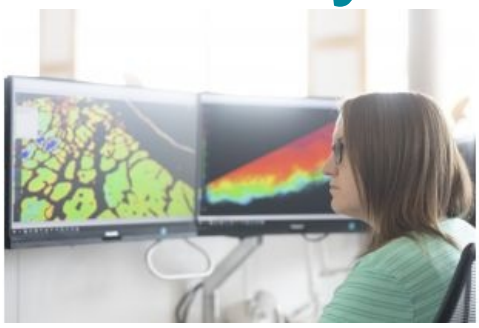
7 QUESTIONS TO PHIL PAYNE, SURVEY DELIVERY MANAGER, UK HYDROGRAPHIC OFFICE

'Check and double check your data before getting somebody else to check it for youâ€™



Phil Payne, survey delivery manager of the UK Hydrographic Office talks about hydrographic programmes to support blue economic growth, intentional projects and the use of lidar for charting purposes. ”There will be a continued drive towards autonomy and automated processing.”

Prior to his work with the UK Hydrographic Office (UKHO), Phil Payne spent 25 years in the Royal Navy as a hydrographic and meteorology specialist. Since joining the UKHO in 2016, he has worked in a number of different roles, most recently as its Survey Delivery Manager - a role he has held since 2017.

Surveys Around the World

As Survey Delivery Manager, Payne is in charge of contracting out and organising surveys around the world, which his organization undertakes as part of the UK Government’s Commonwealth Marine Economies (CME) and Overseas Territories Seabed Mapping Programmes. This forms part of the work carried out by the wider Hydrographic Programmes team to support blue economic growth and help territories to fulfil their international maritime safety obligations under the Safety of Life at Sea (SOLAS) Convention.

”So far, we’ve covered more than 19,500km^2 throughout these programmes and have conducted surveys in Commonwealth states across the Caribbean and Pacific to support sustainable economic growth and safe navigation”, Payne says.

UKHO staff analysing satellite derived bathymetry

The data generated during these surveys will be used to help these small island developing states make use of their marine resources in a sustainable manner. Potential benefits for these states include expanded trade capacity and security through the accurate charting of ports and shipping lanes; the identification and assessment of suitable areas for coastal infrastructure development; disaster planning and resilience; and environmental protection through the identification of sensitive coastal and marine ecosystems.

Hydrographic Specialist

Payne decided to become a hydrographic specialist when he was a Naval CCF cadet at school. “I was put forward to sit the Admiralty Interview Board (AIB), which I successfully passed. So, when I found out that I hadn’t got my first-place choice for university, I decided to join the Royal Navy right there and then,” he says.

When he joined, he wasn’t aware of the hydrographic branch but, after a number of short stints on both small and large vessels, he came

to the conclusion that he preferred the atmosphere and work ethic on board smaller ship types and began to look for a suitable career path. ”This was when I discovered the hydrographic specialisation. As well as being small ship-based, I saw the value in the data we were gathering, which was useful not just for the Navy but for the wider maritime community. Four years into my career, I started my CAT B hydrographic course and never looked back.”

At a recent presentation, you said the sheer size of unsurveyed areas in the scope required a more expansive approach than simply resorting to shipborne surveys. Can you explain this?

Shipborne surveys by their very nature are relatively slow to achieve the area coverage we're looking at in some overseas regions, where little modern survey work has been conducted. In areas where the waters are shallow or there are sensitive ecosystems such as corals, there's also the danger of potential groundings, resulting in significant damage to the vessel and the environment.

Why, in your opinion, has bathymetric lidar long struggled to meet the accuracy and object detection criteria required of special order or order 1A surveys under the IHO S44 Standard?

Since it was first developed, bathymetric lidar has offered several advantages over traditional boat-based echo sounder hydrography. It covers ground much quicker, does not have the same safety issues you get when using boats in shallow waters and has been able to piggyback on the work of the land lidar industry, in terms of development and software.

However, the physics involved when using light and water – specifically what happens when the light enters the water – and the ability of the systems to achieve the density required to match multibeam systems, means that the industry and hydrographic offices haven't been able to state with reasonable confidence that all relevant objects have been detected.

With this in mind, we have been pushing industry since the start of our hydrographic programmes to increase the density of the soundings of their systems, which several manufacturers have done. This is now helping us to find new ways of looking at the resultant datasets and is helping to increase our confidence with regards to object detection.

The UK Government and UKHO have for many years had little reason to investigate the use of lidar for charting purposes. How come?

The UKHO did put considerable effort into looking into lidar when it was in its infancy and did conduct some initial survey work under the Civil Hydrographic Programme (CHP). The CHP, run by the Maritime and Coastguard Agency (MCA) and supported by the UKHO, mainly looks to provide surveys around UK waters for Safety of Life at Sea (SOLAS) purposes, where the detection of significant objects is important. So, when initial work showed the object detection issues mentioned earlier, it was decided to discontinue commissioning lidar surveys for this programme. However, we do continue to accept lidar data from other sources outside of the CHP, which we assess to determine whether it can be used for charting.

Lidar technology has developed since these initial trials and we have had considerable success in using it during our work with the CME programme. While our lidar specification allows for Order 1B lidar surveys, in terms of object detection it does require increased density in line with our equivalent acoustic surveys in shoal waters. It is under these conditions that we commissioned five individual lidar surveys, including two in Turks and Caicos Islands and Belize. These two projects covered 7,395km^2 and 2,575km^2 respectively using a specifically modified light aircraft fitted with state-of-the-art lidar sensors to accurately measure the depth of the water.

