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Lecture Plus 4

Geo-what? Where on Earth are we anyway?

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These notes are intended to accompany the slides used to deliver the lecture.

Abstract

This lecture was intended to introduce the conference delegates to the science of geomatics – the modern term for the surveying and mapping sciences. The lecture started by introducing, very broadly, what geomatics is about. The lecture then moved on to looking at the some of the disciplines of the science. In doing so, it was hoped that clear links between schools' geography and geomatics could be identified by the audience. The lecture then moved on to look at free resources that are available to schools so that they can use geomatics to support teaching and learning in geography and/or in a cross curricular setup with other subject areas.

The latter half of the lecture was dedicated to an open discussion about the potential implications, applications and possibilities for geomatics in schools. Correspondingly, the latter half of these notes report what was discussed during that time.

The lecture was attended by approximately 40 conference delegates and exhibitors.

Introduction

(Slide 4 – Where are we?) The lecture was started by asking the delegates to very quickly draw a sketch, diagram or map that they felt showed where they were at that precise moment in time. The delegates were asked to complete the task quickly and to do so safe in the knowledge that it is not possible to get this task wrong.

(Slide 5 – Blank Slide) After a minute or so, the various results were identified and discussed. Among the delegates' responses were:

- sketches showing mainland UK with a mark to show the approximate location of Manchester;
- maps of the layout of Manchester city centre and our location on the South side of it
- a side on view of the building in which the lecture was being held and a mark showing the lecture theatre location on the top floor;
- sketches showing the layout of the lecture theatre.

The presenter gave examples of other responses that have been prepared in response to this task in the past including:

- a schematic of the solar system showing the position of Earth;
- global and european scale maps;
- a simple dot in the centre of a piece of paper.

This exercise is a quick and easy way to introduce the science of geomatics. Thinking about location (be it of oneself, another person or some object), what data we need to describe location and the different scales and visualisations that we can use to share this information with others is a good point form which to start.

(Slide 6 - Definition) Geomatics is a genuine word. Originating, it is believed, in the 1960s in Canada, the term was widely adopted by surveying and mapping practitioners in the 1990s when it was felt a term other than surveying was needed to more precisely describe the spatial and analytical nature of the science. The increasing use of Information Communications Technology (ICT) in the surveying and mapping sciences also suggested the need for a new name. The term entered the Oxford English Dictionary early on in the 21st Century (2002) with the following definition:

> *The mathematics of the earth;* spec. *the science of the collection, analysis, and interpretation of data, esp. instrumental data, relating to the earth's surface.*
>
> *(from oed.com)*

The presenter explained that while he personally likes the definition and feels it accurately portrays what the science of geomatics is, it is perhaps not the best way of introducing the term those who are new to it.

(Slide 7 - Definition) A brainstorm of words, sciences, subjects etc. associated with geomatics was displayed and several terms that would be familiar to the delegates highlighted. It was also suggested that there would be terms within the brainstorm that the delegates would not be familiar with.

(Slide 8 – Blank Slide) The delegates should by this stage have acquired a broad appreciation of what geomatics is about. To build on this base knowledge, the next few slides looked at disciplines within geomatics. To do this, the delegates were asked to imagine being taken on a journey that starts 20 000km above the surface of the Earth.

(Slide 9 – Global Navigation Satellite Systems) 20 000km above the surface of the Earth, a constellation of satellites make up a major part of the US-owned Global Positioning System (GPS). GPS is now a popular and common tool and many of the audience had heard of the system. Fewer, however, had heard of the Galileo Global Navigation Satellite System (GNSS) that is to be realised by the EU in the next few years and nobody in the audience had heard of the GLONASS GNSS that (was Soviet but) is now Russian owned.

Originally, GNSS were developed as military tools during the Cold War hence there being US and Russian owned systems in operation. Despite their military origins, the systems have been widely adopted and adapted by the civilian sector as tools to support mapping, navigation, industry and recreation. Owing to the increasing use of GNSS by society, the EU has commissioned its own system.

GNSS are a major part of geomatics science and with the ongoing development of GNSS technologies and applications, not to mention the launching of a third system, they seem set to remain so.

(Slide 10 – Remote Sensing) Satellites are also used in geomatics to collect images of the Earth's surface. Sometimes the images are very similar to photographs in so far as they capture light waves from the visible part of the electromagnetic spectrum. However, images are sometimes captured using non-visible light wavelengths and

then rendered in false colours so as to allow the surveyor to identify non-visible or possibly difficult to differentiate phenomena.

Like GNSS, satellite based Remote Sensing has its origins in military and intelligence applications which in turn have been adopted and adapted by the civilian sector. Remote Sensing is a popular tool for monitoring and identifying environmental phenomena (e.g. desertification, deforestation, ground warming). In recent months, however, disasters such as the Boxing Day Asian tsunami and Hurricane Katrina have highlighted Remote Sensing's use as a tool for coordinating disaster relief efforts.

