

DEVON AND CORNWALL POLAR SOCIETY

Lecture held on 21 March 2013 at the Royal Corinthian Yacht Club,
Plymouth

This was a well attended lecture delivered by Dr Adrian Fox, Head of the Mapping and Geographic Information Centre (MAGIC) at the British Antarctic Survey, Cambridge.

Dr Fox was introduced by John Killingbeck who informed the meeting that Dr Fox had been a FID for many years and had made the second ascent of the tallest mountain in the Antarctic Peninsula - Mount Jackson - which made him (John Killingbeck) extremely envious!

Dr Fox commenced his talk by providing an overview of the BAS Headquarters in Cambridge. About 415 staff are employed there and an annual budget of £44 million is allocated from the National Environmental Research Council to support BAS science and operations. BAS is unique in that it has a dual role of providing the UK presence in the Antarctic but is also a research institute of considerable international reputation in its own right. Increasingly, it is also acting as a logistics operation for supporting university teams. Other points include the following:

- The British Antarctic Territory extends between 20° and 80° west and extends from the South Pole to 60°S. Bas also has a presence on South Georgia through the Bird Island and King Edward Point research stations.
- There are two ships: *RRS James Clark Ross* and *RRS Shackleton*; four ski-equipped Twin Otters and one intercontinental, four-engined Dash-7 aircraft.
- To give some idea of scale, the Antarctic Peninsula transposed onto Europe would stretch from the northern tip of Scotland down to northern Spain.

- Four Stations, Bird Island, King Edward Point, Rothera and Halley, are operated throughout the year. During the summer months biological research is carried out at Signy and there are two manned staging depots during the summer at Fossil Bluff (Alexander Island) and Sky-Blu (Coats Land).

Since its inception BAS has occupied 19 research stations. The stations no longer in use are managed according to the Protocol on Environmental Protection to the Antarctic Treaty. BAS also operates Ny-Ålesund Research Station in the Antarctic on behalf of the NERC.

Dr Fox gave a brief outline of the permanent bases. He described how Sky-Blu was an absolutely flat plane of blue ice upon which the planes could land on wheels and how visitors coming down onto the ice for the first time from the aircraft would frequently slip over, giving rise to an injury known as 'Sky-Blu bottom'. He described Halley 6, recently completed, as 'the transportable base'. Altogether the operational footprint of the British Antarctic Survey is about a quarter of the continent. Covering the Antarctic Peninsula needs 63 maps at 1/4 million scale, but nine cover the UK.

MAGIC was formed in 1989 when the British Antarctic Survey took over responsibility for UK mapping in Antarctica. Its role is both to develop the geographic framework of mapping and place names for Antarctica and to provide geographic information support for the scientific work and supporting logistics carried out by BAS and others. It has access to data collected by the Directorate of Overseas surveys going back into the 1940s at the time of Operation Tabarin during the War and this is now an important resource to measuring environmental change. The organisation is a very active member of the Scientific Committee on Antarctic Research and has been managing the Antarctic Digital Database – a compilation of international mapping in Antarctica for SCAR since 1993.

Dr Fox showed some of the maps which have proved most popular. He likes to think that maps produced from his department are considered the most definitive and are certainly the most popular across the globe with sales of several thousand maps per year, many to tourist visitors to the

Antarctic Peninsula. The Foreign and Commonwealth Office is highly supportive of the British Antarctic Survey mapping programme, for obvious reasons.

He then demonstrated the complexity of international relationships and collaborations. On the South Shetland Islands, for example, there are more than 20 representatives of different nations. The UK Antarctic Place Names Committee controls the toponymy in British Antarctic Territory, for example to avoid duplicate or confusing names. The UK-APC is managed by MAGIC for the Foreign and Commonwealth Office. He referred to the naming of 'Queen Elizabeth Land' to mark the Queen's diamond jubilee.

Air operations form a major part of their duties at present. Some of the detail they are able to add is extremely useful to pilots, for example, inserting flight tracks and annotating these with the flight time at 130 knots and the estimated fuel burn in.

Antarctica is a hazardous place for air operations, recently shown when two pilots lost their lives in the crash of a Twin Otter in the Transantarctic Mountains. The unit aims to work with international partners to achieve uniform mapping standards for operational planning maps to help improve safety

Sea ice maps / satellite imagery are also increasingly important. MAGIC manages the PolarView service for Antarctica, which gives near-real-time information to ships about sea ice distribution. This has clear efficiency and safety benefits, can eliminate the need for flying operations to give ice reports to ships, and help in such diverse activities as rescue missions to supporting expeditions i.e. the recent Scott Centennial Expedition, which used the sea ice data to plan its route into the Antarctic.

Aerial photography. This is a mainstay of mapping operations. In 2013 they acquired an Intergraph DMC digital camera, switching from recording on to film, which is no longer available.

Dr Fox spent some time comparing and contrasting aerial against satellite imaging properties – the capability of satellite sensors is improving rapidly. Although the raw satellite images do not yet have the resolution to distinguish individual items as small as, say, penguins digital manipulation of the images with calibration by higher-resolution

aerial photography can be used to give pretty fair estimates of numbers. The unit has been using near-infra-red images for vegetation detection since 1996 providing a basis for detecting future change.

He went on to describe the glacier and ice shelf work. Sequential aerial views provide stereo coverage over a lengthy period and can be compared with unique archive photographs (a new role for historic photos) since the 1940s to show that the ice sheet on the northern Antarctic Peninsula is changing as the area experiences regional warming. Looking at over 400 glaciers from these photos and other sources going back to Operation Tabarin showed that 87% of the glaciers on the Peninsula have retreated during this period.

The MAGIC helpdesk 'Dial-a-Map' service – handles more than 200 very varied enquiries per year, anything from maps showing fieldwork sites to analyzing whale catch data. A recent larger project involved working with the BAS Ecosystems Research programme to map the entirety of Emperor penguin colonies from the colonies' guano stains on satellite imagery. Here they confirmed the 37 previously known colonies and found an additional 20 new ones. The Emperor Penguin total is reckoned to be about 600,000.

The BedMap2 project charted the rock surface under the ice and this involved analyzing geophysical data from 207 different surveys from 35 collaborating bodies. This required handling 26 million survey points and 25 other complementary data sets. Subtracting the sub-ice rock surface from the ice surface gives the volume of ice in the Antarctic and he expected that these new findings would make the news during the next few weeks. If the entire volume of ice were to be melted there would be a rise in the global sea level of about 58 metres and he provided other interesting statistics.

The future - aerial photography is good but satellite activity, e.g. satellite pairing and radar altimetry, will become increasingly important. Quick Bird and WorldView satellite imagery has sub-metre resolution and is as good as aerial photography for some applications. He illustrated the capabilities of satellite mapping by showing the Stromness base on South Georgia in detail.

Two satellites flying in close formation (Tandem-X) are imaging the earth's surface with stereo radar to create a new global surface elevation model. His will be extremely valuable in Antarctica where information about surface height (contours) is often poor.

Demand for delivering digital data over the web rather than in the form of maps is increasing.

Dr Fox concluded by emphasising the effectiveness of BAS as a 'joined up' research institute delivering both internationally recognized research and operational delivery under one roof.

Dr Chris Andrews paid tribute to the work of BAS and Magic and proposed the vote of thanks to Dr. Fox for an informative and excellent lecture.