Operation D-Day' is a collaborative project to survey the approaches to the Normandy beaches and produce an 'underwater map' of the area and two TV documentaries for US channel 'Nova' and French 'MC4' to celebrate the 70th anniversary of Operation Neptune in 2014.

I led the UKHO 2011 survey of the underwater remains of an artificial 'Mulberry' harbour used in World War II for cargo during the Allied landings. As a result of this we were asked to provide advice and data to the new project and Lt Cdr Becca Burghall and I visited Normandy for a week this summer.

The survey boat they had hired was a 24 metre catamaran and although the selection of a yacht was considered dubious, it proved to be an excellent survey platform being stable and roomy.



Etoile Magique (Magic Star) survey yacht.



Edgetech 4600 sonar head.

The survey comprised of two phases. For phase 1 the catamaran was fitted with a wide swath Edgetech 4600 sonar. A RIB was also streamed astern for boat transfer and diving purposes. In phase 2 the Edgetech was replaced with an R2Sonic 2040 allowing ultra high definition images but from a very narrow swath. The

catamaran was joined by French ship, the Andre Malraux, which carried two manned submarines, as well as an ROV to film wrecks.

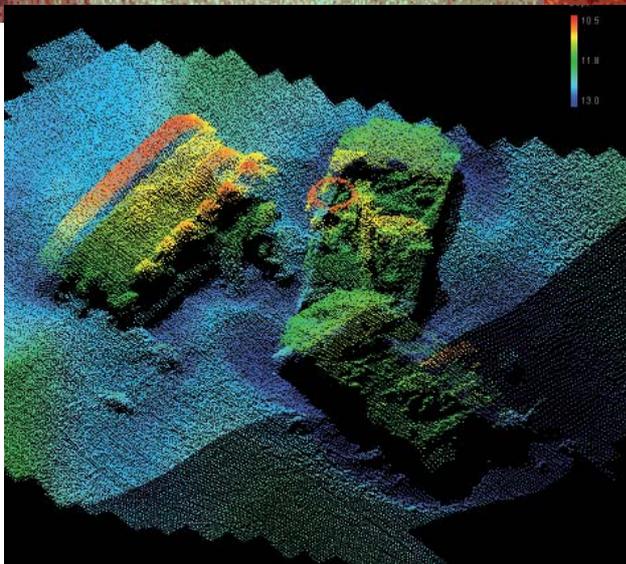
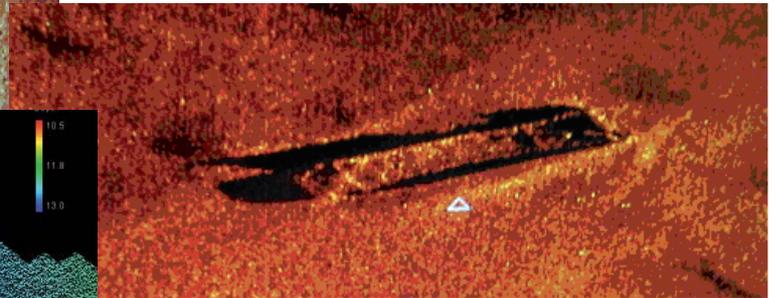
Phase 1 saw the yacht working 24/7 to cover as much area as possible and fix the locations of debris. Eventually this phase surveyed the area from Utah beach in the west to Sword beach in the east and from close to the 5m contour to approximately 8km off shore, some 500 square km. Phase 2 concentrated on obtaining ultra high definition sonar images as well as film and photographs of wrecks located in phase 1 with about 50 wrecks being covered in this way.

Several potential targets were never located. The reported positions of the *US Destroyers Cory*, *Glennon* and *Rich* as well as the *RN destroyer HMS Swift* all yielded no debris. However, many

locations still contained clearly defined wrecks ranging from large troop transport ships through Landing Craft Tanks to numerous barges and even individual tanks. These allowed the multi-beam, divers and submarines to gather stunning underwater images.



Landing Craft Tanks



Three Tanks

The TV crews have also filmed charts in our Archives relating to D-Day as well as modern charting processes and Digital Bathymetry.

Director for Nova, the technology channel for PBS America, Doug Hamilton, says it was important to film at the UKHO to show how we process data today compared with the 1940s.

The documentaries will be shown on American and French TV and should be shown on Channel 5 in the UK.

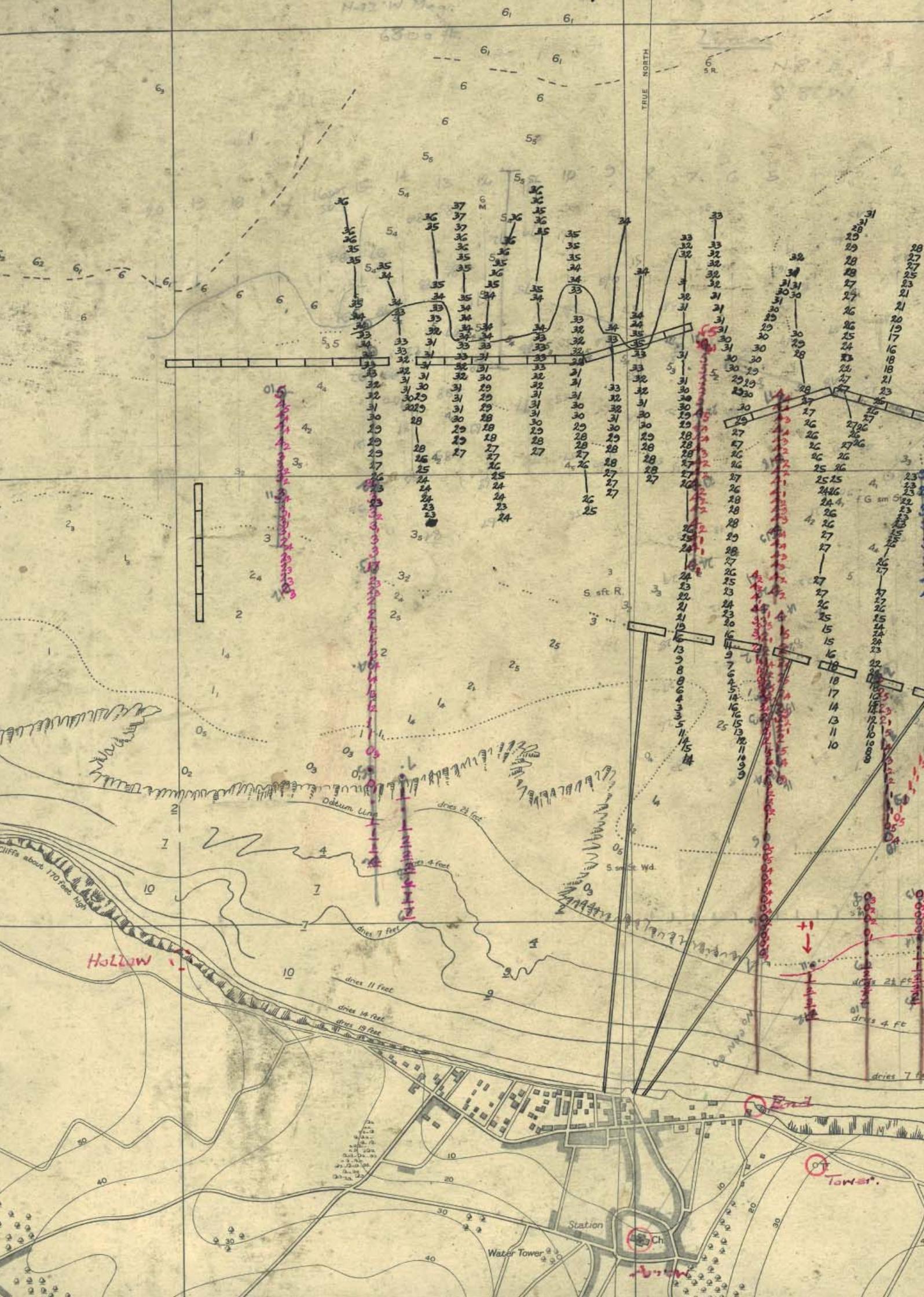
UKHO role in landings:

The Hydrographic Service (Royal Navy and the forerunner to the UKHO) played a key role in the preparations for the invasion of Europe. Hydrographic surveyors undertook clandestine surveys of the Normandy beaches under the noses of the Germans, obtaining crucial data to enable troops to be landed safely on those same beaches many months later. (See the Mulberry Chart overleaf)

Back in Bath, cartographers prepared numerous charts for a variety of special purposes. These included 'Chartmaps' that were a new concept, something that combined data from land and sea which was essential for the landings on the beaches. Also 'Searched Channel Charts' that showed critical routes through minefields.

All of those charts had to be printed and kept up-to-date. This required a small army of men and women at the purpose-built chart factory at Taunton, known as Creechbarrow House (now Edgell Block), to work around the clock to make sure all the charts and publications were ready for D-Day. Just for the British sector alone, the UKHO produced one million charts.

During 1944, the UKHO produced over 1.5 million charts to military support operations all over the globe and over 30 million throughout the duration of the war. Admiral Sir Bertram Ramsay KCB, KBE, MVO wrote of the Hydrographic Service's effort that it was '*equal to every demand made on them and one can place complete reliance on every branch of the Hydrographic organisation*'.



TRUE NORTH

Hollow

Station

Water Tower

Tower

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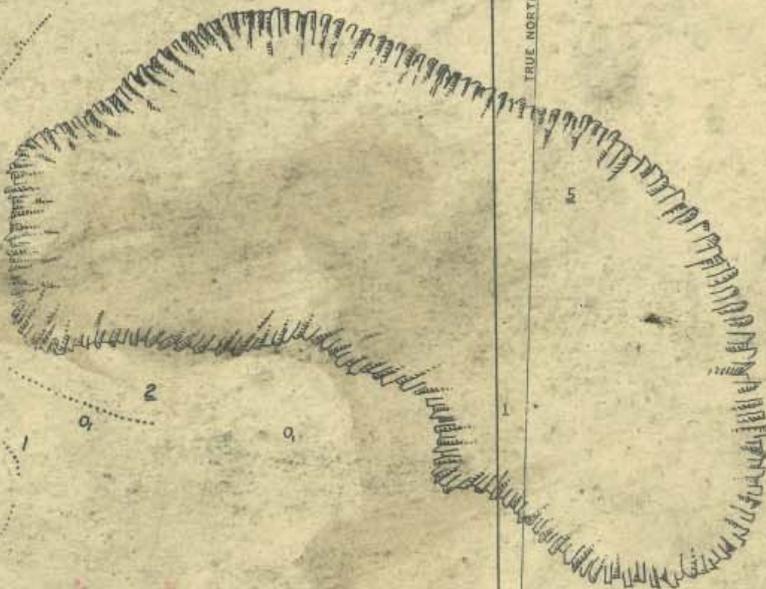
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TRUE NORTH



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Ch Cab

Commemorating the Outbreak of World War I

The war work of the Hydrographic Office

By Emma Down

This article was originally published in the July 2014 issue of the UK Hydrographic Office's in-house magazine "Compass Point".

As the country marks the centenary of the outbreak of the First World War we look at some of the challenges of producing, distributing and protecting our charts during the war.

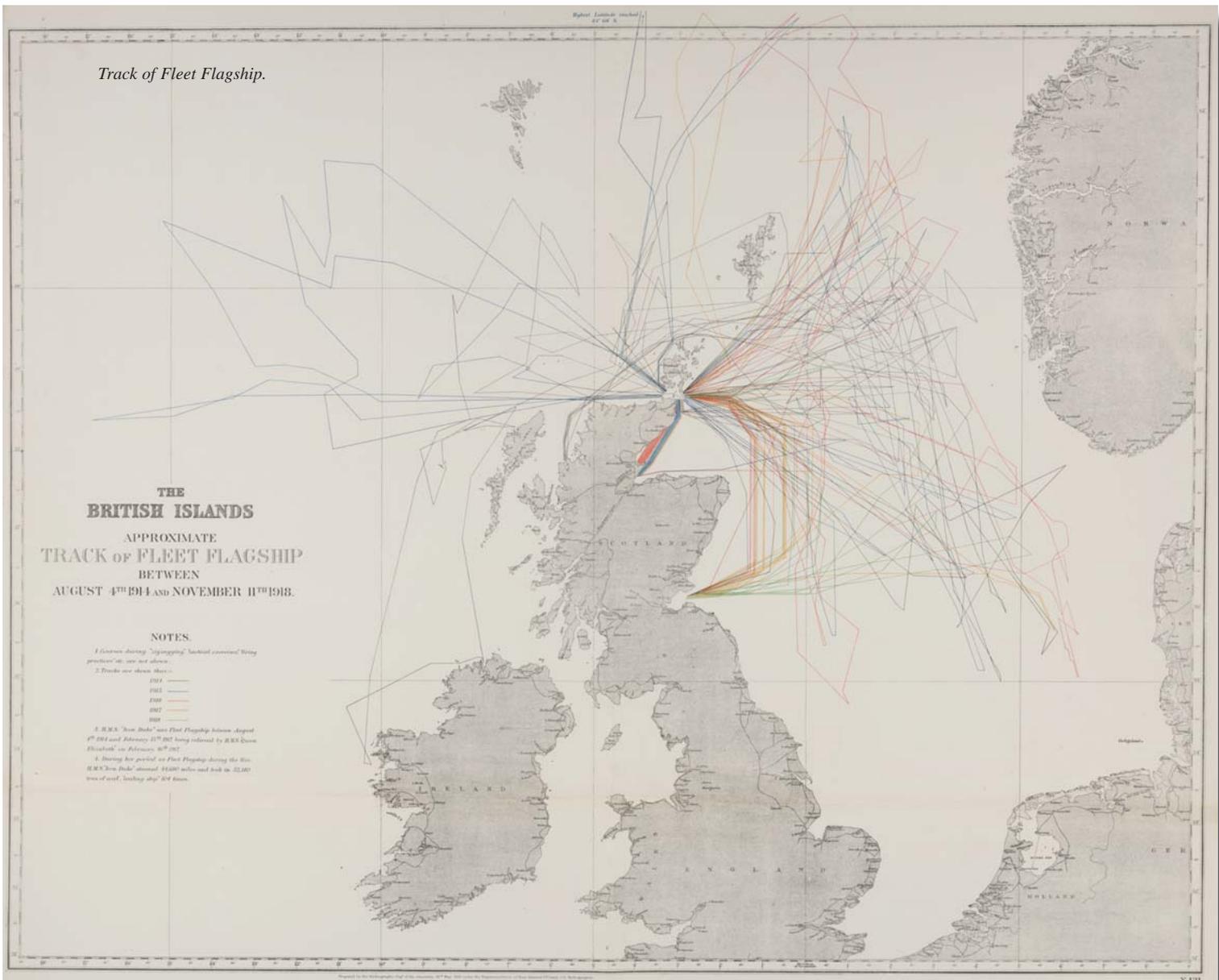
As an island nation at war the work of the Hydrographic Office was vital to our national security. The increased demand for charts and making sure that these were distributed securely had a huge impact on the department's products, processes and people. Staff numbers swelled from 61 in July 1914 to 367 in December 1918 - mainly female clerks and draughtswomen.

Over 600 Special Charts produced

During WWI numerous new charts and products were produced to support the Royal Navy:



Rear-Admiral Sir John F. Parry, KCB.



Fleet Charts

Produced solely for the use of HM Ships, these provided details of moorings, buoys, dockyard, railways and cables for ports in Home Waters. The number produced increased from 56 to 118.

‘X’, ‘Y’ and ‘Z’ Charts

With an increasing number of charts a new system of prefixes was adopted to distinguish which were more important. The charts were produced for our Navy and contained non-confidential (X), confidential (Y) and secret (Z) information.

Air Charts

The first air charts were designed for airships and seaplanes employed in coastal patrols and hunting submarines. The charts were produced in strip form showing the coastline of Britain and the North Sea. A set of small-scale charts were also produced covering the Dutch and German coasts to facilitate air raids on the Kiel canal, Hamburg and Bremen.

Submarine Charts

To give submariners more information about the nature of the bottom of the seabed including wrecks and any other dangers.

German Charts

Before the war two copies of any German Government chart received were kept - one for record and another for reproduction in times of war. The German charts were of a larger scale and often depicted more topography than the Admiralty charts so, on the outbreak of war, the Fleet was issued with a set of German charts to supplement our own.

‘P’ Charts

After the Armistice a small number of charts were produced for the requirements of the Peace Conference. These were mainly reproductions of Admiralty charts. They included areas such as the Adriatic Sea and Galapagos Islands and depicted trade routes and spheres of influence held by countries including Britain and France.

“Preventing charts and other hydrographic publications from reaching enemy hands was a priority.”

Surveys and Updates

Throughout the war surveying was restricted to essential work which directly supported the war effort. As a result, and in an effort to suppress information which might aid the enemy, the number of Admiralty notices published decreased. In contrast there was a huge increase in the number of *‘Temporary Admiralty Notices to Mariners’* issued, which contained changes to lighting and buoyage. The corrections communicated by these notices were intended to be made in pencil on the charts, so they could either be erased or inked in at a later date.

Printing

The need for increased security led to some notable exceptions to our production arrangements:

Eastern Mediterranean press

A lot of survey work was needed to support the ‘Dardanelles campaign’ in the Eastern Mediterranean as most of the charts of this area were old and inaccurate.

As a result, *HMS Endeavour*, under Commander J A Edgell, was sent out to Turkey in October 1915 to establish a printing press. At first this work was carried out on board ship but later the press was set up ashore. The work carried out included making reproductions of navigational, mine and gunnery charts, astronomical calendars and proclamations in Turkish and Greek.

Admiralty secret press

Until August 1917 all secret ‘Z’ charts were printed at the Ordnance Survey Office at Southampton. However, delays and the risk of losing charts during transit led to the establishment of a ‘secret press’ in the Admiralty building which continued for the duration of the war.

Restrictions on sales

Preventing charts and other hydrographic publications from reaching enemy hands was a priority. In September 1915 restrictions were imposed on the export of charts under the Defence of the Realm Act which required chart sellers to hold a formal permit, issued by the Admiralty. Postal and customs authorities assisted to ensure that no package of hydrographic publications left the country uncensored.

Supply & Distribution

Ship and Shore establishments

At the outbreak of war the Chart Issue Branch was responsible for supplying military transport with charts. An enormous increase in demand from reserve vessels for chart sets was met from existing stocks but the preparation and despatch of these required several weeks work, both day and night.

Auxiliary Patrol chart sets

The Auxiliary Patrol service was an antisubmarine initiative which commandeered British trawlers to help combat German submarine operations. The vessels were supplied with a small set of general charts for navigation around the British Isles and a set of large-scale charts covering their designated patrol area. Together the chart sets provided all the information needed to carry out their operations, without the need to carry large quantities of charts.

Supply of charts to Merchant vessels

By the end of the war 90-95% of British Merchant Shipping was using Admiralty charts. The Allied navies, including the US Battle squadron, and the French and Greek navies were also supplied with Admiralty charts.

Increase in chart depots

Prior to the war, 9 chart depots were established at HM Dockyards where stocks of charts were kept and corrected. During the war, this number increased to 15 depots to meet the increased demand to supply the Merchant Navy. Sub-depots were also established abroad at various places including Kingston, Jamaica; Aden, Yemen; Singapore and Port Stanley, Falkland Islands.

Beyond The War

WWI led to great technical advances in surveying, navigation and printing. Copper plate printing was gradually superseded by lithographic printing; and technological change during the war created the foundations for the development of echo sounding in the 1930s. Throughout the inter-war years the Office also took on additional commitments in oceanography and naval meteorology.

Branching into Chronometers

The large increase in the number of ships commissioned during the war led to an increase in the demand for, and shortage of, marine chronometers for navigation. In 1917 the Office's Chronometer Branch assumed control of the whole British chronometer trade and began purchasing second-hand chronometers for the Merchant Navy. Chronometer firms & makers were placed under the 'Schedule of Protected Occupations' so the skilled men employed in making the instruments were exempt from Military Service.

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The Defence Geographic Centre and the Centenary of the First World War

Introduction

In the First World War a massive and unprecedented mapping and survey effort was made in support of the British Army, especially the British Expeditionary Force (BEF) on the Western Front in France and Flanders. This effort encompassed revolutionary developments in mapping and surveying and the legacy of the war is still very strong in the work the Defence Geographic Centre (DGC) carries out today. On the Western Front many new survey and mapping methods and techniques were developed which together greatly enhanced the spatial awareness of the British Army. A new era opened with aerial observation, aerial photography, photographic interpretation, the making of maps from air photos, the provision of air charts, the provision of large-scale maps, the use of an alphanumeric reference system, the use of coloured overprints, the use of sound-ranging, the use of flash-spotting, the making of artillery boards, of panoramas, of photo mosaics and of relief models.

Many of these methods and techniques are still in use by DGC today. DGC continues to use an alphanumeric reference system and coloured overprints derived from aerial photography on its maps and continues to produce large scale maps, relief models, air charts, panoramas and photo mosaics.

During the First World War the functions of DGC were performed by the Geographical Section of the General Staff (GSGS) at the War Office (WO) in London, by the survey units of the Royal Engineers (RE) in the field and by the Ordnance Survey (OS) in Southampton. Today DGC continues to put GSGS edition and series numbers on its products, has Royal Engineers on its staff and maintains a close relationship with OS.

First days

At the outbreak of war in August 1914, it was fortunate that the War Office had at its disposal the GSGS, the Royal Engineers and the OS, all well established organisations experienced in producing maps. Supported by civilian personnel, they were all staffed by military personnel well trained in mapping techniques and very familiar with surveying in a variety of conditions around the world.

On mobilisation, the Printing Coy RE accompanied the BEF and was based at General Headquarters (GHQ) at St Omer in France. It was equipped with cameras, litho-presses, duplicators and a letter-press outfit. On the staff at GHQ was Major (later Brigadier) E M Jack RE, known as “*Maps, GHQ*”. All RE surveyors and map-makers in France and Flanders worked under the direction of Jack. Eventually, he had nearly 4,000 officers and men at his direction.

It was the first war in which British soldiers were provided in advance with adequate medium scale mapping, thanks to the foresight of GSGS. The BEF was originally provided with two sets of maps of Belgium (GSGS 2364 at 1:100,000) and France (GSGS 2526 at 1:80,000) based on native mapping. They were suitable for the mobile operations which were anticipated and in fact occurred in the opening phase of the war but not for the unforeseen static operations which followed. Warfare ceased to be about manoeuvre and became about trenches, barbed wire, machine guns and artillery.

Large scale maps

Trench warfare rendered medium scale maps useless and created the urgent need for large scale maps.

The OS enlarged the 1:80,000 map (which had hachures, not contours) to 1:40,000 but the inaccuracies of the original (surveyed in the early nineteenth century) meant that it could not be relied upon for either infantry or artillery use.