Where previous surveys had to make repeated flights over a body of water, the new sensors have around ten times the point density, allowing the surveyors to meet the UK Hydrographic Lidar Specification density requirement in a single flight. Taken alongside the technology's decreased size and power consumption, this means smaller aircraft can be used for a shorter period, which considerably reduces the environmental impact of the surveys and makes them more cost-effective. This has led to an estimated overall reduction of around 80% in the surveys' carbon footprint compared to the larger aircraft that have previously been used for such surveys.

We've also been able to use satellite-derived bathymetry (SDB) to great effect when scoping out regions where we may look to survey at a later date. For example, the UKHO recently completed an SDB data handover to the Kiribati Government for more than 2,500km of the island chain, including depths and seabed classification to help them monitor sea-level rise and erosion, as well as develop plans to support safe navigation.

The UN lists Kiribati as one of several island groups most likely to be inundated by the sea in the 21st century because of global warming, with low-lying parts of the island chain extremely vulnerable to the effects of tsunamis, tidal surges and sea-level rise. In addition to this, Kiribati has a lack of up-to-date seabed mapping data, threatening the safety of ships at sea and increasing the risk of damage being caused to their marine environment.

What developments in the hydrographic and oceanographic world do you expect in the near future?

At the UKHO, we continue to work with the industry to find ways of leveraging lidar technology and SDB to our best advantage and incorporating these into our global surveying work.

There's also a continued drive towards autonomy and automated processing, which in time, will potentially reduce data collection costs and the environmental impact of larger manned platforms.

This is a trend I expect to see much more of in the future, as it will allow staff to concentrate on the interpretation of the data while outsourcing some of the surveying work to technology.

What challenges do you encounter during acquisition, validation and onward charting?

With acquisition, it's the real-world factors that get in the way of theory and planning. For example, I was surveying in the British Virgin Islands back in 2016 when Hurricane Irma hit. Our boat was thrown about 200m and damaged beyond immediate repair, so all of our original survey plans were out the window. Instead, we managed to get use of another boat with a single-beam echo sounder, which we used to survey key areas around the islands. This crucial work helped the local government to open up ferry jetties and quays to allow maritime traffic to start moving again.

For validation, our main issues are system compatibility. The industry is moving forward at such a pace that we often find it difficult to get datasets to even open fully before we can start to validate them. While we can control surveys specified by ourselves or our colleagues at the MCA, we receive lots of data from other sources that may be provided in a whole raft of different formats – creating this validation issue.

When it comes to onward charting, the cartographers prefer a modern 1A survey that we have been able to fully validate, as this allows it to be dropped into the current chart easily. Where we have less confidence in the data, we have to expend a lot of time and effort in making sure that the best picture of the seabed is given on the chart, while retaining older shoal soundings that are important for the safety of navigation. This explains our drive to get lidar surveys up to a 1A standard.

How do you compare the object detection capabilities of both shallow and deep lidar systems in relation to more traditional multi-beam echo sounders?

The most effective way to compare them is to have overlapping data. With limited budgets and so much unsurveyed water, repeating areas using multiple technologies is not always desirable. However, we have managed to get a few datasets where we have both multibeam and lidar in areas where there are lots of obstructions and small objects – these are ideal for checking out the relative capabilities of these systems.

What is your advice for young people who are thinking of a hydrographic or oceanographic career?

My main piece of advice would be to get ready for a thoroughly rewarding and diverse career path. Work hard at getting the basics right and all these paths will open up to you. And as my Cat A Course teacher once told me, “when it comes to data, check it and then check it again before getting somebody else to check it for you!”

Commonwealth Marine Economies Programme

Funded by the UK Government’s Conflict, Stability and Security Fund (CSSF) and led by the Foreign and Commonwealth Office, the CME Programme is supporting 17 Commonwealth Small Island Developing States (SIDS) in the Caribbean and Pacific in identifying the potential of, and developing their marine economies in a sustainable, resilient and integrated way. The Programme promotes growth, innovation, jobs and investment whilst safeguarding healthy seas and ecosystems. In partnership with the SIDS governments, the Programme will develop and implement national Maritime Economy Plans to ensure it leaves a lasting legacy.

Overseas Territories Seabed Mapping Programme

The Overseas Territories Seabed Mapping Programme is funded by the UK Government’s Conflict, Stability and Security Fund (CSSF). It is co-ordinated by the Foreign and Commonwealth Office as part of the UK’s commitment to support Overseas Territories.

About the UK Hydrographic Office (UKHO)

The UKHO is a leading centre for hydrography, providing marine geospatial data to inform maritime decisions. It works with a wide range of data suppliers and partners to support maritime navigation, safety, security and marine development around the UK and worldwide.

It makes location-based information available through ADMIRALTY Maritime Data Solutions, its world-leading range of charts, publications and custom data sets. Its use of marine data and technology, combined with its expertise, ensures it continues to innovate and provide a wider range of solutions.

It sources, processes and provides access to location-based information, ranging from seabed to surface. This enables its partner organizations to make critical maritime decisions – informing the sustainable use and management of the marine environment and supporting the development of the blue economy.