Boundaries, Borders, Bathymetry, Mega Cities, the Profession. . .

It was all at FIG 2010, says Richard Groom, who has been browsing through some of the papers presented at Sydney earlier this year and has come up with several that readers might like to follow up. All are available for download from www.fig.net/pub/fig2010/papers/ against the session numbers.

In Session TS01I, **Arsana**, **Yuniar** and **Sumaryo** presented a paper on the delimitation of the maritime (territorial water) boundary between Singapore and Indonesia. The first boundary agreement, covering about a third of the boundary, was signed in 1973 but the accompanying map did not state the geodetic datum on which the boundary points were based. In 2009 a new treaty was signed between the two countries that defined the boundary on WGS84 and extended it a little further west.

The paper goes into the issues that need to be resolved next. These include agreeing between Indonesia, Malaysia and Singapore, two three-junction points where their maritime boundaries meet to the south east and south west of Singapore island. However, it will perhaps be more difficult to agree the boundary in the area of Pedro Branca, Middle Rocks and South Ledge. In 2008, the International Court of Justice determined the sovereignty of this group of three geographical features that lie east of Singapore and between Malaysia and Indonesia. Pedro Branca was awarded to Singapore, Middle Rocks to Malaysia and it was decided that South Ledge, which consists of rocks that are only exposed at low tide would belong to the nation in whose territorial waters it sits. The route of the maritime boundary and extent of Exclusive Economic Zone will depend upon whether Pedro Branca is classified as an island or a rock and on the weights that will be attached to the influence of these features on the boundary.

These are problems that take decades to resolve and so delimitation of the boundary is a long drawn-out process. The paper explains the principles used to determine the baselines from which the boundary itself is determined. Indonesia is, of course, an archipelago and can therefore use archipelagic baselines that reach across the sea between islands to connect the outer headlands. Singapore and Malaysia, on the other hand, use normal baselines. The paper demonstrates the effects of using archipelagic or normal baselines on the maritime boundary and the possible boundaries that could arise depending on the status of Pedro Branca and concludes that there is plenty of negotiation ahead.

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International Borders

Moving on to land, **Bill Robertson**'s paper "Challenges for Surveying in the Establishment of International Borders" (session TS2A) acknowledges the importance of survey as an integral component of a complex political / judicial / professional process. The surveyor's role during delimitation of international boundaries involves gathering and examining map and other evidence; and perhaps the more straight-forward role of demarcating the agreed boundary, involving accurate and equivocal determination of the boundary as previously delimited. The essential starting point is the definition of a sound and accepted boundary datum. As well as providing mapping and imagery, the surveyor may well be involved in helping the boundary commission to visualise the terrain by draping imagery over digital elevation models.

The author gives four examples of international boundary work in which he has been involved. The Iraq/Kuwait border was defined in 1922 and had the boundary running northwards up the centre of Wadi al Batin, which is wide and shallow to "an old signpost" about a mile south of an old Turkish fort. Needless to say the signpost was removed and the location had to be determined from a variety of historic maps, building plans, aerial photography and local knowledge. Two possible positions were identified and the average presented to the two parties with transparent acknowledgement that the boundary could not be determined exactly.

As part of the peace agreement following a 35-year war between the north and the south of Sudan, a boundary commission was set up to determine the boundary. The terms of reference required the commission to determine the extent of the Ngok Dinka people as in 1905. The Ngok Dinka were herders who moved their cattle with the seasons and the boundary also happens to fall in an area of significant oil resources. In this case the Sudan government objected to the report of the commission and Robertson was involved with the subsequent tribunal hearing.

Validating multibeam bathymetry

Royal Australian Navy (RAN) hydrographers, **Dean Battilana** and **Geoffrey Lawes**, presented a paper on validation of multibeam bathymetry (session TS21). For a landlubber, it was interesting to see data from a hydrographer's point of view. We (land surveyors) think nothing of redundancy in data, in fact we feel very uneasy when there is none, but for hydrographers, the redundancy that comes with point clouds of multibeam data is still something new. In fact, they traditionally distrust their data to the extent that they use shoal biasing to make sure that ships don't run aground.