Brigadier E M Jack CB CMG DSO RE

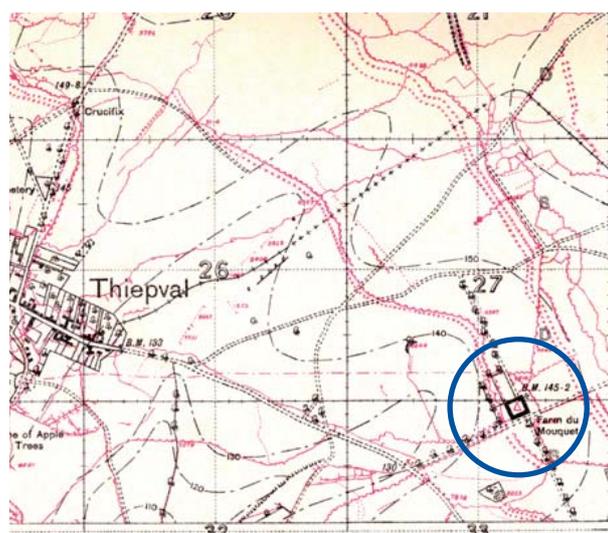
After a further attempt at revising the 1:80,000 was abandoned in December 1914, a decision was taken to carry out a full-scale survey of that part of the British front in France. The 1st Ranging Section under Captain H Winterbotham RE was tasked with the job. The section was experimental and had been deployed in the expectation that it could, from disparate known ground locations, intersect Allied aircraft flying over enemy gun batteries and thus locate those batteries and enable them to be targeted for counter-bombardment. It had been unsuccessful however. Comprising RE observers and topographers, together with plane-tables transferred from OS, the section began the task of re-triangulation in January 1915. The work was often hazardous for the plane-tables as they were taking measurements within range of the enemy.

The work of Winterbotham's section resulted in a new series at 1:20,000 (GSGS 2742), which eventually covered the whole of the British front. During the war over 12,000 square miles were surveyed (initially on the ground and later from the air) at the scale of 1:20,000. On this firm basis accurate large scale maps were produced. The main series were at 1:40,000, 1:20,000 and 1:10,000 scales. Smaller and larger-scale maps were also produced (including 1:5,000 scale for use by the infantry for patrols and raids) but these three scales addressed respectively the main needs of administration, the artillery and the infantry. The most commonly used maps were the 1:20,000. They were often very detailed, for they were designed for use by heavy and medium artillery, which required a precise locational aid to pinpoint particular targets.

That part of the BEF operating in Flanders was more fortunate in that it was already in possession of detailed and accurate maps, reproduced from Belgian 1:10,000 scale sheets taken to OS by Belgian personnel evacuated from Antwerp in 1914. From the Belgian sheets the British adopted sheetlines for their own 1:40,000 and later 1:20,000 and 1:10,000 maps. These sheetlines were extended to cover the entire British front including that part in France. The maps reflected the numbered and lettered squaring of the front in a way which enabled the artillery and infantry to pinpoint locations more accurately and easily.

Aerial photography

Aerial photography, taken by the Royal Flying Corps (RFC) and its successor the RAF, was an invaluable tool both for improving mapping and for locating and confirming locations of enemy artillery made by flash-spotting and sound-ranging. On his own initiative, in January 1915 Lieutenant CC Darley RFC took air photos of part of the German frontline, which he interpreted and made into a map. His superiors were impressed, realising that useful intelligence could be derived from the study of air photos and displayed in an understandable way on a map. From then on aerial photography, Photographic Interpretation (PI) and the depiction of the results on maps became standard practice.

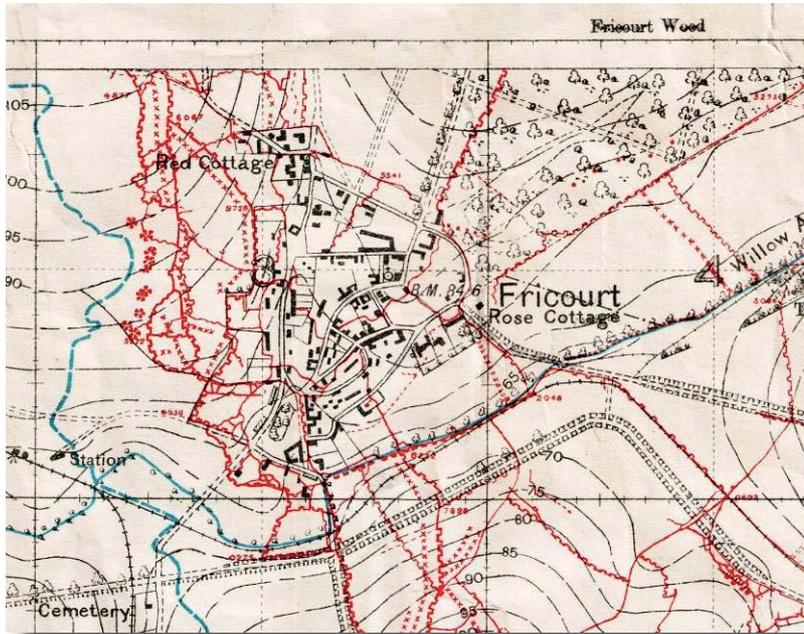


Excerpt of GSGS 2742 Sheet 57D SE, showing Mouquet Farm near Thiepval, Somme; with aerial photograph of the same area

Trench maps

By July 1915 each of the British Armies on the Continent had its own team of expert survey staff responsible for the compilation of larger scale trench maps. The information, usually obtained from aerial photographs and sketches undertaken by staff on the ground, culminated in a large number of 1:5,000 scale sheets. The battle of Neuve Chapelle in March 1915 had shown up a large number of

inaccuracies and it became clear that a new series of large scale maps was necessary if operations were to be mounted effectively. Maps, GHQ had started to introduce a new series of 1:10,000 trench maps (GSGS 3062) in June to 2nd Army and, by August, 1st Army was also provided with such maps. These maps were reproduced by OS and then shipped to St Omer.



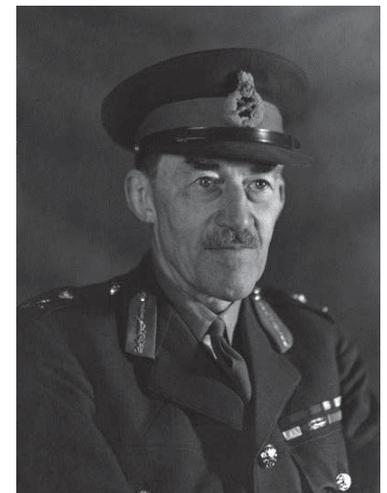
Excerpt of GSGS 3062 Sheet 62D NE2 Meaulte, showing Rose Cottage. Trenches corrected to 15 April 1916.

Series GSGS 3062 is most famously the “trench map”, being the most common used by the infantry. Each sheet measured 80 x 50 cm and covered an area of 8 x 5 km on the ground. The Western Front was divided into alphanumeric squares. The village of Fricourt on the Somme appears on sheet 62D NE2 Meaulte, which is the second sheet of four in the North East quadrant of square 62D. Rose Cottage in Fricourt is shown on this sheet at reference F3d 89, which is 8/10ths North and 9/10ths East of the South West corner of square F3d. Captain C Romer RE invented cards (known as romers) to determine such precise references within squares and they are still in use by DGC today. ‘Secret’ (S) editions of trench maps were overprinted with not only German trenches, batteries, barbed wire, pillboxes,

bunkers etc. but also British (though in less detail, in case of capture). German defences were shown in red and British in blue (though in 1918 these colours were reversed). To maintain their currency, the overprints were updated as soon as new air photos or other intelligence came in, so S editions passed through several editions. Circulation of S editions was naturally limited.

By the end of 1915, Maps and Printing Sections had evolved into the more independent Topographical Sections which were now making extensive use of the new advances in technology. The recently formed 3rd Army had taken advantage of the newly acquired Camera Lucida to provide detailed plotting. The information gained by these new techniques was used to revise a set of nineteenth century cadastral plans, obtained from the Land Office at Amiens, to produce a new series of 1:20,000 scale maps. So accurate and fine was the detail that 1:10,000 scale maps could be produced direct from them. Better photographic equipment, both aerial and land based, together with improved printing presses and developments in flash-spotting and sound-ranging, ensured that the 1:20,000 and 1:10,000 scale maps became the standard issue for artillery and infantry respectively for the rest of the war.

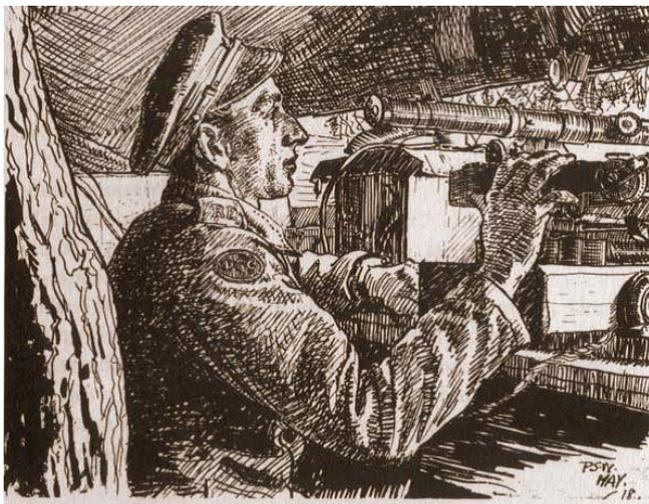
The Topographical Sections evolved into Field Survey Companies in February 1916 and each Army in the BEF was assigned one company. The maps for the Somme offensive (July to November 1916) were produced by 4 Field Survey Company under Major (later Major-General) M N MacLeod RE. DGC named a building in his honour in 2003. In 2006 and 2014 DGC produced commemorative facsimiles of Somme GSGS 3062 trench maps created by MacLeod’s company.



*Major-General M N MacLeod
CB DSO MC RE*

Artillery support

Sound-ranging and flash-spotting were developed to locate the positions of enemy artillery so that they could be targeted by the Royal Artillery (RA). Sound-ranging was an electro-mechanical means of recording the sound waves set up by the discharge of a gun and so computing its position. Flash-spotting aimed at the same result by taking cross bearings of a gun flash. At the beginning of the war, the RA investigated sound-ranging, which had been invented by Lucien Bull, an Englishman working in Paris, and which had been under development by the French Army. The RA discounted the method as unworkable but Jack took the idea up and appointed the young and brilliant Nobel Prize winner for Physics, Lawrence Bragg, to develop the idea. Bragg



Flash-spotter at work in his shelter.

developed very successful equipment and each Field Survey Company controlled the work of Sound-Ranging Sections. In parallel, Harold Hemming developed flash-spotting, a visual method of synchronised observation of gun flashes from known, surveyed, observation posts. These sections were also controlled by the Survey Companies. In 1915 artillery boards were designed to make map use more convenient for the RA and to avoid inaccuracies resulting from an un-mounted map. The earliest boards were simple, carrying only a grid, the gun positions and other conspicuous points. An improved version, made from the 1:20,000 scale map, was designed in 1916. The complementary methods of flash-spotting and sound-ranging enabled the location of enemy artillery batteries, their depiction on maps and their engagement

by counter-battery artillery, to devastating effect at the battles of Cambrai in November 1917 and Amiens in August 1918.

Relief models

Using the GSGS 2742 1:20,000 scale maps, relief models were made of the entire British front. This was necessary because the Germans had the advantage of holding the high ground and occupying the reverse slope. These models consisted of layers of sheets, cut to the shape of a contour. The result was a model which represented the ground in a series of steps, the proportion of the vertical to the horizontal scale being 4.5 to 1 (or for exceptionally flat areas, 9 to 1). Not being moulded but cut, the sheets were raised not bent and remained planimetrically correct. The GHQ master set in its special cabinet, used personally by Field Marshal Sir Douglas Haig (C-in-C BEF) and his Staff (as crayon marks and diary entries testify), was held in storage by the Imperial War Museum for many years. It was eventually transferred to the Royal Military Academy at Sandhurst. After restoration and research work over several years by DGC personnel, it was unveiled at Sandhurst in 2011 by Lord Astor, Defence Minister and Haig's grandson. Today DGC still produces relief models exaggerating the vertical axis to enhance appreciation of ground, both its dangers and its possibilities.

Printing

The first Map and Printing Sections used lithographic hand presses which printed sheets up to 17.5 x 22.5 inches in size. This continued until early 1917 when a larger press (30 x 20 inches) was introduced. Flat bed presses continued to be used until the end of the war, producing maps up to 22.5 x 35 inches in size. From 1916 Field Survey Company personnel were equipped with new cameras. The OS organised short courses in new photo-mechanical reproduction processes, such as heliozincography, which the staff were sent back from the front to attend.

Despite an increase in personnel and better reproduction processes, the ever-growing scale of the war meant that demand for maps constantly outstripped supply. At the end of 1917 OS established an Overseas Branch, Ordnance Survey (OBOS) near Wimereux to support the BEF directly and especially to make up the shortfall of maps. By the spring of 1918 OBOS was in full production. However, the German breakthrough on the Marne in March 1918 meant that maps of areas well in the rear of the frontline had to be produced urgently and despite the loss of equipment. Such areas had not been surveyed. Field Survey Companies were enlarged into Battalions in June 1918.



Excerpt of relief model created from GSGS 2742 Sheet 57C SW; showing Longueval, Somme.

Together with OBOS, the Battalions were able to carry out the entire process of map production in theatre. The large number of sheets being produced at 1:20,000 scale by OBOS was sufficient to allow the Battalions to concentrate on 1:10,000 scale sheets. Production of maps at these two scales now met demand.

Under its Director General, Col (later Sir) Charles Close RE, the OS was fully mobilised in support of the British Army's mapping and survey effort during the war. A total of 34 million maps were produced for the Western Front, of which OS produced 21.7 million and OBOS 3.1 million while the War Office produced 2.1 million and RE survey units in theatre 7 million. Of these 34 million, 31 million were issued.

Last days

With the battle of Amiens, the BEF broke through the German lines and brought the return of mobile warfare, which made trench maps redundant. In 100 days of unrelenting offensive action by the BEF following Amiens, the Germans were driven back into Belgium and forced to surrender.

After the war, the mapping and survey effort on the Western Front received a glowing tribute in Haig's Final Despatch:

The great development of air photography, sound-ranging, flash spotting, air-burst ranging and aerial observation brought counter battery work and harassing fire both by day and night to a high state of perfection. Special progress was made in the art of engaging moving targets with fire controlled by observation from aeroplanes and balloons. The work of the Field Survey Sections, in the location of hostile battery positions by re-section and the employment of accurate maps, was brought into extended use. In combination with the work of the Calibration Sections in the accurate calibration of guns, and by careful calculation of corrections of range required to compensate for weather conditions, it became possible to a large extent to dispense with registration, whereby the chance of effecting surprise was greatly increase. In the operations east of Amiens on the 8th August, 1918, in which over 2,000 guns were employed, practically the whole of the batteries concentrated for the purpose of the attack opened fire for the first time on the actual morning of the assault.

Other theatres

In the war the British Army was concentrated on the Western Front, where most of the German Army was concentrated. The needs of the BEF were paramount and the forces elsewhere had to make do with what could be spared. This greatly limited mapping and survey support in the secondary theatres, which included the Dardanelles/Gallipoli, Salonika/Macedonia, East Africa, Mesopotamia, the Sinai/Palestine and Italy. At the same time, the cutting edge mapping and survey work carried out on the Western Front influenced the work undertaken on all the other fronts.

For the Dardanelles campaign in 1915 a Printing Section RE was initially deployed and this was later joined by a Mapping Section. The expedition deployed with outdated maps including a three-sheet 1:40,000 scale enlargement of a 1:50,000 scale reconnaissance map made by the French en route to the Crimea in 1854. Though this map was completely inadequate, the nature of the heroic but futile efforts at breaching the enemy defences across the Gallipoli peninsula at Helles probably meant that it would have made no difference even if the troops had had accurate large scale maps. By the time of the August offensive at Sari Bair by the Australian and New Zealand Army Corps (ANZAC) and the simultaneous landing of territorial troops at Suvla Bay, Turkish 1:25,000 scale maps made in the period 1911-1913 and taken from the dead or POWs early in the campaign had been enlarged by the Survey of Egypt, the base plant facility supporting the campaign, and produced at 1:20,000 scale. These maps were probably the best topographic maps used by the Allies in the early part of the war.

Throughout the campaign of only eight months, the Mapping Section tried to utilise aerial photographs to produce a good 1:10,000 scale map of each of the three sectors. The question of artillery support was a vexed one. The ability of the Royal Navy to provide accurate fire support was overestimated. With only toeholds on the peninsula a trigonometrical survey was almost impossible though efforts were made. In the frontline, expedient very large scale trench maps were made, notably in the ANZAC sector, by Major SF Newcombe RE. The formal enquiry into the disastrous campaign (the Dardanelles Commission) made inadequate mapping a scapegoat for incompetent leadership and insufficient resources deployed against a tough opponent in formidable terrain.

On the evacuation of Gallipoli, the Mapping Section moved to Salonika and was expanded to become 8 Field Survey Coy RE, which worked alongside the French survey organisation there.

Major H Wood RE of the Survey of India and lately of the Western Front assumed command and initiated a completely new Anglo-French survey. To make good the deficiency in topographers, by now all on the Western Front, he obtained a supplement of plane-tablers from the Survey of India. The Anglo-French survey provided a complete suite of large scale map series based on trig control, plane-tableing and aerial photography and which assisted the Allied breakthrough in late 1918. Trained sound-ranging and flash-spotting personnel were deployed from the Western Front to become part of 8 Field Survey Coy.

Due to the well-established links and co-operation with the Survey of Egypt, the GSGS called upon the Survey of Egypt to support the campaigns in the Dardanelles/Gallipoli and the Sinai/Palestine.



Excerpt of a Salonika map of the Lake Dojran front, compiled from air photos.

The immediate pre-war Palestine Exploration Fund (PEF) survey of the Sinai by Newcombe, accompanied by a young archaeologist TE Lawrence, had provided trig control into the southern part of Turkish-occupied Palestine to connect with that of the PEF survey in the 1870s under Lieutenant HH Kitchener RE (who, as Field Marshal Earl Kitchener, mobilised and directed Britain's Army during the first half of the war). In 1914-16 Lawrence worked at GSGS in London and then in Cairo making maps (including for Gallipoli) before he found fame as a leader of irregulars in Arabia. 7 Field Survey Coy RE, largely staffed from the Survey of Egypt, was formed to support the Egyptian Expeditionary Force (EEF). Between 1916 and 1918, the company produced large scale maps of the Sinai/Palestine in support of the offensives against the Turks. Trained sound-ranging and flash-spotting sections were sent out from the Western Front to join 7 Field Survey Coy.

Conclusion

The effort over the four years of war was unquestionably the largest survey and mapping operation in history up to that time. During the war the GSGS, RE and OS were all greatly expanded to meet the huge needs of the British Army. After the war it was said that no surveyor, however large or varied his military experience, could have foreseen the extraordinary growth which took place. This growth was a common feature in all the armies in every theatre of the war, though in only the British Army was the investment on such a scale. During the war the peacetime links between RE surveyors, the Survey of India, the Survey of Egypt and the OS, all commanded and staffed by the RE, enabled a very high degree of co-operation. Working together, the RE, civil surveyors, colonial surveyors and civilian specialists such as physicists revolutionised mapping and survey during the war. Flash-spotting, sound-ranging, aerial photography, squared and overprinted mapping all combined to produce a dramatic effect on the battlefield, an effect that amounted to a revolution in military affairs and contributed greatly to the Allied victory.

The enormous efforts and revolutionary advances made by the predecessors of DGC during the First World War should not be forgotten. The legacy is important: the foundations of the work that DGC carries out today were laid during the First World War.

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Acknowledgements

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512 Specialist Team Royal Engineers (STRE) (Geodetic Satellite Survey)

By Mike Stanbridge Lt Col (Rtd) RE Svy - 2IC 512 STRE 1976-79

Introduction

Whilst there have been numerous articles published by various individuals about 512 STRE's activities and their specific tours and experience in the unit, some reading like glossy tourist brochures, there is no comprehensive document covering the unit's history from its formation to its disbandment together with its mission, establishment, organisation and deployments. Hence, the purpose of this article is to stir a few memories to discover how it really all began, together with its achievements and details of equipment and satellites used and, indeed, how it all ended.

With this aim, the author has compiled the following outline chronology of the unit and seeks additional material in the form of notes or articles, with photos, names, more exact dates, locations and number of stations, either to fill the gaps or to correct/complement the information below.

The Beginning

512 was not a unique number for a Military Survey unit as there had been a 512 Field Survey Company RE, formed in Egypt during 1940, which served all of its time in the Middle East until 1948. 512 STRE, however, appears to have been formed during the late 60's following, firstly, the establishment of the British Liaison Officers post in 1958 and Military Survey's engagement with the US Army Mapping Service and then the formation of the Sequential Collation of Range (SECOR) Team, led by Maj Prescott, in about March 1963. A Specialist Geodetic Survey Team (SGST) was then approved on 5 July 1966 and the BC-4 (Ballistic Camera) Team, led by Maj Batterham, formed up in October 1966. D Mil Svy's first half yearly report of 1966 states that '*the SGST will incorporate both the SECOR Team and the new BC-4 Team*' – but there was no mention of 512 STRE!

The first mention of 512 STRE that, to date, can be found is in the Sep '68 Edition of the Royal Engineers Journal (REJ) when the E in C's report states '*512 continues to be based in Washington DC with its Optical Team in S. Georgia and Electronic Team in Ascension Island.*' The latter statement indicates that, although part of the same SGST establishment, the SECOR and BC-4 Teams operated independently of each other under different US commands until sometime during early 1968 or even late 1967, because, according to Maj Batterham, the two Teams met unexpectedly in June 1967, in Maui, Hawaii.

To support this formation date of 1967/68, an unofficial 512 STRE posting list, with no publisher or date, shows Lt Col Ayres, Capt Piggott and 4 supporting tri-service NCO's to be the first individuals assigned to 512 in 1968/69 and Lt Col Crawford clearly shows his unit to be 512 STRE in his Mar '72 REJ article. As the US Army's SECOR, the USAF's PV1000 and NOC's BC-4 systems were phased out in 1972 in favour of the US Navy's Doppler System, it is feasible that the SGST was changed and re-designated 512 STRE to meet this future change in satellites and technology. From the establishment perspective, it is known from Maj Prescott's REJ Sep '65 and Maj Batterham's REJ Dec '67 articles that:

- The SECOR Team consisted of 1 Officer and 6 Technicians, two from each of the three services, and
- The BC-4 Team consisted of 1 Officer, 1 WO, 2 Cpls and 1 REME Sgt

Hence, if these are added together the number and mix of personnel is getting fairly close to the total of 14 which was in place by Summer '69 headed up by Lt Col Crawford and Maj Underwood.

During this similar period there was, also, some UK Military Survey activity at Barton Stacey with the establishment of Transit Network (TRANET) Station 106, the successor to the RAE TRANET station 016 which had been in operation at Lasham since 1960. This tracking station, being one of the initial 6 worldwide, produced satellite data automatically 24 hours/day with the crew, managed by Capt Critchley, only in attendance for 8 of these hours. By 1979, there were 19 TRANET stations around the world, in support of the 4 Operational Network (OPNET) stations of the Navy Astronautics Group (NAG), three in continental USA and one in Hawaii. It is not known when the

TRANET Station moved from Barton Stacey to Hermitage or when it was disestablished, possibly in the mid 1990's along with 512 STRE. Any further information on the dates and manning of Military Survey's TRANET Station would be welcomed.

Unit Roles & Responsibilities

512 STRE supported DMA around the world in locations, wherever UK personnel were more readily acceptable than US, as did teams from the remainder of the five Nations engaged in the programme viz. CA, AUS and NZ. The tasks, using a Geociever AN/PRR14¹, costing c. £62,000 and manufactured by the Philips Group, based in California, were either to:

- Track satellites from well established locations to obtain data for scientific and military purposes, or
- Fix ground positions from satellite observations and their orbital data with the position obtained being treated as a 1st Order station.

The first was known as the Special Mission Tracking Program (SMTP) and the second as the Doppler Geodetic Positioning Program (DGPP). The latter were identified on aerial photography or satellite imagery on which local photo-points were also identified and fixed. The Doppler data, on binary and/or punched tape, was returned to DMAHTC for computational purposes by a variety of means - commonly via diplomatic bags. Communications between section commanders and HQ 512, prior to the advent of emails and mobile telephones were generally via UK Embassy's/High Commissions or Cable & Wireless pre-booked telephone or telex.

In DMAHTC, the 2IC was, effectively, in a command position and responsible not only for the day to day management of the team but, for planning purposes, had to respond to DMA's operational needs via DMAHTC's Chief of the Geodesy & Surveys Dept, a USAF 'Bird' Colonel. These needs and a possible solution thereto, then had to be quickly passed on to the AD Svy/CO in HQ DMA and PSO Svy 6, Norman Leppard, for D Mil Svy's deployment authorisation, technical direction and MoD DI briefings as necessary. The AD Svy/CO met all unit personnel whenever possible as they passed through Washington DC and, indeed, managed to visit the sections occasionally in their overseas locations.

The RE Svy WO, based in HQ 512, although having a desk in the units office, was generally employed in the DMAHTC's data collation, computation and distribution department.

Unit Establishment

During 1976-79 and for much of its existence, 512 STRE had an establishment of 16 personnel and was based in the Defense Mapping Agency Topographic Centre (DMATC) later to become, at the end of that period, the DMA Hydro Topo Centre (DMAHTC) in Bethesda, Maryland. The Team consisted of:

- 1 x Lt Col/AD Svy/CO on a 2-3 year accompanied tour and based in HQ DMA adjacent to the British Embassy, Washington DC.
- 1 x RE Svy Major/2IC and 1 x RE Svy WO on a 2-3 year accompanied tour supported by 1 x Civilian Secretary, all based in DMAHTC.
- 12 x military personnel from the three services on 1 year unaccompanied tours, with two 2-3 week leave breaks in the UK between overseas section deployments. These personnel consisted of:
 - 3 Officers - 2 x Capt RE Svy & 1 Capt RE Mainstream.
 - 3 WOs/SNCOs Electronic/Comms Technicians – 1 x RN, 1 x RAF & 1 x REME.
 - 6 RE Svy WOs/SNCOs.

The purpose of this rank/trade breakdown was to provide the capability of deploying three sections, each with one officer, one technician and two RE Svy personnel. This organisation of 3 by 4 sections was in place until Sep 1977 when owing to the growing operational needs it was changed to 4 by 3, whilst ensuring each section had the right qualified and experienced people to meet the

¹ An MX1502 was used later from c.1982/83 but exact date and first location is not known. A TI 4100 is also mentioned in one of the 512 newsletters. Information on both is sought.

different technical and logistic needs of the task in hand viz. either static SMTP in reasonably civilised locations or a roaming DGPP in under developed, difficult terrain or poorly supported areas.

This change in organisation considerably increased the units' Doppler positioning capabilities but resulted in the 2IC, rather than the Section Officers undertaking the recess and liaison with Defence Attaches and/or overseas Survey Departments. However, the advantage of this was that the 2IC was able to experience, first hand, the likely problems the section would be faced with and, hence, be better placed to understand and manage the task from afar. It also allowed him to meet and establish relationships with the people/departments that would be providing the logistical support, for improved communication and liaison purposes during the intended task.

It is understood that the establishment was increased by 1 x SNCO in 1980, to provide additional support in DMAHTC, possibly in view of the 2IC's regular absence from the DMAHTC office. It also reverted to a structure of 4 by 3 in about 1983 with additional reinforcements from 42 Regt, for worldwide deployment, presumably because surveys became more lengthy and complex with the use of gravimeters as well as Geocivers.

Deployments & Achievements

- **SMTP**

Certainly up to 1979, the Team was always deployed to, at least, three well known established stations for at least 3-4 months each year. These stations were Cyprus, Ascension Island and St. Helena. The first two being easy to reach via RAF and USAF aircraft respectively but the second far more difficult and time consuming via ferry from Cape Town, South Africa! However, in 1980/81 it appears that Diego Garcia and Bahrein replaced St. Helena and Cyprus respectively, presumably because of logistic and improved location positions for tracking and orbital position purposes.²

- **DGPP**

During the remaining months of each year satellite Doppler stations were established around the world to meet both national surveying needs and the operational needs of platform/guidance systems as they became more precise and needed more data about the earth's surface, gravity and magnetic fields.

All sections of 512 STRE were self contained with survey technical equipment and only required logistic support from local military units or survey departments in the form of vehicles, drivers and local labour, together with helicopters and vessels when needed.

Whilst there do not appear to be any detailed official records of the number of stations and locations of Doppler points established by 512 STRE, a list of approximate dates and locations has been extracted from a variety of published articles and travelogues of the units' personnel. The list is not definitive and any amendments or additions will be welcomed.

From about 1981 the DGPP tasks were, more often than not, supplemented by Gravity readings using a La Coste & Romberg gravimeter.

The Ending

- The Unit moved back to the UK sometime in the mid-90's and became an integral part of 42 Regt. It is not known exactly when and how this move was implemented and, indeed what further tasks the unit undertook before it was disbanded. Hence further details are sought with possibly a stand-alone article for the next edition of the Ranger. Also, as part of the Units history it would useful to document the satellites used and tracked during both the SMTP and DGPP positioning programmes and as a "starters for ten" the satellites used up to 1979 and perhaps beyond were:
 - Echo 1 (Passive) 1960-65
 - Echo 2 (Passive) 1964-69
 - PAGEOS (Passive Geodetic Earth Orbiting Satellite) 1969-73

² Confirmation of this information is sought together with last dates of using St. Helena and Cyprus.

- Seasat A (Fleet Ballistic Missile Program) 1976-79
- TRANSIT System (5 x NAVSAT OSCAR Satellites) 1976-??

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512 STRE History

List of SMTP, Doppler and Gravity Stations

- **SMTP**
 - St. Helena 1970-
 - Ascension Island 1970-
 - Cyprus 1970-
 - Diego Garcia 1980-
 - Bahrein 1980-
 - Penang 1979-80



- **Doppler and/or Gravity Stations**

(Months/Years and No. of Stations required and whether Gravity included)

North America	West Indies & Central America	Atlantic Ocean	UK & Continental Europe	Middle East
North Carolina	Bahama Is	Azores	Germany	Iran
South Carolina	Grand Cayman	Falkland Is	Iceland	Bahrein
Texas	Bermuda	Madeira Is	Wales	Oman
Iowa	Jamaica		Rockall	Kuwait
Utah	Trinidad		Scotland	
California	Virgin Is		Hampshire	
Louisiana	Belize		Channel Is	
Florida	British Guyana		Scilly Is	
	Cuba			
	Turks & Caicos Is			
	Suriname			
Central Asia	Africa	Indian & Pacific Oceans	Far East	
Nepal	Botswana	Maldiva Is	Hong Kong	
Sri Lanka	Sudan	Hawaii Is	Macau	
Bangladesh	Egypt	Marianas Is	Penang	
	Kenya	Caroline Is		
	Lesotho	New Hebrides		
	Zimbabwe			
	Malawi			
	Zaire			
	Cameroon			
	Ivory Coast			

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"Four Two" – "The Regiment"

A brief overview of 42 Survey Engineer Regiment

Part One: Time in the Zone

By Alan Gordon

This is the first of three articles looking back at one of the army's smallest and most unique regiments – 42 Survey Engineer Regiment, although to generations of military surveyors it was known simply as "Four Two" or "The Regiment".

Background

Since the nineteenth century Britain had wielded a controlling influence over the governments of Egypt to the extent that although that country was never a formal member of the Empire in many respects it was treated as if it were. The rise of fascist Italy between the two World Wars and its expansion into North and East Africa led in 1936 to the Egyptian and British Governments signing a treaty giving the British a base in the Suez Canal Zone for the next twenty years. This suited both parties as it gave the Egyptians some security against Italian ambitions and the British received a huge base in the Mediterranean with control of the world's busiest waterway.

Egyptian nationalism grew through the years of the Second World War against the backdrop of the immense British military presence and after the war a group of young Egyptian Army officers spearheaded the drive to get the British to leave. Britain's abrupt departure from Palestine in 1948 and the subsequent defeat of the Arab Armies by the relatively tiny Israeli forces intensified the nationalists' bitterness towards Britain.

The Birth of the Regiment

If a regiment has a birth certificate then Four Two's was Army Council Instruction No. 209 dated 12 March 1947 which was the authority for the Corps of Royal Engineers to reorganise on the 1st of May from its company based system into one comprising regiments and squadrons. Also, as part of the reorganisation those companies with wartime numbers, generally 500 and higher, were to be renumbered with available lower traditional numbers hence 525 (GHQ) Survey became 47 (GHQ) Survey Squadron whilst 13 and 14 Companies continued as they were but as field survey squadrons.

Military Survey had a significant presence in Egypt headed by a Survey Directorate in the GHQ Middle East Forces at Maadi near Cairo which was supported by 525 (GHQ) Survey Company, a small unit whose task was to produce material to meet the needs of the headquarters. The major unit was 512 Army Field Survey Company which despite considerable repatriation still managed to parade 251 for a group photograph in July 1945. The Company, together with 2 Army Field Survey Depot which stored and distributed 512's maps, remained in the caves at Tura until the 26th of February 1946 when both units moved by RASC transport back into the huge garrison at Abbassia Camp albeit in different accommodation to that which they left in 1941.

In March 1947 19 Field Survey Company, which comprised a very few men due to repatriation, moved from Italy to Abbassia where they were absorbed into 512 Company but on the 1st of April, in accordance with the policy of doing away with the wartime numbers, the combined unit was renamed 19 Field Survey Company. One month later on the 1st of May 19 Field Survey Company changed its title and organisation to become 19 Field Survey Regiment comprised of four squadrons with no numbers but functional names: Topographic, Cartographic, Lithographic and Headquarters.

This appears to have been an autonomous Military Survey move that only lasted a short time as on the 31st of August 1948 the regiment was renamed 42 Survey Engineer Regiment. The renaming was to bring the unit in line with the Corps titles system that allocated blocks of numbers related to the regiment's function and as there was only one regular Survey regiment it was given the last number. At the same time the squadrons were given numbers hence 42 Survey Engineer Regiment then comprised 19 Topographic, 22 Cartographic, 32 Lithographic and Headquarters Squadrons, each made up of a number of Troops with functional titles.

Life in the Zone

Soon the growing resentment in Egypt to the presence of the British bases erupted into anti-British riots although Egyptian resentment was lessened for a while to a certain extent by the signing of an agreement that all the British bases be relocated into a 30- mile wide strip of land running for 120 miles along the western bank of the Suez Canal and Bitter Lakes. This arid patch of desert was called The Suez Canal Zone and 512 had surveyed the area in 1946 and produced the maps later used to plan the construction of the many new camps, one of which was to be purpose built for the Survey unit and the map depot. By the end of 1948 this arid stretch of desert was a not much loved home to 20,000 Army and RAF personnel housed in forty major camps and ten airfields.



Sobraon Camp from the trig pillar on the ridge.

In Sobraon Camp the Headquarters, Quartermaster and MT departments were in sandstone buildings, the printing and proving sections were in a factory-like brick building and all other technical accommodation was in Nissen huts. Living accommodation for all was, as always in the Middle East, the ubiquitous EPIP (Egyptian pattern, Indian patent) tent which, as in Abbassia, were made more comfortable by excavating to a depth of two feet and using the old zinc printing plates and the packaging from the reproduction consumable stores to line the walls and glass plate negatives striped of their emulsion to become sliding windows. Each national serviceman's bed space invariably contained an elaborate 'days to do' chart which was assiduously marked off every day. When the khamsin wind blew everything was covered in sand, tents were frequently ripped or even blown away and they filled with water after the occasional flash rain storms. Toilet facilities were memorable; large funnels with a tube attached stuck into the ground were the 'desert rose' urinals whilst the toilets themselves were a wooden bench with holes at intervals with partitions between each 'station' but no doors. The corrugated iron sides and roof made them unbearable in summer. The weather was very hot in summer but in winter was cold enough to warrant the wearing of battledress and even greatcoats when on guard at night.

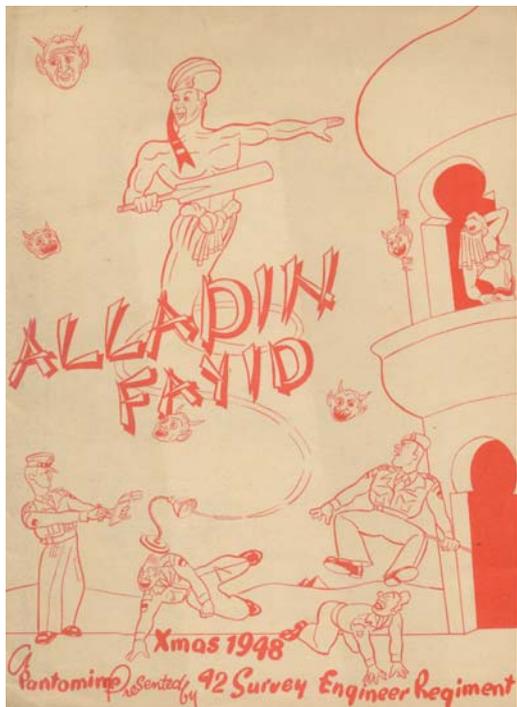
Initially life in the Canal Zone was quite reasonable, although only a few officers and Senior NCOs had married quarters with everyone else on an unaccompanied tour. The SNCOs' families were likely to be initially accommodated in wooden chalets on the shore of the Great Bitter Lake which only received electricity in the evenings and were furnished with primus stoves for cooking and an ice box in lieu of a fridge but after a short while they would move into a properly equipped bungalow. There were shops in Fayid that provided all sorts of services to the British servicemen and the few families.

On 28th February 1947, 19 and 512 Companies moved into Camp 15 near Fayid in the Canal Zone and about the same time 2 Army Field Survey Depot also moved its millions of maps into the same camp. The camp, later re-named Sobraon Camp, lay adjacent to the Treaty Road, which ran down the western edge of the Zone, and the ill-named Sweetwater Canal. The Survey Directorate and its GHQ Survey Squadron also moved into the Canal Zone but were based nearer to Fayid along with GHQ Middle East Land Forces.



Home sweet home in the Canal Zone, could be made quite comfortable – unless it rained.





The Pantomime programme with a suitably 'punny' title.

There was plenty of sport of all kinds and swimming in the Great Bitter Lake was a favourite off duty pastime as were visits to the historic sites of Egypt. Evenings centred around the Messes, the NAAFI, a long walk to the cinema or simply lying on the bed in the tent listening to the radio. There were weekly games of tombola, bingo in today's parlance, at GHQ with a top prize of £1,000, a vast sum in those days. Each Christmas the Regiment put on a pantomime which offered the junior ranks the opportunity to safely poke fun at the officers and Senior NCOs. Guard duty was a regular occurrence but at this time it was mainly as a deterrent against pilfering by the local population.

At one stage there were some 400 civilians employed in Sobraon Camp. A considerable number of these were technically qualified Armenians and were employed as cartographic draughtsmen to replace the Italian and German POWs who had bolstered the technical staff immediately after the war ended. They were organised into a separate unit called No2 Base Survey Drawing and Photo Process Office (2 BSD & PPO) which was commanded by a sergeant. Local Egyptian labourers were also employed in large numbers to carry out all the menial tasks necessary to keep the camp clean and tidy and the men fed hence the soldiers' time was filled by either work, and there were plenty of interesting technical tasks to occupy

them, guard duty, playing sport or sunbathing, an occupation universally known as 'Egyptian PT' and an essential requirement if you were to "get your knees brown!"

However, this relatively pleasant existence changed in 1951 when the Egyptian Government abrogated the Canal Zone Treaty, shut down the road and rail links to the Canal Zone and forced all Egyptians to leave their jobs with the British Forces and shop keepers to cease trading. At the same time anti-British riots were encouraged by the nationalists and these soon escalated into frequent terrorist attacks on either service personnel or facilities such as the water filtration plants. To replace the civilians in both the technical and labouring roles, drafts of soldiers, both regular and national servicemen, were rushed by sea to the Canal Zone and as the security situation worsened Britain's response was to fly in the 3rd Infantry Division and 16th Parachute Brigade and other supporting troops that brought the total in the Zone to over 80,000.



The watchtower, wire and the grim view out of camp.

This sudden unplanned influx of so many additional men put a huge strain upon the supply system and soon there were shortages of everything from food to Brasso. Wartime food stocks that had been buried as surplus to requirements were dug up and issued, but not necessarily 'enjoyed', and for a while parcels from home were the only means of obtaining essentials like razor blades. The British were now increasingly withdrawn behind the high double fences with searchlight guard towers that surrounded each camp; now, from the outside Sobraon Camp looked the epitome of a German POW camp. The increasing level of violence led to the return to UK of the families, guards became ever more frequent and serious and the virtual siege led to a very real reduction in the quality of life. The monastic life of the soldiers was alleviated slightly in the autumn of 1952 when the first NAAFI girls arrived; as they opened the shutters for the first time they were greeted by a huge cheer from almost the entire Regiment gathered for their first sight of a young female.

Conditions in the Canal Zone were such that after a qualifying period soldiers were entitled to spend time at a leave centre, either on Cyprus or at a special 'holiday resort' leave camp at Port Fuad. It was during such a stay in 1952 that two members of 42 Regiment were ambushed by Egyptian

nationalists and stabbed in the back with Sapper George Taylor dying on the spot but the other, Sapper Robert 'Bert' Ross, surviving a punctured lung. The Regiment buried Sapper Ross with full military honours.



42 Survey Engineer Regiment marching in the huge Coronation Day Parade at RAF Kasfareet.

Perhaps for many in the Canal Zone, the most memorable events of 1953 were the two huge Coronation Day Parades each involving thousands of servicemen, one held in the north at Moascar and the other in the south on the runway at RAF Kasfareet. All except those on essential security duties were either on parade or watching and 42 Regiment, less 19 Squadron which was then having its own parade on Cyprus, after many practises and kit inspections joined the other units in the vast march past down the long, hot runway with RAF Meteor jet fighters flying overhead.

This cloistered life style, punctuated with violent incidents, continued until mid-1954 when, after protracted negotiations, an Agreement to the withdrawal of all British Forces from Egypt was signed. Early 1955 saw a loosening of the travel restrictions and the opening up of towns like Ismailia and Cairo for off duty visits. However, the big news was that the Regiment, along with the original pre-emergency Canal Zone garrison, was to move to Cyprus which was a popular leave centre hence the soldiers envisaged future life as one long holiday! Then the task of packing up to leave commenced.

Elderly Equipment

Other than the Multiplex stereo plotting equipment, virtually all the Regiment's technical equipment had originally come to Egypt with 512 Company in 1940 and been worked incredibly hard ever since and breakdowns, especially of the printing presses, were increasingly frequent, a situation exacerbated by the lack of experienced print tradesmen who in the past could 'nurse' the old equipment along.

Multiplex was used to plot the Lar Project map sheets, the unit's first major post war tasking, otherwise all compilation from air photography involved the slotted template process, parallax bars and graphical techniques unchanged for years. The most precise item of air survey equipment was the Cambridge Stereocomparator which again, had come to Egypt in 1940.

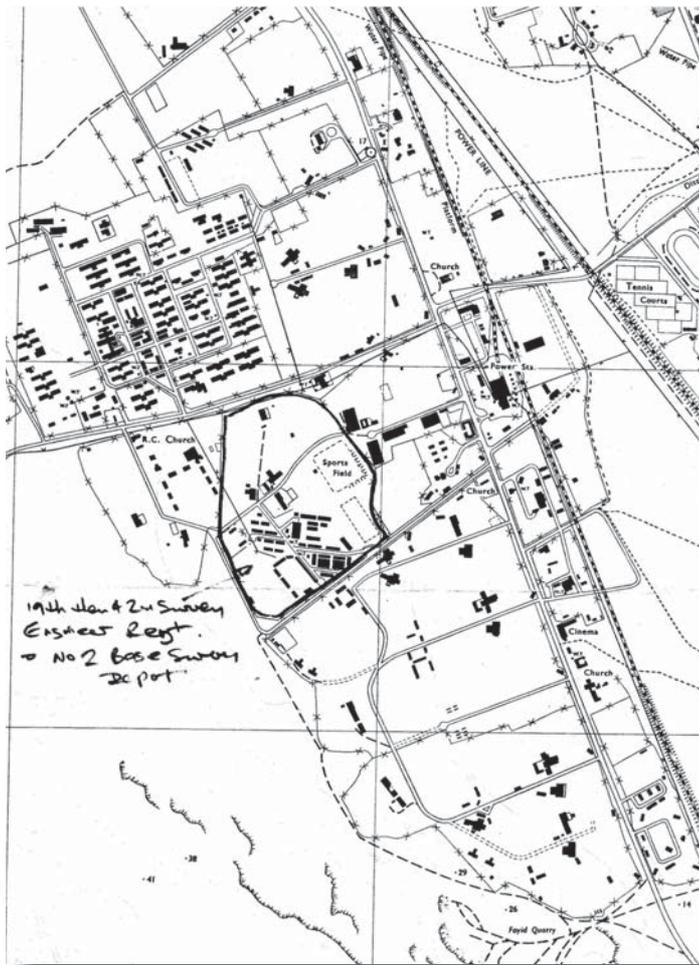
Whatman's cartridge paper and the transparent mediums Kodatrace and ethulon had been the drawing materials for many years but latterly a much more stable plastic material called astrafoil was introduced into use, it was quite difficult to get the ink to adhere to it but soon became the standard drawing base.

Lettering was either hand drawn or set up on a letterpress machine, an ornate press liberated from the Italians during the Western Desert campaign, with pulls taken and then cut up and patched together by the cartographic draughtsmen whose tools were mainly the ruling pen. A new innovation for some symbols such as marsh or date palm plantations was an American product called Zipatone which were transparent sheets with the symbols on the face and an adhesive on the reverse. The required shape of symbol was cut from the sheet and then burnished down onto the drawing.

The lithographic draughtsmen, one of whom was Kenneth Williams later to become a well-known comedian, worked directly onto the printing plates using fine sable brushes. These were highly skilled tradesmen and in very short supply. The photographers operated three large gallery cameras until 1953 when a fire destroyed two of them. The remaining camera was damaged but eventually made to work again.



The lens of one of the large cameras that was later destroyed in a fire.



Extract from the 1:10,000 series covering the Canal Zone – in daily use throughout the Zone. This extract has a hand annotation delineating Sobraon Camp.

The Press Room contained a considerable number of Crabtree single and double colour printing machines at demy, double demy and quad crown sizes and also both hand operated and powered proving presses. The room was always very hot and sandy.

Pre-sensitised printing plates had yet to be introduced during the Regiment's time in the Canal Zone and so the sound of the graining machines was a continual background noise as the perpetual shortage of plates meant the Graining Shop worked 24 hours a day, seven days a week and if for any reason the work stopped everyone noticed the quiet.