The authors go through the process that the navy used to introduce the Combined Uncertainty and Bathymetry Estimator (CUBE) which uses the a priori uncertainty

assessments provided by a software derived Total Propagated Uncertainty (TPU). But in using their Atlas Hydrographic Fan Sweep 20, the authors wanted to make sure that the TPU computed by the Hydromap suite of programs was applying the correct a priori uncertainty assessments when used with Caris HIPS and SIPS for post processing of multibeam data. All this is necessary in order to run statistical area based tools to remove outliers from multibeam datasets.

This paper includes a useful comparision between beam forming and interferometic multibeam systems and there are a stack of perceptive quotes from the authors of the CUBE users' guide. It is tempting for once to read the manual for literary reasons alone!

Mapping Mega Cities

In session TS1B, **Anthony Adeoye** presented a paper on geoinformation infrastructure policy in Lagos State. Any city of over 10 million population is a mega city and Lagos certainly falls into that category. The paper describes the creation of an enterprise GIS database and requirement for mapping to support the venture. First and second order control stations have been established along with a geoid model and a GPS active network. Base mapping is crucial to the venture. The work is 80% complete but when finished there will be aerial photography over the whole state at 1:4000 scale which will be used to produce 1:500 scale maps for the urban metropolis and 1:1000 scale plans for surrounding rural areas. To complete the picture there will be a DTM on land and bathymetry in the major waterways.

This infrastructure paves the way for property valuation and revenue collection, population and housing census, planning of settlements, transportation and communications and flood and erosion control. This is an ambitious project by any standards but in a sense Lagos is following the lead of Nigeria's new capital city, Abuja, for which GI was collected as it was constructed and now the data brings in a revenue of over $10 million per year.

Surveying Body of Knowledge

Finally for this review, **Joshua Greenfield** presented a paper entitled "Surveying Body of Knowledge" in session TS3G. He opens by expressing his concerns, along with many of us, over the popular perception that "everyone can do surveying". This is a concern not only because it is a public perception but also because it is a widely held view within the geospatial community. Establishing the body of knowledge is essential; in order to take the focus away from the belief that anyone who has the equipment can do the job and to focus back on the core skills, attitude and knowledge that are essential to being a professional surveyor.

There are, he says, two approaches to considering the surveying body of knowledge. Firstly, in general terms, the body of knowledge can be the skills, attitudes and knowledge that enable an individual to become and remain a professional expert. This can be seen at a macro level, conceptual long-term definition. Secondly, it could be defined by a detailed list of theories, methodologies, technologies and procedures that the professional surveyor needs in order to be able to practise. Greenfield sees this as a micro level approach. In this way both approaches can coexist.

At the macro level, Greenfield lists the following knowledge base and skills:

- *A technical core of knowledge and breadth of coverage in maths, science and technology.*
- *Law, ethics and professionalism.*
- *Communication, history, social science and contemporary issues.*
- *Business, economics, management*
- *Plus at least one in-depth speciality*

At the micro level, the American Congress of Survey and Mapping (ACSM) is working on subsets of bodies of knowledge for surveying in areas of positioning, imagery, law, GIS and land development. Greenfield chooses to look at the GIS subset in detail, which may seem disconcerting because in Britain we tend to think of GIS as a specialism practised by GIS people. On the other hand, Greenfield argues that GIS uses the same macro level knowledge as wider surveying. However, not every surveyor has to know everything about GIS but every surveyor should have a minimum knowledge of the subject. He therefore establishes the knowledge base as a function of the surveyors' involvement in GIS, which he classifies as 'user', 'specialist' and 'scholar'. He then applies three levels of competency (recognition, understanding and ability) to the knowledge areas of GIS to build up a capability matrix for each function. So, for example, knowledge of query operations and query languages has to be at 'understanding' level for a user but 'ability' level for specialists and scholars.

Finally, Greenfield produces another matrix that identifies the educational requirements for surveyors in the micro level GIS body of knowledge. Thus, we have the routine user, who must have an undergraduate degree and professional education whereas the scholar does not need a professional education but does need a post-graduate degree.

Why spend so much time on this? I suggest that this is a better way to establish status for surveyors than simply saying we are the best. It identifies what a surveyor does, the body of knowledge required to be a surveyor and the education required to get there. The full paper is well worth reading.

• Watch out in the next issue of GW for an abridged version of another paper presented at FIG on promoting the surveying profession.

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