Within Sobraon Camp a special security production section was set up in a barbed wire compound. It was a completely self-contained section manned by security vetted soldiers and its equipment included a gallery camera and four presses.

Technical Tasks

The trig and topo surveyors of 19 Squadron were perpetually busy but spent almost no time at the Regiment's base in the Canal Zone as they were deployed for long periods across North and East Africa, Cyprus and the Middle East. The story of their tasks and travels is worthy of a separate article.

The squadron spent from 1948 until 1951 in what was then known as TransJordan where they literally followed in the footsteps

of Lawrence in the Hejaz Desert. Here the surveyors witnessed a country and lifestyle that had remained unchanged for decades but would later become a magnet for tourists. 19 Squadron then went to northern Iraq although 1 Troop spent several months of 1952 in Kuwait and it was not until March of that year that the entire squadron moved to join the Regiment in Fayid. In May 1952 the squadron moved to Cyprus for extensive survey work until September the following year when it returned to Iraq where it would stay for the next five years.

The ending of the war in no way diminished the map production workload on the Military Survey units in the Middle East. The ever changing political situation in the region ensured that there was an endless requirement for up to date mapping and the security section produced a wide variety of classified products mainly for GHQ and target maps for the RAF. Work in the immediate post-war years included plotting 1:500,000 maps of Cairo and Rome and printing of various sheets of Egypt, Palestine and Greece. Also, as a source of talented artists and printing presses, there were always a few 'grace and favour' tasks for other units, often on some form of quid pro quo basis.

In addition to producing mapping over the entire Middle East Land Forces area of interest the unit was given any task that involved maps, for instance, when Field Marshall Montgomery visit Fayid in August 1947 the briefing on MELF was given using diagrams and a 120 square-foot coloured wall map prepared by military surveyors in just 36 hours. Montgomery was so impressed that he had a fair-drawn fully layered coloured copy produced for the C-in-C's War Room.

The unit compiled and drew maps at mainly two scales during its time in the Canal Zone, 1:25,000 and 1:100,000 with Multiplex generally used for the larger scale work such as the 1:10,000 scale series covering the Canal Zone which was done from photography flown by 13 PR Squadron RAF. This was followed by the plotting of sheets of the 1:25,000 scales series of Egypt and other specialist products such as 1:25,000 cover of an artillery range at Garian on the Libyan coast.

There was a never ending flow of graphical work producing mapping at 1:100,000 of Sinai, TransJordan, Iraq, Kuwait and Persia. 19 Squadron provided the ground control which was then extended by the slotted template method but some areas were politically not open to field survey

parties so other methods had to be used to generate control. For the Sinai mapping use was made of First World War large scale plane table surveys by Australian surveyors from which it was possible to identify control points on the new aerial photography. Another widely used method was to utilise a radar beacon system called OBOE. The photography from which the maps were compiled was taken with a K17 camera mounted in a Lancaster flown at a height of 15,000 feet around ground based radar beacons at radii that could be calculated. The resulting strips of photography

were in a series of concentric arcs and as ground control trig data was scarce, these arcs of known separation provided an additional means of controlling the slotted template laydown. An indication of the scope of this mapping task is that one series of laydowns, Operation Birds Eye View, comprised 9,000 air photographs.

There were also taskings to revise existing maps including 1:25,000 sheets of TransJordan and Hebron and Rafah in Palestine.

When the Mau Mau Uprising first erupted in Kenya in October 1952 the mapping support was provided the civilian Survey Department in

Kenya but as the Uprising spread so 42 Regiment provided additional cartographic and reproduction support. The demands for mapping grew to such an extent that a new field survey squadron, 89, was formed in December 1953, initially with just a field survey capability but by the end of 1954 the establishment was increased to carry out full map production.

During 1952 and 53 a sixty sheet series of Cyprus was produced but several sheets had to be redrawn in 1953 following an earthquake in the south of the island. Between January and March 1954 the last series of mapping produced by hand drawn lithography was produced by the Regiment. The job consisted of 21 sheets of the Island of Rhodes at a scale of 1:25,000. A colour copy and a contour negative was the only reproduction material available and as the camera studio was out of action due to the fire it was decided to draw directly onto the printing plates, the successful end of the task also marked the end of an era. 1954 saw a considerable amount of work generated by the Canal Zone Treaty signing and the impending move to Cyprus.

Farewell to the Land of the Pharaohs

The withdrawal of over 80,000 men and all the materiel needed to maintain such a force was a mammoth task and occupied most of 1955 and the first half of 1956. An equally massive task was the provision of accommodation on Cyprus and elsewhere for the withdrawn troops and their equipment. The Regiment began dismantling its heavy reproduction equipment in the summer of 1955 and packing it into hundreds of packing cases. A review of the printing equipment led to the decision to scrap all but four of the twenty presses as they were now old and beyond economic repair, the remaining four were dismantled and packed to transporting Cyprus as was virtually everything the Regiment had even including the unit gymnasium, a large corrugated iron structure.

GHQ Middle East moved to Nicosia at the end of 1954 but the Survey Directorate and 47 Squadron remained in the Canal Zone with the Rear HQ until the autumn of the following year. The Regiment's advance party left Fayid for Cyprus on the 5th of August tasked with preparing the camp at Zyyi for the main party. By the 7th of October everything had been packed and transported to the docks and that night, the last in Fayid, everyone slept on the tent floors with hurricane lamps for light as even the electricity had been disconnected. Next morning the Commanding Officer paraded the Regiment for the last time at Fayid and then the unit boarded a fleet of Bedford QL 3-ton trucks and wended their way out of Sobraon Camp northwards up the Treaty Road through the now run down looking garrison to Port Fuad and the former leave centre that was now the transit camp. The Regiment spent several days in the camp where they were employed on dismantling tents before boarding Her Majesty's Troopship Empire Halladale on the 11th of October for the overnight voyage to Famagusta. And so, fifteen years after 512 Field Survey Company disembarked at Port Said on the 14th of March 1940, their successors left the land of the Pharaohs.



Slotted template laydown showing the concentric nature of the flight lines around the radar beacons.

2 Army Field Survey Depot was the last Survey unit to leave the Canal Zone, its small staff spent from October until December transferring over 100 tons of mapping to Cyprus where receiving the stores was complicated by the unit having its HQ at Polymedhia and the stores depot 40 miles away at Larnaca.

At 6.30 on the morning of the 13th of June 1956, the tank landing ship *Evan Gibb* slipped out of Port Said carrying the last 80 men from the one time garrison of over 80,000 from the Canal Zone thus ending 74 years of continuous British military presence in Egypt. As a result of the four year Egyptian terror campaign they left behind 54 dead, including military surveyor Sapper George Taylor. However, little did they know that a few months later British boots would once more be on Egyptian soil.



The QM and his party after handing over Sobraon Camp to the Egyptian Army on the 10th of October 1955 – with Egyptian soldier in background.

The Guns of 6 A.G. R.A ... continued

Article start on page 14.



Command Post



Surveyors RA



Mobile Met Section

Defence Team helping Navy Safeguard Environment

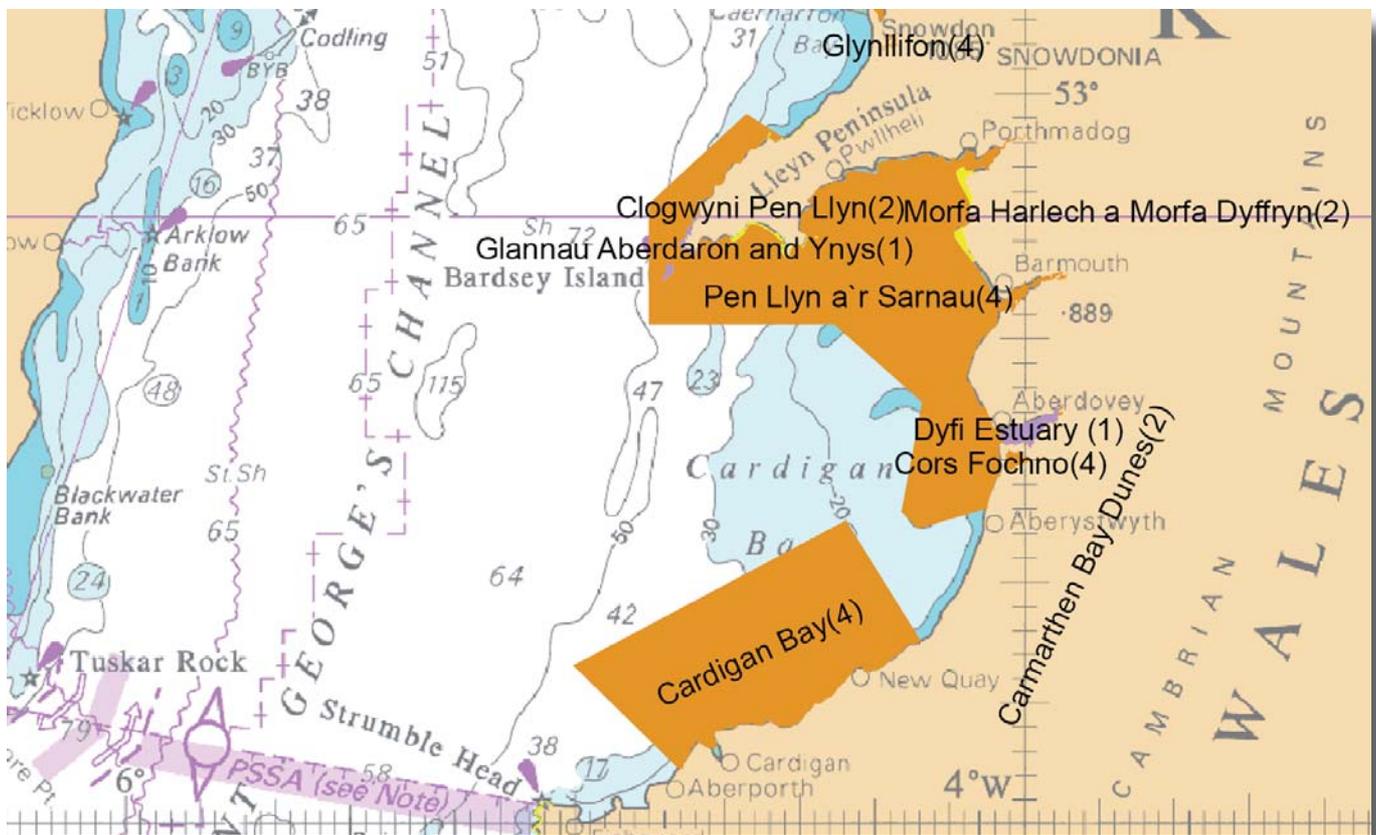
By Paul Barton

This article was originally published in the March 2014 issue of the UK Hydrographic Office's in-house magazine "Compass Point".

Our Defence Maritime Geospatial Intelligence Centre (DMGIC) has contributed to the development, of a new product which allows the Royal Navy to minimise its impact on the environment whilst on military manoeuvres. Paul Burton, Additional Military Layers (AML), Air & Fleet Charting Manager, tells us how, by using our data, this environmental tool will be extended to the rest of the continent and further afield.

The Royal Navy has recently adopted a new approach to minimising its impact on the environment using data produced by DMGIC.

The Environmental Protection Guidelines (Maritime) (EPG(M)) provide guidance on the restrictions and control measures for conducting military activities in and around designated marine protected areas.



The Defence Situational Awareness team (DSA), in DMGIC, has supported the Navy for a number of years with provision of data to help mitigate the risk to marine mammals from the use of SONAR. Now EPG(M) extends this to all activities undertaken by the RN in the air, on land, at sea or underwater.

Additional Military Layers

Support for EPG(M) is provided through an interactive AML which can be overlaid on an ENC in WECDIS (a warfare variant of an ECDIS), or used on other RN systems as a standalone product.

We were approached three years ago by the Navy for a way to display the marine protected areas geospatially, but also to retain textual information relating to the areas.

AML was suggested as the ideal format for this guidance and we created a product set using data from the Joint Nature Conservation Committee (JNCC) and MOD. This includes more than 500 designated areas around UK alone and is set to grow over the coming years. Each protected area is

evaluated and assigned to one of four categories based on the habitats and species being protected. Each category has different restrictions and environmental control measures associated with it. This information is accessible by clicking on any protected area portrayed on the system.

By following these guidelines, ship planners and operators can plan their operations and exercises to prevent impact on the environment and record that appropriate action has been taken.

We also deliver the marine protected areas in PDF format for those planners and foreign navies exercising in UK waters who do not have access to a WECDIS or other AML-capable system.

First of its kind

It is thought that the EPG(M) is the first of its kind amongst naval forces. It currently covers the UK Continental Shelf but we are working with Fleet and JNCC to extend the data to cover Europe and the UK Overseas Territories and Crown Dependencies.

Rod Jones, SO2 Environmental Protection (maritime), at Navy Command Headquarters (NCHQ), said: *"Giving naval commanders the right information on marine protected areas had been a headache for NCHQ for some time. With UKHO help we have now been able to provide commanders with concise guidance on their planned activities in a WECDIS format which makes the information readily available during planning and real time whilst navigating. The EPG(M) AML is an elegant solution to a tricky problem and provides commanders with optimum operational flexibility with minimum risk to the environment and also importantly, with little additional burden on ships' staff."*

We produce a number of different AML products covering bathymetry, seabed, wrecks, territorial waters, practice, exercise and operational areas and many more maritime features of value to the defence user to inform planning and operational decision making.

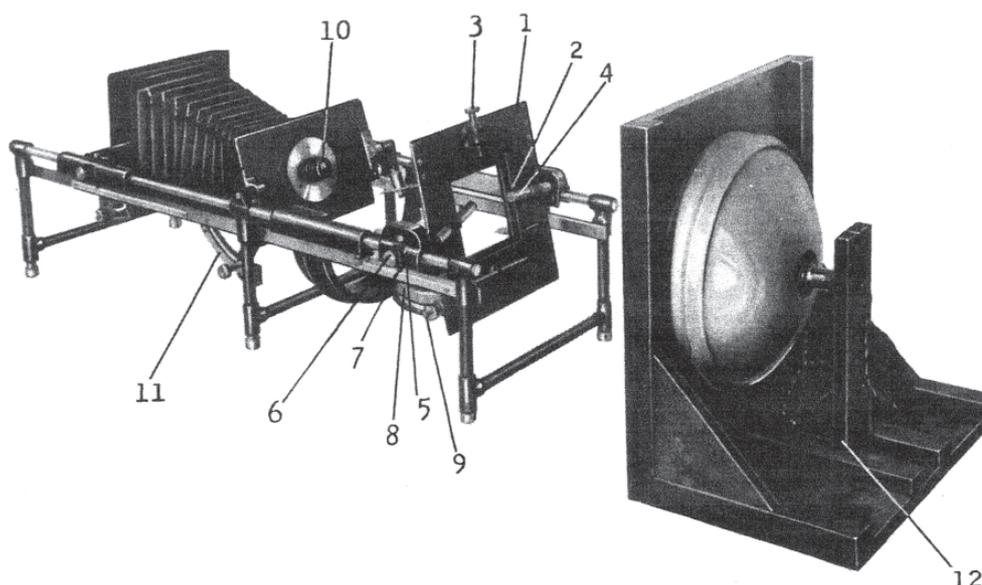
What are the risks to habitats and species?

- Anchoring - species can be harmed by physical disturbance e.g. coral or seagrass beds and their associated marine life.
- Amphibious landing - can cause damage to saltmarsh or nesting birds.
- Firing of munitions, fast boat exercises or low flying aircraft - have the potential to disturb marine mammals and birds and can cause a change in behaviour such as being displaced from a breeding or feeding area.

Puzzle Corner

Can you identify this?

For the answer visit the DSA website <http://www.defencesurveyors.org.uk/>



Photographic Interpretation for Operation "Overlord"

By Mike Nolan

Introduction

Numerous posters of D-Day mapping and related subjects were displayed at the DSA's "Maps & Surveys" Seminar at the RSMS on 20 June 2014. Prominently featured were Series GSGS 4347 at 1:25,000 scale known as the Benson Series including variant overprints showing the Enemy Defences on various dates. Also featured was Series GSGS 4490 at 1:12,500 scale, known as the Baby Benson series which showed strong-points, enemy gun batteries, obstacles to air landing and beach obstacles. Images of these maps featured prominently in the 2004 volume of Ranger. Both these series had been in work since about 1942 and both depended upon aerial photography flown by the RAF and later the USAAF. The story of the work of 1 Air Survey Liaison Section RE in the planning and assessing of photography for this work, and also for the production of ZM Beach Maps and Potential Airfield Sites has already been told at a DSA seminar. This short article aims to explain how the features shown on Defences Overprints and on the Baby Benson series were identified, evaluated and plotted.

It is taken almost wholly from a document in the National Archives.

Evolution of APIS

After Dunkirk photographic intelligence in the UK was centralised in the C.I.U. (Central Interpretation Unit), which included a small Army Section. However, it was realized, that photographic interpretation needed to be decentralised down to field formations, and thus in May 1942 an A.P.I.S. (Army Photographic Intelligence Section) was set up as part of GS (I), G.H.Q., Home Forces. Its establishment consisted of a G.S.O.II, G.S.O.III, S.I.O's, and a number of plotting and other clerks.

Also established at GHQ was a Mobile Field Photographic Section.

"On 22 Nov 1942 the War Office laid down the detailed organization for the coordination of photographic intelligence in the field. By this, there would be an A.P.I.S., as part of the Intelligence Staff at G.H.Q., Army and Corps Headquarters. At GHQ and Army Headquarters the APIS consisted of Officer Interpreters, clerks and plotting sections, the Army Section being smaller but similar in all respects to the G.H.Q. section.

Mobile Field Photographic Sections (M.F.P.S.), consisting of one officer and 14 other ranks, equipped, maintained and administered by the Royal Air Force, were also established at GHQ to provide the necessary processing and negative storage facilities. The MFPS were equipped, on a mobile basis, to carry out all processing requirements including contact printing, enlarging, mosaicing, copying etc.

The M.F.P.S. held nine vehicles, in which air-conditioning and temperature control were incorporated Tender Photographic Servicing, Tender Photographic Multi-Printer, Tender Photographic Copying and Enlarging, Tender Rectophot Reflex Printer and two Tankers Power and Water, Truck 30 cwt, Truck Utility, Combination Motor Cycle. At each Corps H.Q. the APIS consisted of two Photographic I.Os and but there was no processing section."

The task of the APIS section was to provide, from air photographs, information on the G.H.Q., area of responsibility, extending from Den Helder to the Spanish Frontier and 30 miles inland. It started to assemble a comprehensive photographic library covering most of France and the Low Countries. The Section had to answer innumerable and diverse questions put to it by Intelligence and Planning Staffs at G.H.Q., and by many of the other Intelligence agencies who were concerned in planning the return to the Continent. In addition a considerable amount of work was done in providing C.O.H.Q. (Combined Operations Headquarters), with Intelligence for Commando raids. The section also had a training role and provided interpreters for various exercises.

Numerous U.S., Canadian and British Interpreters were attached to the section from time to time for training.

In the summer of 1943 A.P.I.S., G.H.Q., prepared for the planning staffs oblique panoramas of the French Channel coast. From suitable close and distant oblique sorties flown at high and low angles,

mosaics of the coast were made and annotated by interpreters with the information likely to be of use to forces approaching from sea or air; landmarks such as towers and church spires were marked with their map reference and information concerning the topography of the cliffs and beaches was included, for instance, heights, gradients, incidence of gullies and cliff falls, positions of footpaths and beach exits. These mosaics were mounted on sheets of white cardboard which were hinged together with adhesive tape to procure continuous coastline panoramas. The originals were then reproduced photographically in quantity.



An oblique linen-mounted photo-panorama with some defences marked. D-Day Museum.

At a later stage the sorties used were re-ordered and the annotations were copied on to the loose prints, providing a more convenient and portable version of the same information.

In August 1943 the Op Overlord area appeared settled and, although a certain amount of work was still required in other areas, for instance for C.O.H.Q., work was concentrated on the Calvados area.

In July 1943 the Section was transferred to 21 Army Group and in December 1943 to the T.I.S. (Theatre Intelligence Section) under COSSAC.

The War Establishment for A.P.I.S., T.I.S., was merely one G.S.O. II, but in actual fact the section consisted of upwards of 30 officers and O.R. interpreters and 18 draughtsmen, plotters and clerks. These bodies were attached to A.P.I.S., from A.C.I.U., M.I.S., ETOUSA, COMNAVEU, First Canadian Army, 2nd British Army, 21 Army Group, 12 Army Group etc.

A constant turnover of these attached personnel enabled additional training to be given to a number of divisional interpreters, who thereby had the opportunity of becoming acquainted with the Op Overlord area. The assumption of responsibility for the interpretation of the Op Overlord area by A.P.I.S., T.I.S., which retained its nucleus of interpreters from G.H.Q., permitted the photographic interpretation sections of the various Army Groups and Armies to concentrate on training, assembling personnel and equipment and generally preparing for operations in the field.

Role of APIS/TIS in the Planning for Op Overlord

The main task of the section was to produce by the interpretation of aerial photographs, in conjunction with information from other sources, traces of the enemy defences and installations for reproduction in overprint form on operational maps.

From the annotated maps and traces already compiled a preliminary 1/50,000 trace for planning purposes was produced. At this point the demand came for greater detail on larger scale maps and so eventually the whole area was produced in trace form for overprinting on 1/25,000 scale maps. These were amended and reports issued daily until a matter of hours before D-Day. The production of the new 1/25,000 and 1/12,500 maps of France by R.E. Survey is well documented and A.P.I.S. had co-operated at G.H.Q., and 21 Army Group by checking the proofs against air photographs and settling any doubtful points.

DEFENCES - OUISTREHAM

Issued with Annex III to
MARTIAN REPORT 3, dated 16.

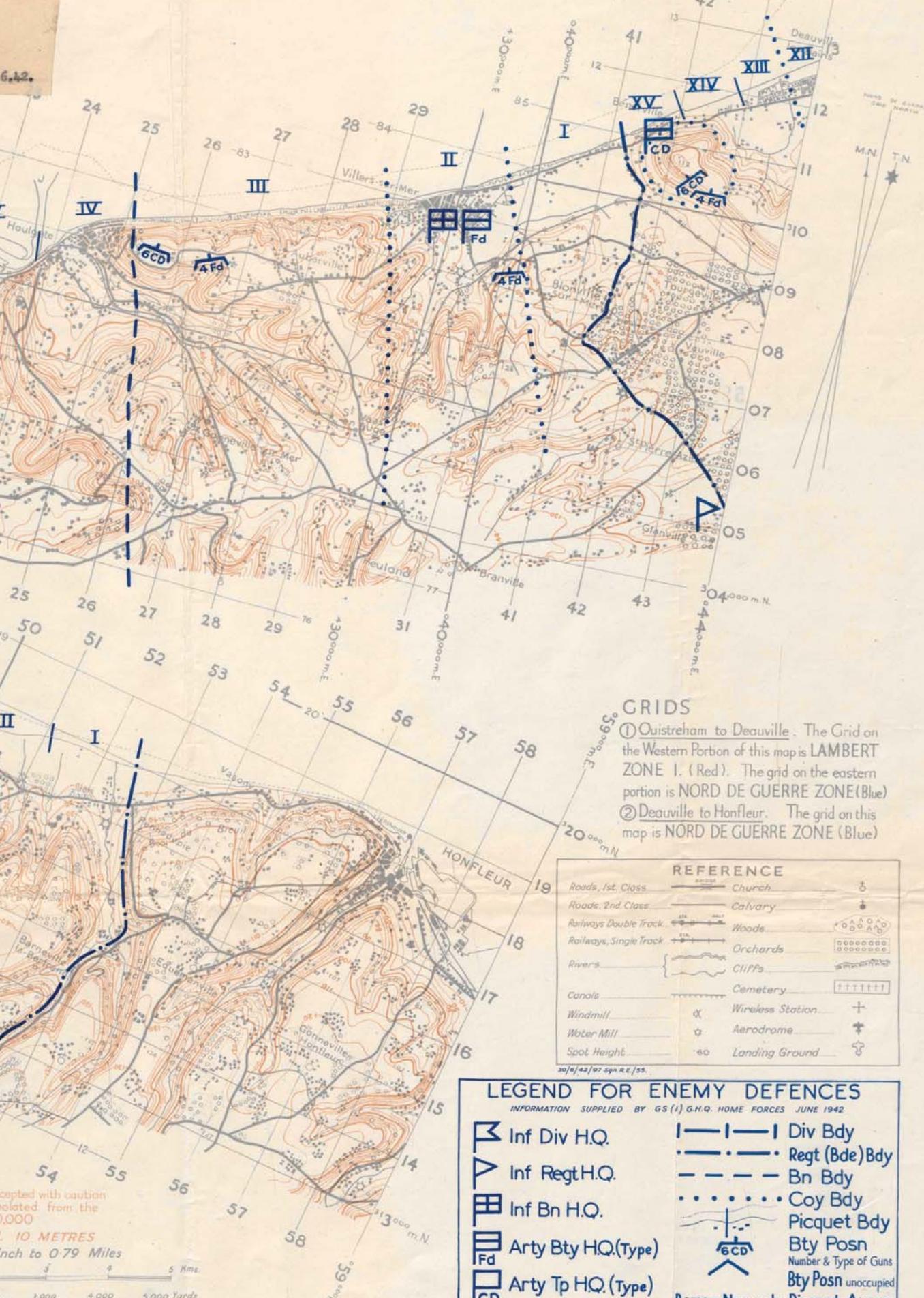


Series HE 27, Enemy Defences Oustréham to Honfleur,
an early 1:50,000 scale Enemy Defences product.

AM TO HONFLEUR

Copy No. 18

6.42.

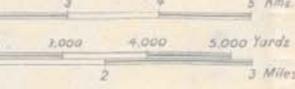


GRIDS
 ① Ouiretham to Deauville. The Grid on the Western Portion of this map is LAMBERT ZONE I. (Red). The grid on the eastern portion is NORD DE GUERRE ZONE (Blue)
 ② Deauville to Honfleur. The grid on this map is NORD DE GUERRE ZONE (Blue)

REFERENCE	
Roads, 1st. Class	Church
Roads, 2nd. Class	Calvary
Railways Double Track	Woods
Railways, Single Track	Orchards
Rivers	Cliffs
Canals	Cemetery
Windmill	Wireless Station
Water Mill	Aerodrome
Spot Height	Landing Ground

LEGEND FOR ENEMY DEFENCES	
INFORMATION SUPPLIED BY GS (1) G.H.Q. HOME FORCES JUNE 1942	
Inf Div H.Q.	Div Bdy
Inf Regt H.Q.	Regt (Bde) Bdy
Inf Bn H.Q.	Bn Bdy
Arty Bty H.Q. (Type)	Coy Bdy
Arty Tp H.Q. (Type)	Picquet Bdy
	Bty Posn
	Number & Type of Guns
	Bty Posn unoccupied
	Roman Numerals Picquet Areas

Accepted with caution
 isolated from the
 10,000
 METRES
 1 inch to 0.79 Miles



Series HF 27, Enemy Defences Ouiretham to Honfleur, an early 1:50,000 scale Enemy Defences product.

The 1:25,000 & 1:12,500 Map series

The production of the new 1/25,000 traces meant the re-drawing and re-plotting of all the previous defences, plus the additional information which could now be annotated in more detail. The new maps were issued monthly in dossier form accompanied by basic air cover of each particular sheet for the Army Groups to study and use for comparison purposes at a later date. 1/12,500 traces of the coastal area were also prepared and for the final programme of May 1944 all 1/25,000 and 1/12,500 Defence Maps of the Op Overlord area had to be amended, up to the latest sortie, and fair drawn by Survey draughtsmen, who prepared the talcs, or transparencies, for reproduction by Field Survey Companies and Map Reproduction Sections.

Information was carefully checked with all other sections of T.I.S. Engineer and Topographic Information, such as flooding, bridge classifications, beach exits and gradients, road classifications etc., was separately marked on the maps, whilst any information from 'Ia', which could not be confirmed from air photographs, was added in a different colour from A.P.I.S. annotations. Information on sites for airstrips was sent out separately. All the checking and redrawing had to be done within a period of 10 days before the issue of overprints on 20 May 1944. From then all additional photographic information was reported immediately and a trace kept up in order to produce a STOP PRESS edition, which was in fact a second colour overprint over the final sheets.



*Strongpoint and Defences near Bernieres-Sur-Mer,
GSGS 4347 Sheet 37/18 SE GR 9985*

Battery Booklets

In addition, photographic enlargements of all battery positions and strong-points, at scales varying from 1/3,000 to 1/30,000, were annotated and kept up to date. These formed the basis for the Battery Booklets later requested by ANCXF (Allied Naval Commander Expeditionary Forces). None of these booklets has been found by the compiler of this note.

Target Dossiers

During the period of preparation for Op Overlord the production of the Tactical Target Dossiers was undertaken by the Air Ministry. This was a joint venture between A.I.3(c) and A.P.I.S.; it entailed the collating and editing of the greater portion of target intelligence material and the supplying of photographic illustrations for the dossiers. The A.I.3(c) publication, "Tactical Targets" Areas 4900, 4901N, and 4902W, was a typical product.

Rail & Road Intelligence

In March 1944 a detachment of four, augmented at peak periods to seven interpreters, was set up at R.A.F. Benson for the sole purpose of interpreting rail and road movement of enemy transport. The daily coverage "lay-on" for all road/rail movement originated in O.I. and the interpretation, therefore, was deliberate, in the light of the information held by them, as distinct from the routine reports issued by A.C.I.U., on incidental cover. Examination of the daily cover was completed within a few hours of the aircraft landing and the information was then passed immediately by

telephone to S.H.A.E.F., in order that the German Army and Enemy Communication Sections could make an appreciation by 0800 hours the following morning to place before the Chiefs of Staff. These findings, together with information from other sources, invariably led to the correct appreciation of the movements of whole divisions against which an interdiction programme could be laid on with the minimum of delay.

A.P.I.S. Library & Clerical Tasks

In June 1942, the Section began the compilation of a comprehensive library of photographs of France, Belgium and Holland. As this library grew in size a system was adopted of plotting all large and medium scale sorties on traces to fit 1:50,000 maps and all small scale sorties on traces to fit 1:250,000 maps to facilitate consultation of cover of any place within the Section's area of responsibility. This system was maintained throughout 1942 and 1943, and at the time of the Section's move to T.I.S. in December 1943, the library, then comprising some 2,500 sorties, and all maps and traces were transferred with the Section. A new library at TIS had been built to allow for a 10% increase in sorties, but by the end of May, 1944, even this space proved to be inadequate, and the daily receipt of totals of 300 and 400 boxes of prints had increased the library to well over 7,000 sorties comprising some 3,000,000 prints.

Approximate Record of Prints Received

Month	Estimated number of sorties		Estimated number of prints
	per day	per month	
December 1943	10	310	93,000
January 1944	10	310 taking average of 300 prints per sortie	93,000
February 1944	15	420	126,000
March 1944	20	620	186,000
April 1944	30	900	270,000
May 1944	35	1,085	325,500
	Totals	3,665	1,093,500

The greatest number of sorties in any one day was 80 resulting in 24,000 prints.

This increase in the amount of material received coincided with a parallel increase in the number of sorties drawn from the library for consultation. By the end of May 1944 as many as 600 sorties per day were being issued from the library for use by interpreters. Three modifications to the original system in use at A.P.I.S., G.H.Q., and A.P.I.S., 21 Army Group were found necessary to enable the clerical staff to cope with this exceptional traffic in sorties, namely, a card index system of booking out sorties to interpreters; a more complete system of recording details of sorties at the time of their receipt, so that questions concerning date, scale, quality, etc., could be answered without having reference to the actual prints; and the plotting of all sorties on traces to fit: 1:100,000 maps instead of the 1:50,000 and 1:250,000 maps previously in use.

During this time extensive use was made of the library not only by A.P.I.S., T.I.S., interpreters but also by many sub-sections and outside agencies, amongst which were :- Engineer and Topographical Sub-Section, Defences and Survey etc. In addition a detachment of TAF personnel working on the compilation of Tactical Target Dossiers relied on the library for a considerable proportion of the cover they used.

Some Notable Features of Photo Interpretation for Op Overlord.

Defence Overprints

In meeting its responsibility for the production of the defence overprints the section was able to rely on material that had been accumulating since June, 1942. In this way the 1/25,000 and 1/12,500 Defence Overprints were based on information already recorded on the 1/50,000 defence traces maintained since the section's formation.

As a result many features which had been on early photographs but which were not discernible on more recent cover for instance cable trenches, minefields and buried shelters dating back to the early days of the German occupation could be re-plotted on the new maps.

Similarly, detailed studies of various types, such as those done on Cherbourg and its harbour forts in August, 1942 and the Quinneville beaches in January 1943 were available for consultation and comparison. Throughout the period from 1943-1944, numerous far-reaching discoveries were made during the routine examination of the thousands of photographs which were being flown. The day to day examination of new cover and the accurate plotting on 1/25,000 and 1/12,500 maps of all new defences was the principal task of the section during this period up to D-Day. As D-day approached, close liaison was maintained with Divisional and Army photographic interpreters, who were, therefore, able to follow in detail the final developments of the enemy's defences in their particular areas and to discuss fully with APIS/TIS interpreters any discoveries of importance.



*Strongpoint and Defences at Courseulles-Sur-Mer;
GSGS 4347 Sheet 37/18 SE GR 9785*

Enemy Artillery

From June, 1942 to July 1943, all batteries in the G.H.Q. area of responsibility from Den Helder to the Franco-Spanish Frontier had been studied and plotted on maps of a scale of 1/50,000. (See pages 52-53 again).

In September 1942 experimental annotations were made on maps of the Pas de Calais at a scale of 12,500 in order to increase the accuracy of plotting, and in February 1943 a general annotation of defences and batteries on maps of a scale of 1/25,000 was commenced wherever these were available.

From October 1942, detailed studies of selected batteries were made in the light of accumulated ground information, and large scale plans of several batteries, with sections, perspective views and plans of their individual emplacements were produced.

As a result of the experience obtained in carrying out this detailed work the section was able to identify correctly and report the first activity seen in Western Europe in connection with the building of casemates for light and medium coastal guns. An example of the value of photographic intelligence as a means of providing early information on unusual developments in enemy defence policy was the identification of the Type 611 casemate, the first casemates for light or medium guns to be authorised for use by the German High Command, the first to be discovered on air photographs, and the first for which detailed plans were furnished by ground sources.

The plans of this type of casemate appear to have been authorised for use on 2nd November 1942, but it was not known how soon after this date work was actually put in hand. In March 1943, however, A.P.I.S., G.H.Q., reported unusual construction activity at Dunkirk Harbour from a sortie flown on the 12th March. The photographs showed three excavations sited in a concave arc and spaced about 120 yards apart. A.P.I.S., interpretation was that this was a new battery position under construction and that the structure, when complete, would consist of a shelter at the rear to house personnel and/or ammunition, and a blunt-nosed casemate in front for the gun. When this report was submitted work on the casemates had not proceeded further than the laying of the concrete floor of the rear compartments and the digging of the excavation for the chamber for spent charge-cases beneath the casemate; no walls had then been built.

The interpretation was not accepted by I(a) GS(I) G.H.Q., who vetoed its publication on the ground that only super-heavy guns had so far been put under concrete, and that it was unlikely that the enemy would restrict the arcs of fire of his light and medium coastal guns by extending the policy of casemating to include them.

From cover of 19th May and 1st July, 1943, A.P.I.S., again reported activity similar to that at Dunkirk, now seen at Calais and Franceville Plage. The latter example, where the new casemates obstructed the field of fire of the old emplacements, finally convinced I(a) of the accuracy of the original interpretation of the activity at Dunkirk, and a report on the three sites was issued on 7th July, 1943 (**Martian Report No. 57**).

In December 1943, ground sources furnished a plan of this type of casemate, later identified as Regelbau 611, which was published on 21st December 1943, in **Martian Report No. 75**. Despite slight inaccuracies in measurement, the plan drawn from photographs in the previous March was substantially correct not only in shape and size but also in its interpretation of the functions of the two main parts of the casemate.

Photographic sources were, therefore, responsible for the correct appreciation of this development in enemy defence policy some nine months before the first accurate information was furnished by ground sources, by which time the programme of case-mating had been extended to a substantial proportion of the batteries along the coastline of occupied Europe.

At the end of August, 1943, the plotting of all enemy defences in the Overlord area on 1/25,000 scale maps was commenced, but as it was felt that this did not permit a sufficiently detailed representation of the battery positions, experiments were made in the production of defence traces of these positions, superimposed on photographs enlarged to a scale of approximately 1/3,000. This in turn led to the compilation during February and March 1944, of two Battery Booklets intended primarily for the use of ANCXF and dealing with all coastal artillery in the area.

These booklets comprised annotated enlargements of 83 batteries with detailed descriptions of their armament and associated features, as many as 30 sorties per battery being consulted to ensure that the case-history of the sites was complete.

The close watch kept on all cover flown over these batteries resulted in the identification and reporting of many new types of gun casemates then making their first appearance in Western France. In this way casemates of 649/652 type were reported as early as June 1943. The 669/671 type and the 680/679 type in March 1944.



Four Heavy (170mm) Guns unemplaced at La Pernelle, GSGS 4347 Sheet 31/20NE GR 368198

In all cases identification from photographs preceded identification by ground sources by several weeks or even months. Studies were made in the methods in building these casemates and of the time required for their completion.

As D-Day approached, immediate interpretation reports were issued to record all changes to the batteries and to give estimates of the damage inflicted on them by Allied Aerial bombardment. A partial check of coastal artillery in the Op Overlord Area carried out after D-Day showed that photographic interpretation had succeeded in identifying 90% of the batteries actually in existence, the remaining 10% being flak batteries used in a coastal role without permanent positions. Photographs were the sole source of information for the existence of 16% of the batteries.

The 4 gun 17 cm battery at La Pernelle

On 28 January 1944, an oblique sortie flown over the beam station at La Pernelle showed a gun identified as 17 cm calibre in a hedgerow. The oblique was plotted, and vertical cover flown over the pinpoint revealed the presence of a battery of 4 cleverly camouflaged guns at this spot. A close watch was kept on the position, and in March it was seen that the guns had been moved to a new site adjacent to the original one. On the 18th of the same month it was noticed that work had commenced on the digging of an excavation for a casemate some 200 yards north-east of the battery. By the 26th work was in progress on 4 casemates which in the following month were elaborately camouflaged. Despite the camouflage, the pinpoints given from photographs enabled aerial and naval bombardment to destroy two of the guns and to force the enemy to abandon work on two of the casemates. The remaining two guns were destroyed by their own crews shortly after the D-Day landings.

The 4 gun 10.5 cm battery within the Montagne De Roule

Persistent reports by ground sources of the construction of tunnels to house "railway guns" inside the Montagne de Roule led to a close watch being kept on this hill. The suspicions of interpreters had already been roused by the presence of five mounds of spoil at the foot of the hill when a sortie under favourable lighting conditions on 26th March, 1944 showed the noses of two casemates projecting from the hillside below the walls of the old fort that crowns the summit. Bearing in mind the presence of the other three heaps of spoil, the position was reported as a 4, or possibly 5, gun battery in casemates. After the capture of the fort it was found that there were in fact 4 casemates and an OP built into the face of the hill and connected by a system of tunnels.

Underwater Obstacles

One of the most exacting responsibilities undertaken by the section for Op Overlord was the identification and accurate plotting of underwater obstacles off the invasion beaches.

During the Dieppe raid in 1942, landing craft at Berneval had encountered steel stakes driven into the sand below the water-line (**Martian Report No. 19 of 7.10.42**). In the Spring of 1943, ground sources had occasionally reported experimental work in connection with underwater obstacles, and photographic confirmation of this was obtained from an oblique sortie flown on 12 May 1943 which showed a few units of curved rail some 100-150 yards offshore at Quinneville on the east coast of the Cotentin peninsula. It was later learned that the enemy had used this beach as an experimental area.

No further developments were seen there and apart from the discovery of wire below the high-water mark off the Belgian coast, seen on photographs taken on 4 August 1943, air cover showed that the coast of occupied Europe was free from this type of construction until February 1944.

On 20 February, 1944, air photographs showed that work had commenced on the laying of underwater obstacles both off the Op Overlord beaches and in other parts of France and Belgium. The programme was obviously in a very early stage of development, the stretches of obstacles were small, and working parties were seen engaged in erecting them. From this time onwards cover of the beaches was flown regularly with a view to keeping a close watch on the progress of the work, and by the end of February, it was seen that 13,200 yards of the Op Overlord beaches had been obstructed by Element 'C', hedgehogs and tetrahedra, many of which had been obtained by dismantling existing anti-tank obstacles on the land edge.

During the following three months the work continued and increased in intensity. In March an additional 17,600 yards were constructed, curved rail was first seen to be employed in quantity, and the practice of "thickening" existing stretches of obstacles with additional rows commenced. In April another 26,050 yards were added and the use of stakes was confirmed and by the end of that month it was determined that a total of 56,850 yards had been laid in the Op Overlord area.

On 1 May 1944, loaded barges were seen off Ouistreham engaged in transporting obstacles to the beaches.

A fortunate accident had betrayed the enemy's policy of attaching mines to the obstacles. On 25th April, 1944, strike photographs of the aerial bombardment of the medium coastal battery at Benerville showed that the explosion of a stray bomb in the sea some 700 yards from the beach had caused a series of fourteen smaller explosions near the coast. At the time of photography the underwater obstacles were covered by the tide, but comparative cover showed that the explosions had occurred within the depth of the belt of obstacles at that place. It was appreciated that they were caused by the sympathetic detonation of mines set amongst the obstacles. As a result of this, feigned attacks were later made on other coastal strong-points and bombs were deliberately allowed to straddle the underwater obstacles at low tide. No explosions were seen amongst the obstacles, which suggested that the mines were fastened to the units themselves and were not buried in the sand between them.

Up to this time all interpretation had been done from vertical cover of about 1/10,000 scale and from normal operational obliques. A new reconnaissance technique was now employed in order to obtain more detailed information. Photographs were taken from cameras fitted in the noses of Lightnings flying at zero feet along the lines of the obstacles. The point-blank obliques obtained in this manner gave a complete answer not only to the types of obstacles employed and the methods of mining them, but also to the way in which they were erected and the materials of which they were made. Element "C" curved rail, hedgehogs, concrete, wooden and steel tetrahedral, stakes, ramps, "easels", mined rafts and "barriers" were all successfully interpreted, and nutcracker mines (the existence of which had already been deduced from vertical photographs) teller-mines, shells and bottles filled with explosive, were identified. The use of hoses and mobile pumps to prepare holes for the planting of stakes was also discovered. Later operations carried out by Combined Operations Task Forces to secure specimens served to confirm the interpretation previously made from photographs and a survey made after D-Day shewed that photographic interpretation had been responsible for the correct identification of all types of underwater obstacles and for the substantially accurate appreciation of the various methods of mining employed.

As D-Day approached, daily sorties were flown along the Op Overlord beaches, and daily reports and traces were issued showing in detail all alterations and additions to the obstacles bringing up to date the information published on the Defence Overprints. The last report left the section at 1600 hrs on 5 June 1944.

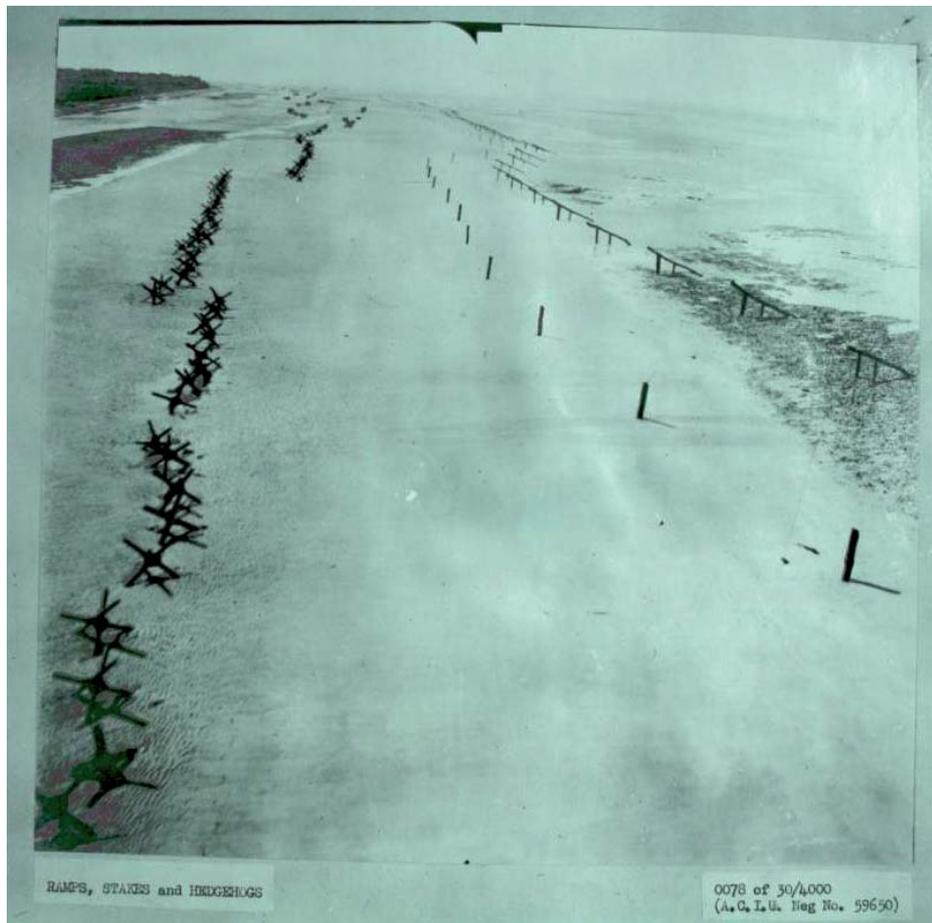
Anti Air-Landing Obstacles

For some time previous to the landing in Normandy the Germans had obstructed disused airfields by ditching and ploughing, and had later extended this policy to obstructed areas of open ground suitable for airborne operations by means of planting vertical poles in the fields. At first the areas obstructed by the latter method were mostly in the Pas de Calais and the Pays de Caux, and it was not until some three months before D-Day that the detection on air photographs of an unusual amount of tree-felling in the Op Overlord area warned interpreters to expect similar developments there. The programme of obstruction, once put in hand, proceeded with a rapidity that even outstripped the rate at which underwater obstacles were being laid off the coast during the same months.

The main type of anti-landing obstacles used was the vertical pole, easily identified by its cast shadow, or by the light-toned spoil thrown up from the pit made to receive it. For the most part these poles were planted equidistant from each other, forming a regular pattern in the fields. Another type, used mostly on rough or rocky ground, or in the neighbourhood of HQs, showed on photographs as groups of spoil marks forming triangles or pentagons. Oblique cover shewed



About 8 mines exploding between bomb-burst and shore at Benerville, Sheet 43/18SW, GR 420116



Zero-level oblique of Ramps, Stakes and Hedgehogs

that the peculiar patterns were caused by the holes for supports to a central pole, which could not be inserted deeply owing to the nature of the ground. Rare instances also occurred of the use of standard types of steel anti-tank obstacles, hedgehogs, tetrahedra, dispersed in single units over vulnerable areas. Within the Op Overlord area the airfield at Trouville provided an example of obstruction by ditching, by vertical poles and by felled trees laid horizontally end to end along the ground.

About a month before D-Day the erection of anti-air obstacles was extended from the coastal to the inland districts of the Cotentin and Calvados. The work was carried on right up to D-Day, obstacles in the Granville region only beginning to appear in bulk at the beginning of June.

In addition to plotting the areas obstructed on the Defence Overprints, A.P.I.S. issued daily reports giving details of new areas, so that the operational maps could be kept up to date until the day of the landings. These obstacles did not prevent gliders from landing but they might have done if the operation had been delayed, for it was intended to link up with wire and attach mines. This had not been done by D-Day.

Conclusion

This note has been taken almost verbatim from an APIS account written at the end of the war found in the National Archives as have some of the images. Mention is made of the interaction between the interpretation, made mostly on F24 reconnaissance photography, and the final plotting of the defences on the G.S.G.S. maps and a harmonious relationship may therefore be inferred from the statement that A.P.I.S. checked the proofs of the maps against the aerial photos. This was not always the case in other theatres of the war, from the Western Desert and North Africa, in Sicily and in Italy where Survey accepted the interpretation of defences etc but insisted that the plotting was a Survey responsibility. It is hoped a subsequent article may cover this aspect.

The use of D-Day Museum, Portsmouth and National Archive material is gratefully acknowledged.

The First World War

A personal perspective one hundred years on.

By Barbara Taylor DGC - August 2014

The First World War was a turning point in world history. It was the largest war Great Britain had fought to date and the first war fought with weapons resulting from mass industrialisation. It claimed the lives of over 16 million people worldwide and had an impact on the lives of every family in Great Britain and the Empire. It saw the beginnings of the huge social changes which have resulted in the lifestyles, freedoms and advances in medicine and technology we enjoy today. 2014-2018 marks the Centenary of the First World War; it is, therefore a landmark anniversary for Great Britain and the world.

2014 sees the start of some five years of commemorations. Five years, not four because the Treaty of Versailles that formally ended the war was not signed until 28 June 1919; which incidentally was five years exactly since the assassination of the Archduke Franz Ferdinand and his wife, Sophie in Sarajevo. The event that '*lit the blue touch paper*' and speeded up the start of what was arguably inevitable: The Great War; or from 1939, the First World War.

Contrary to what most people think, the Armistice of 11 November 1918 was a cease fire only and had to be renewed every month until the peace treaty was signed.

But let's not get ahead of ourselves. All war is awful for everybody involved and everybody is involved. The soldiers, obviously, because they have to fight it; those who have to serve, supply and then nurse them when wounded, both military and civilian. The families left behind to wonder what is going on – no TV or internet then for almost instant reporting. It could take days to get news and then weeks for it to be detailed and a more realistic picture to emerge. Those people who live on what becomes a battlefield and become refugees for years. The aftermath; rebuilding lives, livelihoods and homes. The war might be over, but the repercussions can last for many years. Civil war often breaks out in former war torn countries as has been seen on many occasions since the end of the Second World War and the opening of the '*Iron Curtain*'.

But war isn't just about negatives, which is really my point. Having said that I wouldn't want anybody to think I am making light of it; I am not, but there are an awful lot of misconceptions about the Great War.

Firstly, I am sure everybody has heard of the First Day on the Somme; even if you don't know much about the war, most people have heard of 1 July 1916. The reason why most people are familiar with this date is because this is when the war became 'real' for everyman. This was the middle day of the middle year of the war and it remains and will probably always remain the worst day in the history of the British Army.

No question

It was a disaster on the human front; very nearly 60,000 casualties in one day. Sadly many of the men who died that day – nearly 20,000, belonged to Kitchener's so called New Army and it was their first time in an attack, although not in the line. This had an appalling consequence for the northern industrial towns, as it was many of these that supplied the so called 'Pals' battalions: the Accrington Pals and the Glasgow Commercial being examples. These men and boys joined up and served together – and why not? The local connections of workplace and sporting affiliations were an attractive proposition, especially for people who would not normally have joined the services. It was seen, quite rightly, as being a huge boost to morale. The trouble was that many died together leaving a huge massed grief on localities and an impact on economies at home. It is said that the war losses damaged the economy of Newfoundland for two generations.

But the other side of the coin is this. It was not a disaster on the whole front; the southern part of the British front, where we fought alongside the French army – yes, they were there too – took most of their objectives. The French had an extremely successful day, only checked because the northern part of our front did so appallingly, which meant that the enemy could fire on them from the flank. Some historians believe that the Germans lost the war during the five months of the Somme battle, because the attrition rate was actually greater for them.

Lets not forget the appalling French casualties at Verdun and I bet you don't know that the French had 27,000 killed in one day during August 1914. The simple truth is this: all the warring nations had the staggering casualties they did simply because they put larger armies into the field than ever before. It is about percentages. Believe it or not, but the death rate is a similar percentage of those mobilised for any war. Not that it makes it any more acceptable.

The British and Empire army that contributed to winning the war in 1918; mainly from 8 August, which Ludendorff called the Black Day of the German Army, was quite simply the best army it could have been. In 1914 it was a regular army used to fighting colonial type wars, but by 1918 it was an army; by that time mostly conscripted, that had evolved to fight in tandem with other arms and with weapons capable of killing and destruction on an industrial scale.

But now for positives, the pros rather than the cons; and there are many; things we now take for granted.

Medicine. Two everyday procedures; blood transfusions and the irrigation of wounds were both perfected during the war. The wonder that is plastic surgery; this had its beginnings then, treating men with the most appalling facial injuries enabling them to live a life rather than be exhibits in some kind of freak show. Of course, in some cases it took many years and wasn't perfect. In the Second World War, this was taken even further for the men who were badly burned as a result of their planes crashing. They called themselves The Guinea Pig Club.

Amputees; you see now the kind of prosthetic limbs that men injured in Afghanistan can have, enabling all sorts of sporting activities.

Innovation. Aeroplanes; I am sure most of us have jetted of somewhere or other. The internal combustion engine. These 'new fangled' things were around before the war, but vastly improved through necessity. The tank. Developed during the war; it's name came from the 'cover' story for secrecy; a water carrier for Mesopotamia!

Everyday things. Washing machines; dishwashers; carpet cleaners; microwave ovens. We would have had these things by now anyway, I daresay, but we have had them sooner than we would have. The use of the microwave came about blocking radar in the Second World War. The computer; most certainly evolved through war. Think of Bletchley Park, Alan Turing and Colossus; the world's first electronic computer, which took up a whole room!

The way we live our lives now. Home ownership; virtually unheard of for even the middle classes before the two wars. Professions that are now open to us; most working people were in service (like at Downton Abbey) or worked on the land or in factories. And it has to be said; the opportunities for women. It wasn't Mrs Pankhurst chaining herself to railings that got women the vote. It had been discussed in parliament and would have had to have come quite soon, but the work women took on in the war while the men were away is what tipped the balance. Munitions factories were nearly as dangerous as the Western Front!

I hope that all of this has sparked an interest and at the very least is '*food for thought*'.

Lest we Forget.....



Running the Flags

'with a little help from Fougasse!'

Condensed from a news release by Sgt Rees, RSAF Wyton.

At precisely 1400 hours on 10th July 2014 three teams of runners from 42 Engr Regt (Geo) arrived at Royal Air Force (RAF) Wyton in Cambridgeshire, having carried their Regimental and Squadron flags 120 miles from Hermitage in Berkshire. Having raised the Regimental Flag, Sapper 'Jonty' Pope (22) said: "It was a real thrill being asked to raise the flag. Everyone who took part in the run understood the significance of what we were doing and we all got a big buzz when we entered Huntingdon over the Town Bridge with our flags held high."

Brigadier (Brig) Nick Davies, Commander (Comd) JFIG and Lt Col Blunt both addressed Stn personnel at the flag raising ceremony, which included 42 Engr Regt (Geo) personnel already working at Wyton. Lt Col Blunt explained the significance of 'Running up' the Regimental and Squadron flags and detailed the feat of those who participated in the run. He said: "This event has been a resounding success and I would like to thank the runners and organisers for all their hard work in planning and participating in this challenge."



The flag Teams entering Huntingdon over the Town Bridge.

He also took the opportunity to tell those gathered about the Regiment's wish to raise money for Cancer Research (UK) as a result of the Exercise FOUGASSE FLAGS run. He said: "The charity has been chosen due to the loss of Cpl Colin Clark RE, a member of the Regiment who died from this horrible disease in 2013. Doing this with Colin in mind has been a real motivating factor for many of the individuals taking part in the run."

The two articles which follow are from two of the runners. LCpl Greene and Sapper Dempsey, both of 16 Geo Sp Squadron.



Capt Phil Ryder (front right) and the Regimental flag team.

Eat, Sleep, Run, Repeat.

By LCpl Greene

On Wednesday 9th July a contingent of 18 runners set off from Dennison Barracks, Hermitage across country to the newly refurbished RAF Wyton just outside of Huntingdon.

The run symbolised the moving of 42 Engineer Regiment from its former home to the new multi-intelligence, tri-service camp in Cambridgeshire.

Runners representing the Regimental Headquarters as well as 13 Squadron and 16 Squadron carried their respective flags in relay along the 120 mile route throughout a full 24 hour period.

The flags were delivered to the runners by the Commanding Officer, Lt Col Blunt, outside the old Regimental headquarters in the Hermitage camp in front of a parade of the RSMS students, as well as the few civilian employees remaining at the camp. At 1400 hours the RSM, WO1 Robinson, set the runners off in only the way a RSM can: the echo of “*standby, GGGG0000000000*” still ringing in the ears by the end of the challenge.

The initial section was ran by all runners carrying the flags outstretched so as to show off the colours of the regiment.

At the first hand over point the flags were packed into day sacks and handed to the first leg runners, a representative from each squadron and Regimental Headquarters would run at the same



The flag teams on their final approach to RAF Wyton.

time with a support vehicle following close behind. The second support vehicle would then jump ahead to the next handover point where the next three runners could prepare for their leg.

Each leg was roughly a distance of 5 miles with a generous hour allowed for each leg. It shortly became apparent that the time allowed would be far more than sufficient (*Editor's note – BFT does seem to work then!*).

Surprisingly the weather for the event was better than forecasted, with high temperatures and all

but no wind. This, however did make some of the legs more uncomfortable, especially for the fairer complexion amongst us. The heat also aiding the fermentation of the runner's kit as they clambered back on to a cramped mini bus after each leg, which by only the third hour was beginning to smell somewhat ripe!

All participants remained in high spirits throughout the afternoon despite the cramped, putrid conditions onboard the mini bus. By 1900 the group were ahead of schedule and decided to push on a further leg before meeting the support drivers who would not only be relieving the drivers from the afternoon but would also be bringing hot scoff from RAF Wyton.

Pushing on to the next stop the 18 rather sweaty and dishevelled runners descended on to a posh pub called the Shoulder of Mutton at Wendover. Despite the group's appearance we were made very welcome, the subsequent look at the drink prices, realised why. Most of us opted for a soft drink: most, but not all.

It was at this point the group would be told that they were not going to receive a hot evening meal. This was received with mixed emotion, some of the runners opting to sample a local fish and chip shop; regretted by some when they returned to hear that the next group would be pushing on.

So, off set the group leaving the destination some 3 hours earlier than the programme had stated having filled up on their personal supply of flapjacks and energy bars.

The run progressed smoothly with evening turning to night time with little more to see than either the tarmac dimly illuminated by the mini bus behind (which did well to hide any increases in gradient) or the inside of the mini bus now with its distinct aroma and filled with the sounds of soldiers snoring.

Around 0200 a break from the monotony came from a bevy of blue flashing lights and the sight of an up turned vehicle in the hedge line. Fortunately all its passengers had escaped unscathed. On the runners went into the morning until 0400 when the illuminated signage of Tesco generated an excited flurry of conversation about what treats or caffeine based drinks would be purchased.

By this time the group was 6 hours ahead of schedule. After indulging in the delights of the 24 hour Tesco most of the runners settled for a rest to awake only a couple of hours later in eager anticipation of the café opening at 0830, much to the surprise of the café staff who were not expecting the arrival of 20 hungry soldiers. This also allowed the CO to check in on the group and hear some of the events from the evening as well as wishing the group luck on the final few legs.

Setting off with renewed energy and the promise of making the evening news the group pushed through their final 16 miles, again faster than anticipated, and arrived short of the rendezvous point with enough time for a final rehearsal on carrying the flags around Huntingdon and on to the camp. At 1230 on Thursday 10 July the group crossed over the bridge at Godmanchester and onto the ring road where ITV snapped away.

From this point on it was business as usual. The runners' change-over from running to sitting cramped on a mini bus was now down to a fine art. There was even time for a further refreshment break prior to entering the new home of 42 Engineer Regiment, where the flags were greeted by the regiment, some civilians and RAF.

The three junior members were invited to carry the flags to their respective poles and under direction were raised signifying the arrival of the regiment at the former air base.

After a brief address from the CO all were invited to enjoy a hog roast and liquid refreshments at the camp's sports bar '*the sin bin*'.

All in all the entire even went off without a hitch with the only rain being a gentle drizzle on arrival, which actually served to freshen up the participants, who had still not showered some 24 hours after setting off.



Welcome to RAF Wyton.

Fougasse Flags

By Spr Dempsey

As part of the Regimental move to RAF Wyton, it was decided that the Regimental and Squadron flags from 42 Engr Regt (Geo) were to be moved in a memorable manner. In a symbolic gesture to mark the relocation, three teams of six soldiers representing each squadron endured and completed an arduous run between Hermitage Station and RAF Wyton (120 miles) within a 24 hour time limit.

The teams were selected a few weeks before the event in order to build up to running the set miles. The training was easy to start off with, and gradually built up running four 5 miles stints every Tuesday and Thursday. On Wednesday 9th July 2014 the teams and their flags were set off by the RSM as they were cheered out of Denison Barracks. The flags were then sent on a relay by each member of the team until they were hoisted at the other end in RAF Wyton.

After being told not to race it, all the runners set off at gruelling pace so that we were ahead of the 24 hour schedule. At some point during the event we were 6 hours ahead of schedule. Due to this the decision was made at 0200hrs for the runners to take a break and have a sleep for a few hours before the big day. However, taking this break did not pay off. After waking up from an already bad sleep, everyone's legs had seized up and each team struggled to hit their stride in the subsequent runs.

We pushed ourselves to the end and arrived into Huntingdon just on time. We ran the flags around Huntingdon in our teams until we finally arrived at RAF Wyton ready for the flags to be hoisted outside the new RHQ building. The relocation of 13 Geographic Squadron and 16 Geographic Support Squadron was all the more important as we joined 14 Geographic Squadron, and the flag raising ceremony marked the occasion of the three squadrons being together for the first time in the history of the Regiment.



42 Engr Regt (Geo) preparing for the flag raising ceremony.

In hindsight it was a great experience for everyone involved. Not only did we mark this historic occasion of bringing the squadrons together by completing a physically challenging feat, we also raised money for a charity that touches us all in one way or another, Cancer Research UK. The one lesson that we did learn was that we should have all been like the tortoise and taken our time, because in this occasion (and this one only) it did not pay to run at a speed of a thousand gazelles.

Notes:

42 Engineer Regiment (Geographic)

Based at RAF Wyton in Cambridgeshire, 42 Eng Regt (Geo) is a JFC specialist RE unit that provides geographic support to all elements of UK Defence.

The Regiment consists of 13 and 14 Geo Squadrons, 16 Geo Support Squadron. 135 Independent Geo Squadron RE routinely reinforces the Regiment with Reservists as 'individual augmentees'.

Capabilities

The role of 42 Eng Regt (Geo) is to provide field deployable geographic support to Defence. As well as supporting Current Operations, it maintains sub-units and individuals at readiness for deployment and support to exercises.

The capabilities provided by the Regiment range from raw data collection (including geodetic surveys) and information management; through information exploitation, terrain analysis and visualisation; to geospatial information dissemination (electronically across networks, by bulk reproduction and supply of hard copy mapping, or on a digital media).

Deployments

The Regiment's current main effort is support to Op HERRICK in Afghanistan; providing additional specialist officers and soldiers to augment and reinforce existing embedded geographic personnel on the deployed staffs. The current requirement for geographic support in Afghanistan has led to a dispersed Geographic Support Group (GSG) of about a half-Squadron size being deployed from the Regiment on an enduring basis there.

In addition to Afghanistan the Regiment plays a key part in other Defence outputs. These tasks have recently included deployments of airfield survey teams around the world to contribute to international air safety as part of the Terminal Aeronautical GNSS Geodetic Survey (TAGGS) Programme; support to other Defence Intelligence organisations; support to other Intelligence Agencies; and finally support to the Op ELLAMY Libya campaign where Regimental personnel worked both in the Foreign and Commonwealth Office, and at sea with the UK Naval Task Group.

Closer to home, the Regiment continues to be heavily involved in support to UK Operations through the Standing Joint Command.

Defence Intelligence (DI)

DI is an integral part of the Ministry of Defence (MOD) and is the main provider of strategic defence intelligence to the department and the armed forces. This includes timely intelligence products, assessments and advice to guide decisions on policy, to inform defence research and equipment programmes and to support military operations.

Joint Forces Intelligence Group (JFIG)

JFIG was established in 2012 under the new Joint Forces Command and superseded the Intelligence Collection Group (ICG). JFIG makes up the largest sub-element of Defence Intelligence. It is responsible for the collection of Signals, Geospatial, Imagery and Measurement and Signature Intelligence. 42 Engineer Regiment is one of its component units.

Programme to Rationalise and Integrate the Defence intelligence Estate (PRIDE)

Under PRIDE, construction of the new Pathfinder Building, which is home to the Defence Geospatial Intelligence Fusion Centre and JFIG Command Group, and its associated JFIG accommodation was completed as an in-service capability and delivered ahead of schedule and within the £308 Million budget.

What (or who) is 'Fougasse'?

For those of you who aren't familiar with the work of 42 Engr Regt (Geo), it is likely that you won't be familiar with the term 'Fougasse'. So, the question that needs to be asked is; what is Fougasse?

By definition, a fougasse is an improvised mine constructed by making a hollow in the ground or rock and filling it with explosives (originally, black powder) and projectiles. Fougasse was well known to military engineers by the mid-eighteenth century but was also referred to as early as the sixteenth century. This technique was used in several European wars, the American Revolution, and the American Civil War. The term is still used today to describe such devices.

So you now know what a fougasse mine is and its link to military engineers. But why does the term remain so significant to "Four Two"?

As is the will of military units to adopt and nurture nicknames, often adapting humorous illustrations to breathe life into its chosen logo or maxim, so "Four Two" came up with its own; a character they

call Fougasse, and at first sight some sort of run of the mill globe carrying soldier. However, "Four Two" will tell you that their Fougasse is no ordinary run of the mill soldier. His origins are a thing of legend, but he's instantly recognisable to them and can be found everywhere you find soldiers with maps. He's more than just a logo or a badge. With a rifle in one hand and a globe over his shoulder, Fougasse is the embodiment of the Military Cartographer; Soldier First - Geographer second. Or is it the other way round?

Clearly significant, but who is responsible for designing the Fougasse character?



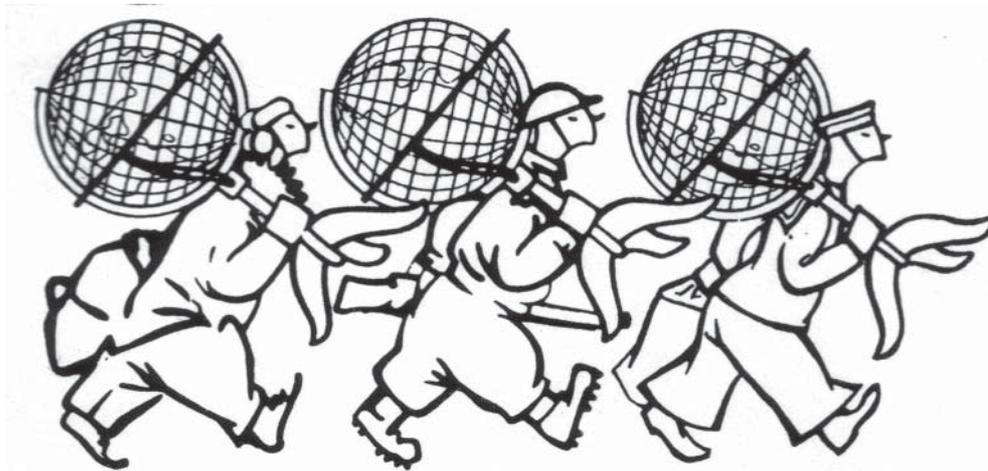
This version appeared on the cover of a 1950 Map and Air Chart Catalogue.

Born in 1887, Cyril Kenneth Bird, better known by his pen name 'Fougasse', was one of the most influential cartoonists of the time. A Royal Engineer himself, he was seriously injured at the Battle of Gallipoli during World War I and invalided out of the British Army. However, he was best known for his editorship of the satirical magazine Punch and his World War II warning propaganda posters.

His drawings were considered innovative, with a style that was both unique and popular. They were featured in many advertising campaigns and, as well as designing many posters for the London Underground, he also contributed to several British newspapers and magazines, including the Graphic and Tatler. During World War II, he worked unpaid for the Ministry of Information, designing humorous but effective propaganda posters, including the famous "Careless Talk Costs Lives" series. It was during this time that he reputedly sketched the character that "Four Two" call Fougasse.

Although Cyril Bird, alias 'Fougasse' died in 1965, aged 77, his drawings live on in the Fougasse character adopted by "Four Two". Sometimes a small bronze statuette given as a farewell gift, and regularly used as a logo on the back of sports vests, Fougasse plays a big part in the lives of those in "Four Two", even expressed as a term used in the naming convention for the regiment's military exercises.

So you see, it really isn't the whimsically made-up name you thought it was and, as 42 Engr Regt (Geo) folk will tell you; anything can be achieved with a little help from Fougasse!



In 1970 a sailor joins the line up to become Tom, Dick and Harry.

Major John Eady BSc (Eng), MSc, MInstRE

1 Aug 35 - 28 Jan 14

A personal recollection of his life by Colonel Bill Codd

John Eady was educated at Worthing Grammar School and commissioned into the Corps of Royal Engineers from the RMA Sandhurst on 29 Jul 55. While at Sandhurst he won the Prize for Physical



Training. He attended 15 Young Officers' Course (Beckett's Batch) at the SME Chatham prior to spending the following three years studying for a B.Sc. (Eng) degree at the RMCS Shrivenham. He and I were on the same degree course and we became firm friends. We played rugby in the 2nd XV and he introduced me to the etiquette of rough shooting. John married Hilary immediately after Shrivenham and we were posted back to the SME for a Junior Officers' Course. As there were no married quarters for junior officers, John and Hilary rented a flat above a butcher's shop in Chatham. We were both subsequently posted to 1st Fd Sqn RE in the Infanterie Kaserne, Paderborn, where John and Hilary set up home in married quarters and where their son Richard was born. We spent the next 2 years on exercises training to repel an invasion of Western Europe by Soviet Block Forces. On one exercise, John's cook set fire to a German farmer's large wooden barn with a hydraburner, a dangerous petrol burning cooker. The barn was full of pigs, which like the Gaderene swine tried to dash back into the flames as soon as the soldiers had rescued them. Later John recommended two of his sappers for gallantry awards for risking their lives saving pigs but HQ BAOR dismissed his recommendation as frivolous. It did cost a tidy sum to recompense the German farmer for his loss.

Later that year the Squadron moved to Nienburg midway between Hannover and Bremen, from where we became involved in the Hamburg floods of February 1962. After a week of severe storms in the North Sea the River Elbe burst its banks and a large area of the city was inundated in the night of 16 February. Despite the deployment of German and British soldiers with assault boats, 310 citizens lost their lives. After 1st Fd Sqn RE he served with the Army Apprentices College Chepstow, and with 25 Corps Engr Regt in Osnabruck. In 1965 he attended 36 Army Survey Course at the School of Military Survey. His career with Military Survey included a tour as Exchange Officer with the Royal Australian Survey Corps, Bendigo, Victoria, as Officer Commanding 1 Air Survey Liaison Section RE in RAF Akrotiri, Cyprus, and as Officer Commanding 14 Fd Svy Sqn RE, in Ratingen near Dusseldorf. He then returned to UK in 1973 where he studied for a M.Sc. degree in Geodesy at Oxford University. For the next 3 years he served as Manager Geodetic Surveys with Ordnance Survey in Southampton and then became Senior Instructor Field Survey at the School of Military Survey. His final tour of duty was in MOD Directorate of Military Survey, Feltham before he took early retirement in 1981.

He then spent an academic year as a student in King Alfred Teachers Training College, Winchester qualifying as a mathematics teacher. In his new career he taught in Queen Mary's College for sixth form students in Basingstoke until August 2000. He was then employed as Clerk to the Governors of the College until finally retiring in August 2013.

John was a family man, who is survived by his sons Richard, Clive and Carl and his daughter Jane. Hilary died in 2005 and he continued to live in the family home in Winchester until his sudden death. He loved music and his hobby was tuning and restoring pianos. He was always physically fit, enjoying athletics, rugby football, orienteering and rough shooting.



Colonel A R Wilby late RE BEng(Hons) MSc psc(j)

*ACOS Force Development, Plans & Training Policy and
Commander Royal Engineers (Geographic).*

Colonel Antony (Tony) Wilby assumed his appointment in the Joint Forces Intelligence Group (JFIG) in April 2014 and is responsible for developing the Group's long term strategy, medium and short-term plans, and training policies. He also oversees the Measures of Effect section on behalf of the Commander, and the management of JFIG liaison and embed posts; particularly those with Partners Across Government (PAG) agencies. As Commander Royal Engineers (Geographic) (CRE(Geo)), he has functional responsibility for all aspects of the Royal Engineer Geographic capability and its personnel across Defence and in international appointments.

Born in 1968 and educated at Birkenhead School and the University of Birmingham, Colonel Wilby commissioned into the Royal Engineers in 1989. Nine years at Regimental Duty and as an instructor at both the Royal Military Academy Sandhurst and Royal School of Military Engineering followed; including tours in Bosnia on Op RESOLUTE, the Falkland Islands, and in Angola leading a short-term mine clearance training team. He completed an MSc in Defence Geographic Information (the Army Survey Course) in 2000, and attended Advanced Command and Staff Course (ACSC) No 5 at the Joint Services Command and Staff College (JSCSC) before his "Black Bag" appointment as DCOS 42 (North West) Brigade in Preston. Taking command of 5 Field Squadron in July 2004, he deployed immediately to Basrah on Op TELIC 4 in support of 1 Mechanised Brigade and led a squadron-level construction tour in Canada, before moving to Hermitage as COS of the Joint Aeronautical and Geospatial Organisation (JAGO). Promotion to Lieutenant Colonel in July 2007 saw him posted to the Defence Geographic Centre (DGC) at Feltham as its COS/SO1 Ops & Plans, where he was responsible for the provision of foundation geospatial intelligence products, services and liaison to UK Defence. He commanded 42 Engineer Regiment (Geographic) from June 2010-December 2012; a period dominated by delivering field deployable geospatial support to Op HERRICK, Op OLYMPICS, Op ELLAMY and Op ATALANTA both overseas and in the UK. This included preparing, force generating and maintaining an enduring half-squadron sized commitment in Afghanistan throughout. Immediately prior to his current appointment, he served as the DACOS Geospatial with HQ Allied Rapid Reaction Corps (ARRC); the UK's NATO High Readiness Force (Land).

A keen sportsman, he has represented the Combined Services at cricket, the Royal Engineers at rugby and squash, and played football for the Army Crusaders. He is Chairman of the Royal Engineers Cricket Club, still plays recreational squash, and enjoys snowboarding and hill walking when the opportunity arises.



Lt Paul Trudgian RN

A proud Cornishman hailing from the St Austell area, Paul graduated with first class honours in Computer Games Technology from the University of Portsmouth. After two years of work as a computer games programmer, he chose a new career, entering BRNC Dartmouth in April 2010. His IFT took place on *HMS Albion*, visiting the West coast of Scotland and Belfast. Upon leaving BRNC, Paul served as an SFT YO on *HMS Clyde*, spending three months patrolling the Falkland Islands. After leaving *HMS Clyde*, Paul joined *HMS Protector* for the remainder of his SFT, crossing the Atlantic and visiting Antarctica on her maiden deployment.

On completion of IWOC in 2012, Paul entered further training at FOST HM to qualify as an HM officer, joining *HMS Echo* on completion for his first complement job as OOW and crypto custodian. Whilst on *HMS Echo*, Paul has been involved in surveys of Al Khums and Tripoli in Libya, acting as the Survey Motor Boat officer as well as searching for the missing Malaysia Airlines plane MH370 in the Indian Ocean.

In his spare time Paul enjoys playing flamenco guitar as well as competing in a variety of sports including boxing, having represented BRNC, Plymouth Command and *HMS Echo* in RN novice competitions.



Dr Vanessa Lawrence CB

Secretary General of Ordnance Survey International

In July 2009 Vanessa was appointed Honorary Colonel of 135 Independent Geographic Squadron, Royal Engineers.

Vanessa is the Secretary General of Ordnance Survey International, a new post created this year, after having been Director General and CEO of Ordnance Survey since 2001. Vanessa is the adviser to the British Government on mapping, surveying and geographic information and is co-Chair of Global Geospatial Information Management (UN-GGIM).

She received her business training from the publishing company Pearson plc and held senior positions at Autodesk Inc.

Vanessa is the Honorary Vice-President of The Geographical Association and a member of the Council of the Royal Geographical Society and the University of Cambridge. She is also a Visiting Professor at the University of Southampton and Kingston University.

Vanessa is a Companion of the Chartered Management Institute, a Chartered Geographer and a Fellow of the Royal Geographical Society, the Royal Institution of Chartered Surveyors and the Institution of Civil Engineering Surveyors. She also has been elected an Honorary Fellow of the Royal Academy of Engineering.

In January 2008, Vanessa was appointed as a Companion of The Most Honourable Order of the Bath (CB) in the Queen's New Year Honours List.

Vanessa is one of the few recipients of the Scottish Geographical Medal, a prestigious award conferred only occasionally since 1890 by the Royal Scottish Geographical Society. In addition, she has six Honorary Doctorate degrees and is an Honorary Fellow of University College London. In December 2008, she was named South-East Director of the Year by the Institute of Directors.

In January 2011 Vanessa was awarded the GeoSpatial Personality of the Decade 2000 – 2010.

Vanessa enjoys scuba diving, sailing her Solo dinghy, walking most weekends with friends, collecting antique maps and playing tennis at her local tennis club.



Group Captain Mike Hart

MA MA MPhil QCVS RAF

Group Captain Hart has been an Intelligence professional since 1989.

His operational service includes the first Iraq War (DESERT STORM), Northern Iraq (PROVIDE COMFORT and NORTHERN WATCH), Southern Iraq (SOUTHERN WATCH), Bosnia (between 1992 and 1995), Kosovo (ALLIED FORCE) in 1999, and Northern Ireland (2001-2003) where he commanded the Reconnaissance, Intelligence and Geographic Centre(NI).

As an OF4 between 2005 and 2007 he commanded the Operational Intelligence Wing at the RAF's Air Warfare Centre.

His Operational Service as an OF5 includes 12 months as UK Chief J2(A) in Afghanistan in 2008-9, and 6 months as ISRD Chief for Operation Unified Protector (Libya) in 2011, for which he was awarded a Queen's Commendation for Valuable Service. Non specialist tours include a year on the UK Air Staff, and a tour as Director of Defence Studies for the RAF. Most recently he served as DACOS J2 (Ops) at the United Kingdom Permanent Joint Headquarters.

Group Captain Hart studied History at Oxford University as an undergraduate and latterly completed a Master of Philosophy degree in International Relations at Cambridge University. He is a graduate of the UK Joint Service Command and Staff College.

Away from work he enjoys running, classical music, history, wildlife, mountain climbing and cricket which he used to play well. He is married to Jenny, a successful painter, which has fostered a (non-practitioner's) interest in art.



Rear Admiral Tom Karsten

The UK National Hydrographer

Tom Karsten was born in 1961 and joined the Royal Navy in 1979. Following training at Britannia Royal Naval College Dartmouth and an in-service degree in History from Exeter University, he embarked on his seagoing career qualifying as a Principal Warfare Officer in 1987.

After a range of warfare appointments, including serving as Naval Assistant to the Commander-in-Chief Fleet during the First Gulf War, he took command of his first ship, the Hunt class mine hunter *HMS Bicester* (1993-94). Subsequent promotion led to command of the Type 22 frigate *HMS Sheffield* (1995-96) for operations in the Far East, Gulf and Mediterranean.

In 1996 he graduated from the Joint Service Defence College and went on to serve in Navy Plans in the MOD during the Strategic Defence Review. After a tour as Staff Operations Officer to the Surface Flotilla he was promoted to Captain in 2001 and appointed first to HQ Royal Marines as the Chief Staff Officer for Plans and Programmes and then to the Fleet HQ as head of the Commitments Division. In 2003, he took command of *HMS Endurance* (2003-05) for two Antarctic seasons.

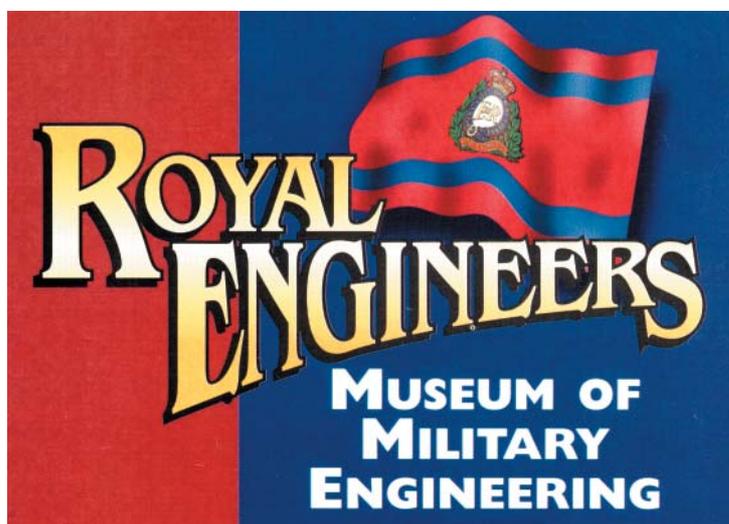
Returning ashore in 2005, he spent two years as Director of the Maritime Warfare Centre and, in 2007, was promoted to Commodore serving as Navy Command's Deputy Commander Operations. This was followed by a year at Oxford University as the Royal Navy's Senior Hudson Fellow researching Arctic geopolitics. On completion he was appointed as Commander British Forces Gibraltar in September 2010, serving on the Rock for two years.

Promoted to Rear Admiral, he became the UK National Hydrographer on 14 December 2012.

The UK National Hydrographer is Deputy Chief Executive (Hydrography) and also Head of Defence at the UK Hydrographic Office. The UK National Hydrographer is responsible for:

- defence navigation and development, defence situational awareness (DSA) and maritime operations support
- safety and quality
- Law of the Sea
- international partnering, external relations, technical standards, capacity building
- HM Nautical Almanac Office

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A Different Kind of Escape and Evasion Map

The "Q" Type Sailing Dinghy Chart Pack

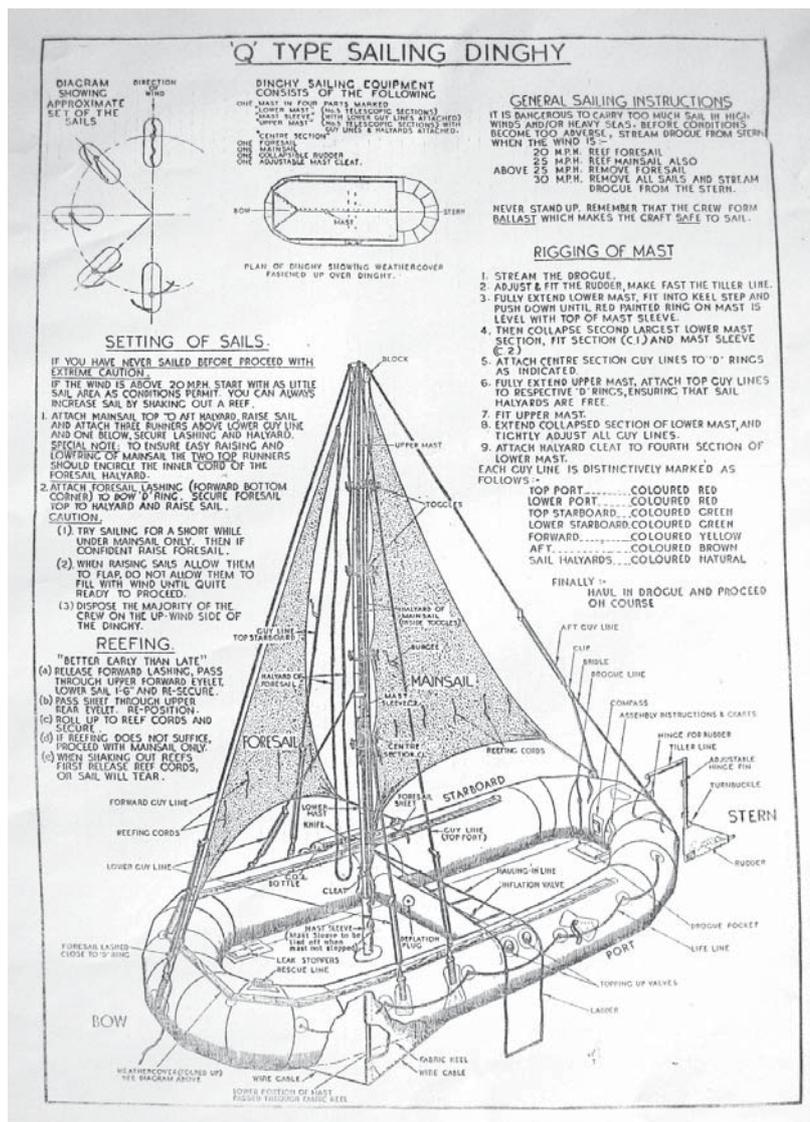
By Mike Nolan

In the course of my duties in the 1970's I occasionally visited 8 Map & Air Chart Depot R.E. and often returned to my office with the odd sample map. On one occasion I was given a copy of the "Q Type Sailing Dinghy Chart Pack." The story of this cartographic curiosity is :-

In 1943, 1,188 allied aircraft were lost, or believed lost, at sea, involving 5,466 aircrew. The rescue service was wholly or partly responsible for saving 1,684 lives, or 31% of the total. One of the means of saving lives was the use of inflatable rubber dinghies. In February 1943 a multi-seater sailing dinghy was trialled. There were initial teething problems and improved designs were introduced in April and May.

However in May a rescue was achieved by means of a "Q" type sailing dinghy which demonstrated the potential if a satisfactory type could be evolved for general use.

On the 17th May 1943, the starboard engine of a Whitley aircraft from R.A.F. St. Eval on anti-submarine patrol off the west coast of France failed. The pilot ditched the aircraft and in spite of several injuries, the crew were able to board the dinghy without difficulty. The wireless operator threw the dinghy radio into the sea from which it was recovered. (The radio was waterproof and cork-bound, designed to float).



The next day they crew consulted the instructional diagram and hoisted the mainsail. They failed to set the foresail successfully but made fair progress under the main sail alone. After six hours they were sighted by a Sunderland aircraft which on landing unfortunately dipped its nose right into the swell. The captain was lost but the remainder of the crew managed to board the Sunderland's "J" type dinghy. The two dinghys made fast alongside each other and awaited further assistance. The next morning another Sunderland landed on a calmer sea and rescued all the survivors.

By December 1943 the "Q" type dinghy was in general production for use in Whitley, Wellington, Warwick, Halifax and Lancaster aircraft. Difficulties in erecting the rigging and sailing the initial type led to the introduction of a simplified sail plan based upon a single lateen type sail. Both British (T.1333) and American (SCR.578) radios were in use from 1943

The “Q” type sailing dinghy was also equipped with a compass and a chart pack which were included in pockets in the stern of the dinghy. The chart pack consisted of 18 extracts of the standard Series GSGS 4090 1:1,000,000 scale Plotting Charts covering the littorals of Iceland, Norway, the North Sea, the Mediterranean Sea and the coast of West Africa, together with an index map showing the coverage of the 18 sheets and a set of instructions for erecting the mast and sailing the dinghy, all printed on cotton and bound together as a set by means of a brass rivet/eyelet in the top left corner.

The set comprised 10 linen sheets, each 33 x 33 centimetres overall, printed back to back.

Illustration of Dinghy & Key Map to Sheets 1 to 18	No. 9 English Channel & No. 10 Spain, North West
No. 1 Iceland & No. 2 Norway North	No. 11 France (South) & No. 12 Adriatic
No. 3 Norway West & No. 4 Faero Islands	No. 13 Gibraltar & No. 14 Algeria
No. 5 Norway South West & No. 6 Scotland	No. 15 Greece & Tripoli & No. 16 Anatolia & Egypt
No. 7 North Sea & No. 8 Irish Channel	No. 17 Morocco & No. 18 Cape Verde I. & Senegal

It is assumed that the intention was that any crew having successfully ditched at sea should occupy the dinghy, erect the sails, set a course and sail for a friendly shore.

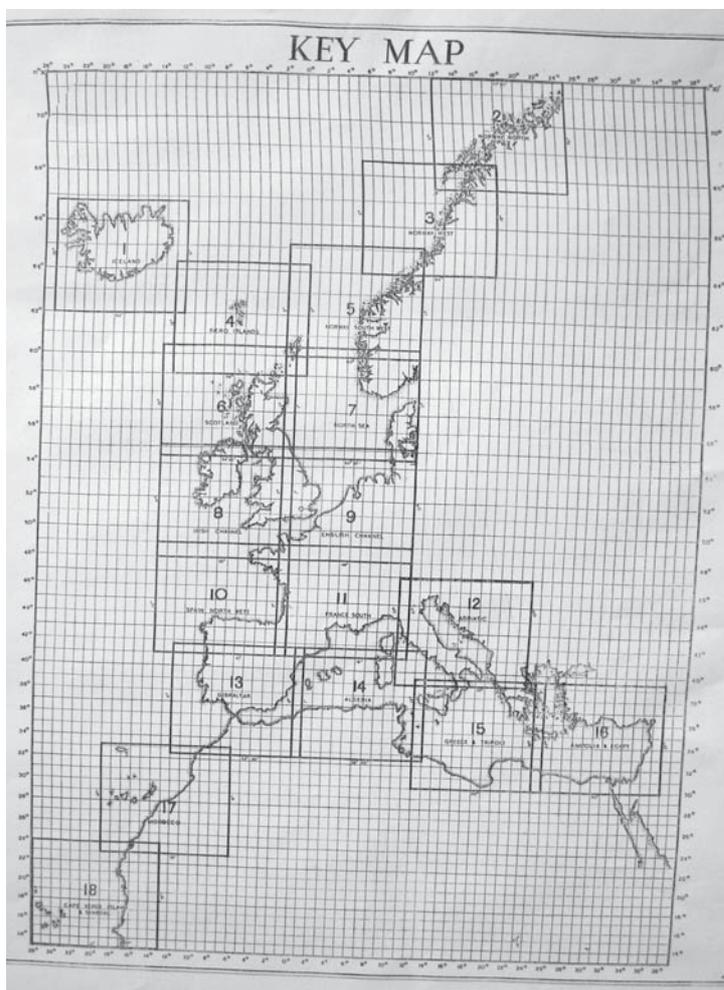
Series GSGS 4090 was constructed on a Mercator Projection and had a 10 minute graticule.

The extracts used in the dinghy pack were simply “windows” from these normal aeronautical charts and included the Reference and terrestrial information shown on them though this was of no relevance to the question of survival at sea.

Since the chart was on Mercator’s projection, it might be presumed that most users would use the latitude scale as a measure of geographical miles, however, a scale of Statute Miles was shown in the west and east margins. On the face, the charts included a compass rose and isogonals which, supposing one’s position was approximately known, allowed application of a value for magnetic variation when using a compass to set a course.

The charts also included a “Method of Giving a Position Reference on the Sheet” which enabled a coded position reference to be signalled by the radio :-

“First give the code letters denoting the exact degree of latitude and longitude etc immediately to the south and west of the required point. Then give in figures the distance in minutes of latitude and and in minutes of longitude of the point from the degree intersection so described. Thus if 50N is represented by AB and 23W by XY, then the position of 50-08N, 22-33W will be denoted by ABXY 0827. Similarly if 50N is represented by AB and 5E is represented by PQ, then the position of 50-17N, 5-38E is ABPG 1738.”



Finally, the marginalia also included a note “To Find A Conversion Angle”. This instructed users how to use a nomogram to obtain a Conversion Angle from mean latitude and change of longitude.

It may be thought that, in the happy event of surviving a ditching at sea a crew would be more than occupied in applying basic survival techniques and giving a coded position reference in the hope of being picked up by friendly air-sea rescue facilities within a reasonably short time. However the instructions imply that a crew should have been able to set a course and sail the dinghy on a great circle route rather than a Mercator rhumb line. It might also be thought that such an intention was somewhat academic and that the vagaries of sea currents and leeway would outweigh any attempts to apply this correction.

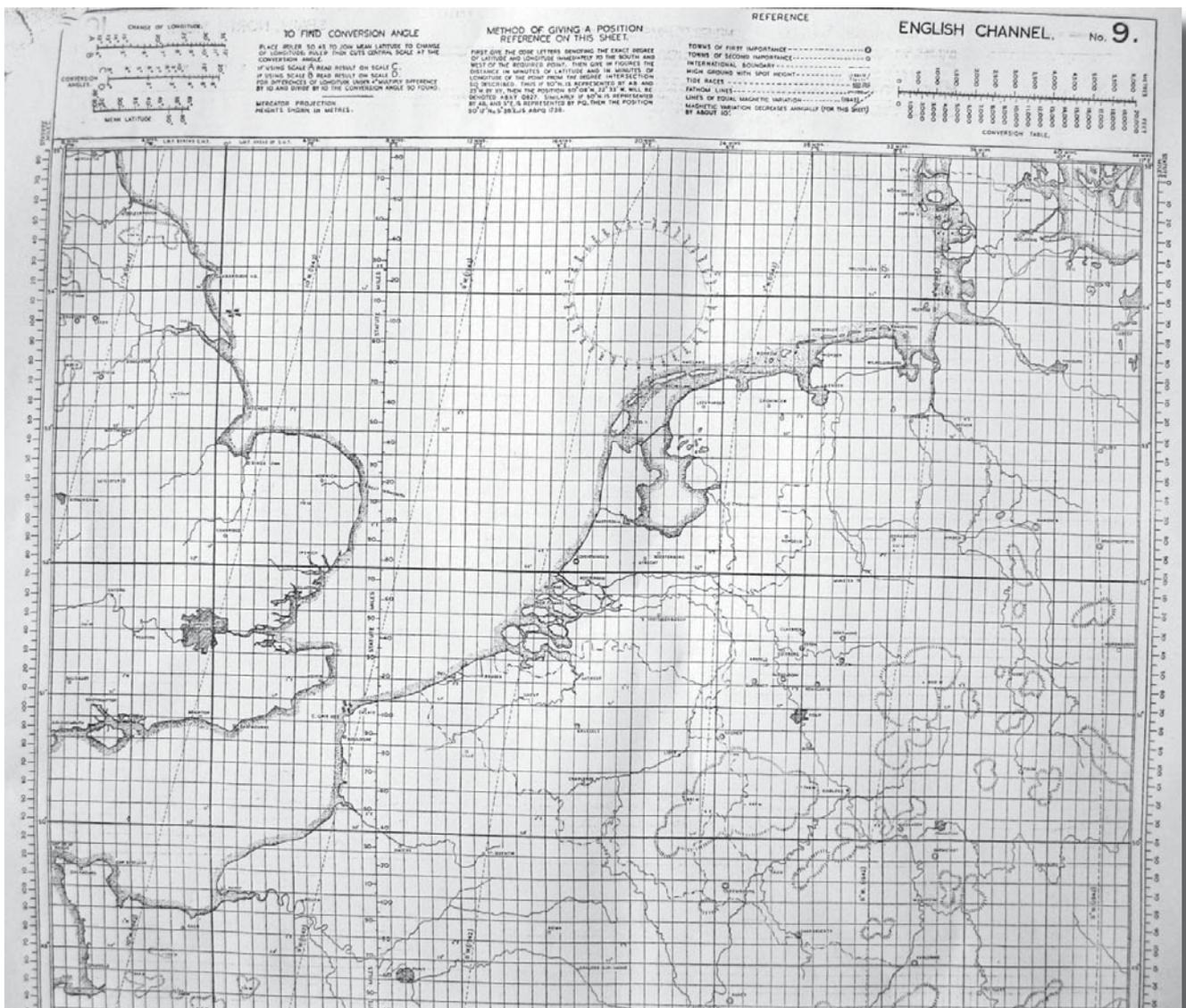
The charts carry a production note – “Sea Rescue Equipment Drawing Office, Traced from GSGS 4080 Plotting Series.”

The above notes on the chart pack refer to the set illustrating the type with main and foresail. No examples have been found to date showing instructions for rigging the lateen sail.

For those at sea, the Hydrographic Branch of the Admiralty produced a similar pack of “Lifeboat Charts” consisting of five charts covering the Atlantic, Indian and Pacific Oceans, but that’s another story.

Information relating to the development of the dinghy was taken, with the permission and assistance of the R.A.F. Historical Branch, from “The Second World War, R.A.F. Air/Sea Rescue, 1952”. (PRO Air 10/5553).

An example of the Q Type Sailing Dinghy Chart Pack is held by the compiler of this note and a copy can be found in the British Library at Maps 185.T.2(1).



DSA Visit to The Polish Institute and Sikorski Museum April 2014

Through the kindness of Mr Krzysztof Barbarski CEng, MISTructE., on the 5th of April 2014, a small group from the DSA paid a visit to the Polish Institute & Sikorski Museum at 20 Prince's Gate, London, an elegant Edwardian mansion over five floors situated about 100 yards due east of the Royal Geographical Society in Kensington.



Badge of 12 Polish Field Survey Company.

**INSTYTUT POLSKI
I MUZEUM IM. GEN. SIKORSKIEGO**

THE POLISH INSTITUTE AND SIKORSKI MUSEUM



The Institution is named after General Wladyslaw Sikorski who as both soldier and statesman had personified the hopes and aspirations of a nation shackled through history by more powerful neighbours and it was established after the Second World War when it became obvious that the majority of Polish ex-servicemen and civilian nationals would not choose to return to their Soviet dominated homeland but remain, in exile, in this country.

A pressing need was felt by this community to preserve all that which bore witness to their struggles, values and aspirations for a new and better Poland. In practical terms this meant the preservation of documents, historical records, regimental colours, uniforms, works of art, military artefacts and personal effects and so the museum came into being. In the years that followed it produced articles and pamphlets on history and politics to counter the distorted history put out by the communist state. With the collapse of the eastern block it continues to function as an independent cultural, educational and research institution.

It may be wondered, of what relevance was the visit to the DSA? The answer is simple. Apart from being a fascinating, largely military, museum in its own right, it contains much material relevant to 12 Polish Field Survey Company R.E.

The Company was formed in Iraq in 1943 and after training and equipping with British survey equipment it moved first to Palestine as part of Ninth Army, then to Egypt, and finally to Italy where after completing its training under a British Training Team R.E., it joined Eighth Army.

The Company was in action at the time of the Battle of Cassino and in all the later Eighth Army battles in N.E. Italy approaching the River Po crossing and so on. Its work was mainly the revision and printing of the British GSGS 4164, GSGS 4229 and GSGS 4228 1:100,000, 1:50,000 and 1:25,000 series all based on Italian originals. As with the many other allied survey units in Italy, it also produced special Defence Overprints and A.F.V. Goings maps. The maps it printed usually bore bilingual British/Polish imprints and often a unit designator "Geogr".



In addition to maps it produced a set of beautifully drawn panoramas of Monte Cassino.

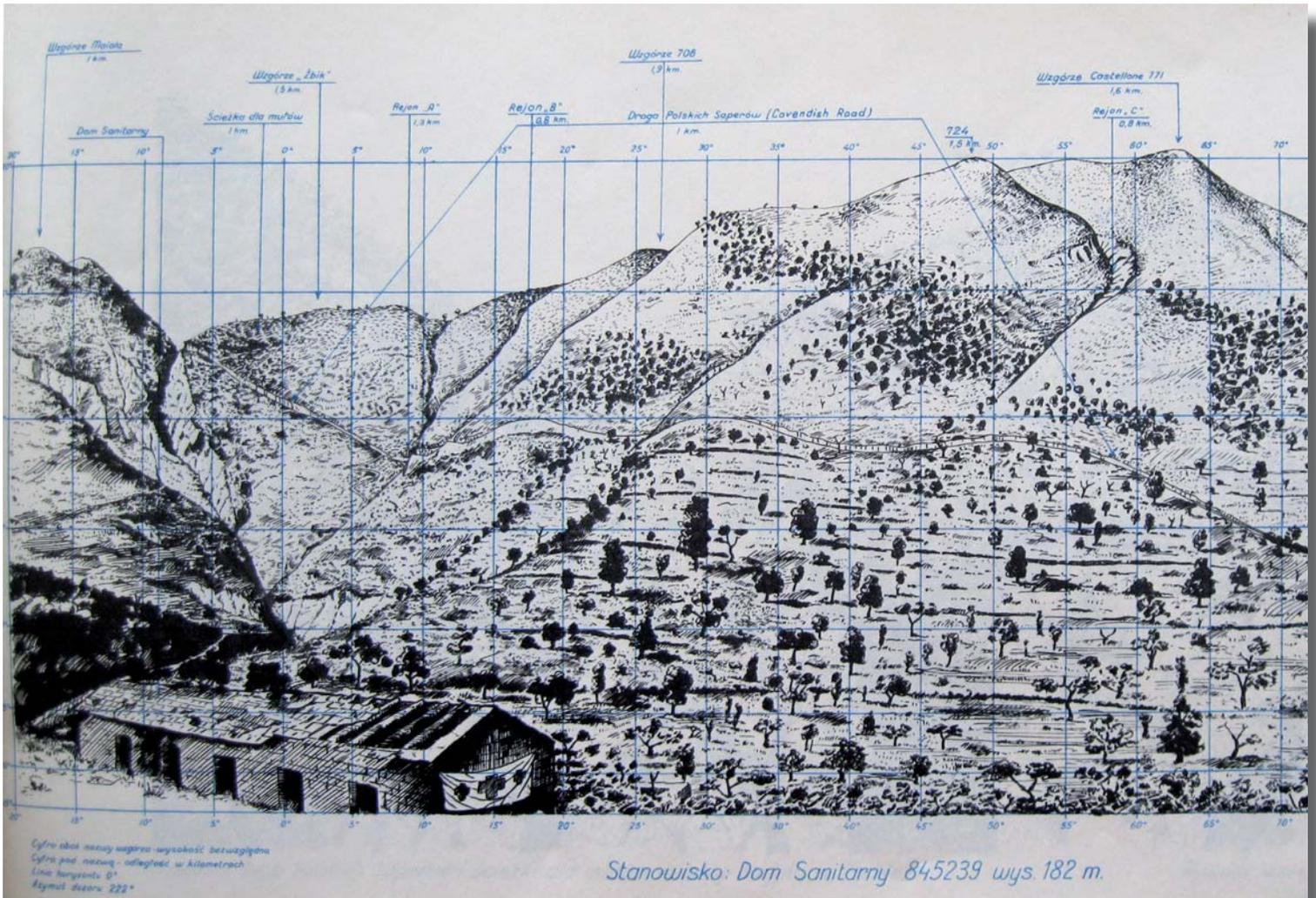
At the end of the war, it is believed that many in the former Company obtained employment in No. 1 Survey Production Centre at Park Royal.

During the visit, our group were briefed fully on the Institute and given a thorough guided tour of the very elegant building with its huge collection of artefacts including an Enigma Machine. Additionally the opportunity was given to leaf through the very large collection of seven folders of maps and related geographic material, much of it not to be found in other archives in U.K.

The visit concluded with a pub lunch.



View of Polish Section Drawing Office at No. 1 Survey Production Centre, Park Royal, 1950.

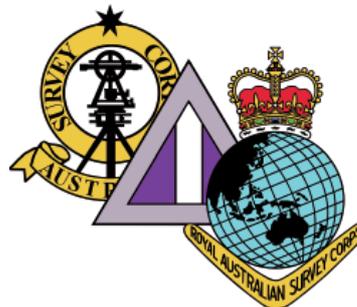


Part of a Polish Panorama.

A Short History of The Royal Australian Survey Corps – 1915 to 1996

By Lt Col RF Bob Skitch (Ret)

The 1st July 2015 is the 100th anniversary of the formation of Royal Australian Survey Corps. Celebrations are to take place in Canberra and then Bendigo, at Canberra based mainly at the Australian War Memorial and at Bendigo in the grounds of 'Fortuna Villa' once the home of the Army Survey Regiment, celebrations also in other locations well known to soldiers who served there.



The following outline history of the Royal Australian Survey Corps through its eighty one years of service is compiled from several previously published sources.....Compiler...LtCol R.F. (Bob) Skitch (Ret)

Introduction

Military Mapping in Australia began in 1907 as a part time activity of the Australian Intelligence Corps (Citizen Forces). In 1910 the Survey Section, Royal Australian Engineers, was created and raised as a full time unit within the Permanent Forces to cope with increased mapping tasks. This unit initially consisted of two Australian draughtsmen – Honorary Lieutenant Raisbeck and Warrant Officer Constable, plus one corporal and three sappers on loan from the British Royal Engineers.

Formation

On July 1st 1915, the Australian Survey Corps was raised as a unit of the Permanent Military Forces in an Order-in-Council which proclaimed that all members of the Survey Section Royal Australian Engineers be transferred to the new Corps with their present rank and seniority. The unit was commanded by Lieutenant Lynch with Lieutenant Vance as his second-in-command. It is of interest to note that the extract of this Order-in-Council also carried what became the Corps Motto - '*Videre Parare Est*', formally adopted in 1965, meaning '*to see is to prepare*'.

World War I

Of the three officers and 17 other ranks who constituted the Australian Survey Corps in 1915, all but three other ranks enlisted in the Australian Imperial Force (AIF) and saw service in France, Belgium, Egypt or Palestine. Two members, Lieutenant Murray, and Sergeant Stafford, were awarded the Distinguished Conduct Medal. The first use of air photos for mapping was made during World War I. Photography was also used to plot trench detail on existing maps compiled by laborious field plotting methods (about 1 sq km per day).

Between the Wars

In 1921 the Survey Corps lost its separate Corps status to become the Survey Section – Engineers (Permanent) but was re-established as the Australian Survey Corps in 1932. Limited military mapping continued throughout that period. In 1927 the RAAF commenced flying aerial photography for mapping purposes and the first map produced using aerial photographs was of Albury at a scale of one inch to a mile. When the Corps reformed in 1932 the total strength was fourteen but it increased steadily and by 1935 it stood at thirty five.

World War 2

The Corps entered World War 2 with nine officers and forty one other ranks. Total strength reached a peak of 1,700, with some 5,500 men and women being engaged on mapping tasks during the war period. Corps members served with distinction in the Middle East, the Australian mainland, New Guinea, Pacific Islands and Borneo. It was in Borneo where HQ 1st Australian Corps praised the efforts of the Survey Corps by recording that '*...never in this war have Australian troops been so well provided with accurate maps, sketches and photo reproductions ...*' their tasks culminated in the production of the Japanese 'Instrument of Surrender'. At the end of the war the Corps had 862 all ranks serving overseas which together with mainland personnel had produced a total of 1,419 maps of various scales. The map production factory of the Corps was in the gold mining city of Bendigo, Victoria where the previously Melbourne based Cartographic Company was relocated

in 1942 within the mansion and associated mine buildings of 'Fortuna' previously the home and headquarters of George Lansell, Bendigo's mining magnate. Fortuna was to continue in that role as the home of the AHQ (later Army) Survey Regiment until the demise of the Corps in 1996.

Post War Development

By mid 1947 Corps strength had declined to 430. In 1948 the Australian Survey Corps was granted the prefix 'Royal' in recognition of its service during the war. That same year saw the initial establishment of the Army School of Survey at Balcombe, Victoria, on the Mornington Peninsula. In the late 1940s Corps surveyors undertook exploratory surveys for the Snowy Mountains hydro-electric project, hydrographic surveys in Flinders Gulf (South Australia) and later the Woomera Rocket Range and at Maralinga, the site of the British atomic weapon testing. Anaglyphic stereoplottting equipment was introduced into the Corps in 1952 and was used extensively for over 10 years.

Despite the efforts of pre-war Corps surveyors, in 1950 the Australian continent could only be described as being very poorly mapped. At that time mapping consisted of inch to the mile mapping of some limited coastal areas and emergency maps at four miles to an inch produced by civilian agencies, mainly state lands departments during the war. These four mile maps were based on existing property surveys and what are commonly called 'traveller's tales' and had no or limited height information. Many were of dubious accuracy. Both national development and defence demanded better.

In 1957 the decimal map scales of 1:50,000, 1:100,000 and 1:250,000 replaced the imperial scales. At about this same time scribing replaced conventional pen and ink draughting methods. In 1957 helicopters were first used for mapping by army surveyors in Western Australia. 1957 also saw the introduction of electronic distance measuring (EDM) equipment to field surveying superseding traditional methods of triangulation. Direct station to station EDM progressed to the aircraft based master station measurement allowing lines up to 50 kilometres to be measured without the need for terminal station intervisibility. This gave rise to the concept of 'trilateration' alongside of traditional triangulation.

In the early 1960's map compilation from aerial photography was greatly expedited by the use of electronic computers for analytical photogrammetric processes replacing slotted template assemblies.

Survey for mapping programs in the then Territory of Papua and New Guinea commenced in 1954 with ship based surveys of New Britain (1954) and New Ireland (1956/57). These were carried out conjointly with the United States Army Mapping Service providing logistic support. From 1961 through to 1979 mapping surveys were undertaken annually on the mainland of Papua New Guinea,



*'Fortuna Villa' – Home of the Army Survey Regiment and its predecessor
Land Headquarters Cartographic Company, 1942-1996.*

finally providing total map coverage at the scale of 1:100,000 and culminating in the presentation of a three volume atlas to the Prime Minister of Papua New Guinea Sir Julius Chan on the 26th June 1980.

The School of Military Survey moved from the Mornington Peninsula south of Melbourne to Bonegilla in northern Victoria on the banks of the Murray River late in 1965. Also in 1965 '*Wandering the Kings Highway*' was adopted as the Corps marching song.

Geodetic and map control surveys

From the early 1950's until the disbandment of the Corps in 1996 extensive geodetic surveys and mapping operations were undertaken in all mainland states of Australia as part of a national mapping program leading to the development of the Australian National Spheroid replacing the Clark 1856 Spheroid and the adoption of a central Australian origin replacing the Sydney Observatory origin. Co-participants were the various state and federal mapping agencies the latter principally the Division of National Mapping of the Department of National Development. Coordination of all survey and mapping operations was achieved through the National Mapping Council the members of which included the Director of National Mapping, the Director of Military Survey, the Naval Hydrographer the Commonwealth Surveyor General and the Surveyors General from each of the States. Most of the Council members had served in the Australian Survey Corps during World War 2 and over the life of the Council a remarkable level of cooperation and coordination was achieved without the need for legislative support. The National Mapping Council came to an end in 1986 being replaced by an intergovernmental committee with lesser functions.

The Corps' specific area of responsibility was north of the Tropic of Capricorn but included other substantial areas in all States. Total map coverage at the scale of 1:250,000 had been achieved by 1965 and a 300 kilometre band of 1:100,000 mapping around the coast by 1980.

Defence Cooperation Program

From 1970 to 1996 the Corps participated in Australia's Defence Cooperation program. Survey operations and mapping programs were undertaken in Indonesia and later the South West Pacific island nations. The first of the Indonesian mapping projects in 1970 was of West Kalimantan codenamed 'Mandau' and was conducted conjointly with British surveyors from 84 Survey Squadron RE, then based in Singapore. Over a ten year period mapping control surveys with aerial photography flown by the RAAF provided total coverage of all of Sumatra, Maluku and most difficult of all Irian Jaya (later West Papua)

Vietnam

In 1965 the 1st Topographical Survey Troop was raised to provide direct mapping support to military operations. In 1966 a detachment of the Troop, later re-designated 'A Section', was deployed with the 1st Australian Task Force to Phuoc Tuy Province in South Vietnam based at Nui Dat and saw continuous service through to 1971.

Technology

In its final three decades the Corps developed into a highly professional and technical organisation employing advanced mapping systems and equipment. Examples in field survey include the use of the satellite positioning system and airborne laser terrain profiling; in map production, computer based analytical photogrammetry to produce photo control for stereo plotting of map detail, computer-assisted cartography, orthophoto mapping equipment and in map printing; a large format computer controlled cartographic camera and computer controlled lithographic colour printing presses.

Changing Times

Although one of the smallest army corps, the Royal Australian Survey Corps retained a position of seniority in the corps listing being preceded only by Armoured, Artillery and Engineers. The strength of the Corps in the mid-1980s stood at approximately 650 all ranks, including 100 officers.

On completion of 1:250,000 and 1:100,000 mapping programs of Australia the Corps commenced a program of 1:50,000 mapping of areas of tactical significance. While the Corps entered its most productive time in map output, two successive reviews of defence mapping and charting capabilities were to decide the future of the Corps. The Baker-Byrnes Review of 1988 refocussed the Corps to a more operational role in direct support of the Australian Defence Force. Much of the Corps'



*'Fortuna Villa' – Home of the Army Survey Regiment and its predecessor
Land Headquarters Cartographic Company, 1942-1996.*

field assets were rationalised and the 1st Topographical Survey Squadron was raised in Brisbane to support the 1st Division.

The advent of the Wrigley report was to signal the end of the Corps when sweeping government reform resulted in the civilianisation of many Defence activities. The mapping activities of the Corps were handed over to public service organisations. The operational assets of the Corps were considered too small to exist as a separate corps and on the 1st July 1996 the Royal Australian Survey Corps was disbanded. A geomatic trade of approximately 120 all ranks was raised within the Royal Australian Engineers to provide topographic support to the Army.

The achievements of the Survey Corps were threefold. It supported our forces overseas in three of the major conflicts of the 20th century, it made a major contribution to the mapping of Australia and surrounding countries essential to their defence and development and finally, it achieved a reputation as a world standard technical mapping organisation. This last achievement is evidenced in the pride that marks the character of any ex-serving member of the Royal Australian Survey Corps.

For further information see

http://en.wikipedia.org/wiki/Royal_Australian_Survey_Corps

Principal References:

Australia's Military Mapmakers by C.D. Coulthard published in 2000, Oxford University Press ISBN 0 19551343 6

Lebanon to Labuan by Lawrence Fitzgerald O.B.E. ISBN 9594979

Mapmakers of Fortuna – A History of the Army Survey Regiment by Valerie Lovejoy

ISBN 0 64642120 4

Forthcoming Events

The Gurkha Museum - 21 March 2015

With the kind permission of the Curator of the Gurkha Museum, Winchester, arrangements are well in hand for a mini-seminar to be held at the Gurkha Museum, Winchester. The plan is to have two presentations before lunch. Lunch will be a sit-down Gurkha curry. After lunch there will be a further presentation, possibly followed by a film. The likely cost is £30 per head.

Both the Gurkha Museum and the King's Royal Hussars Museums will be open during the day at no extra cost.

When finalised details will be circulated to the membership in the usual way. In addition, the event will be open to members of the Gurkha Brigade Association and those who attend the Winchester Military Museums' Lectures so early bids to attend from the membership are recommended.

The Annual Maps & Surveys Seminar – 20 June 2015

Planning is under way for the annual seminar at RSMS Hermitage in accordance with the well-established programme. When finalised, details will be circulated to the membership in the usual way in the New Year.

Joining The DSA

An application form to join the Defence Surveyors' Association can be found on the Association's website at www.defencesurveyors.org.uk. The completed form should be either emailed to the Membership Secretary at applications@defencesurveyors.org.uk or posted to:

Honorary Membership Secretary
114 Harnham Road
Salisbury
Wiltshire
SP2 8JW

Applications may be made by letter to the above address and should include the following information:

Name, contact details, details of any service career, name of a sponsor and a short summary of relevant experience and courses with dates and/or details of professional, commercial or academic background in the Defence Surveying business.

In accordance with the Data Protection Act, the above information will only be held for administrative purposes by the DSA.

When accepted for membership, applicants will be informed by the Chairman and receive an introductory pack from the Honorary Membership Secretary.

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