It is worth pointing out that "Remote Sensing" is a term that can describe any type of surveying which does not require contact measurement techniques. However, for the purposes of this lecture, we took Remote Sensing to mean satellite based image capture.

(Slide 11 – Geodesy) There is a branch of geomatics that is concerned with studying the shape of the Earth and how that shape is behaving and changing over time. What shape is the Earth? What are the details of the Earth's rotation - is it getting faster, slower, staying the same? What effect do the tides have on the shape of the Earth? How do we know the tectonic plates are moving and how quickly in which directions? Maps are generally flat, the Earth isn't – how does one relate to the other? These are all examples of questions that geodesists are dealing with.

(Slide 12 – Photogrammetry) The audience were asked to identify the image shown and, as expected, the answer came back as "Eastenders". That's true but, more seriously, the image shows a set of aerial photographs of London that have been merged together. The audience were asked to call out what they could see on the image: the river, Millennium Dome (as an example of large buildings and landmarks), the docks, roads and railways, open space and parks, London City Airport and so on. Although a bit of fun, this slide demonstrates just how much information we can collect from what at first glance appears to be a simple image.

(Slide 13 – Photogrammetry) As a result, there is a branch of geomatics, called Photogrammetry, dedicated to the process of recording spatially referenced data from photographs. It is possible to map in not just 2-dimensions as one might expect, but also in 3-dimensions.

(Slide 14 - Topographic Surveying) Continuing the journey that started 20 000km out into space, the audience were introduced to geomatics work on the surface of the Earth. Topographic, or land, surveying is often the stereotypical image of surveying. Frequently conducted using tripod-mounted instruments, topographic surveying is concerned with recording data for a variety of purposes but working in areas small enough for one to assume that the Earth is flat not ellipsoidal as is known to be true. Depending on the purpose of the survey and the scale at which the collected data are to be plotted, these surveys can be very sparse and made up of just a few measurements through to very detailed, intricate pieces of work.

(Slide 15 - Blank Slide) So far, the disciplines of geomatics that had been looked at were largely concerned with **collecting** spatial data. This posed the question, "What do we **do** with all these data?"

(Slide 16 - Cartography) A quick answer is that we still make maps. Cartography, the art, technique and science of map making, is a large part of geomatics. Cartographers are highly skilled in quality-checking data, at working at a variety of scales and ensuring that data are presented in a consistent and logical manner.

There are still a variety of uses for paper based maps and charts. Ordnance Survey maps, road atlases, engineering charts, hydrographic charts and tourist information leaflets are just some contemporary examples of where cartographers produce paper based products.

(Slide 17 - GIS) However, in addition to the paper based map, geomatics is becoming increasingly involved in ensuring that spatial data sets can be used in a digital environment. The rapid development in recent years of ICT has been successfully applied to many areas of geomatics not least of which is the rise of Geographical Information Systems. GIS is an increasingly powerful tool in industry and now in schools and, as such, is a hot topic at the GA each year. In the opinion of the presenter, geomatics and geomaticians are the “what” and the “who” behind how GIS work and the power that they afford the user. The strength of a GIS is that it can combine, visualise and analyse several different, often very diverse, datasets that are all commonly spatially referenced in some way. The whole process of collecting the spatial element of a data set, of managing those data and ensuring that a GIS can handle those datasets is the forte of the geomatician.

(Slide 18 - Applications) Knowledge about where objects are, how big they are, their orientation and their spatial relation to other objects can be incredibly valuable information. There are, therefore, a wide variety of applications of geomatics techniques including, but not limited to, those listed on slide 18.

(Slide 19 - Blank Slide) That concluded a brief overview of the science of geomatics, what it entails and hopefully, allowed the audience to see some clear links with geography education. The lecture moved on to looking at the support available from the UK geomatics community to schools who wish to use geomatics to support teaching and learning.

(Slide 20 - Geomatics.org.uk) It was not the purpose of this lecture to give a detailed description of how the geomatics.org.uk project came about. However, a short description will give valuable background information.

Geomatics.org.uk was originally, as the name suggests a website that people could use to discover and explore the world of geomatics. Originally setup with the support of the Royal Institution of Chartered Surveyors (RICS), the running of the project moved to the University of Newcastle in 2001/2002. The project became a community-wide

initiative with professional bodies, trade groups, private companies, universities and several other groups contributing to the project in some way. As well as wishing to continue being a portal for the general public to the UK geomatics community, the project decided to focus on providing free geomatics-based resources to schools.

Today the project's mission statement is to:

- raise the profile of science, engineering and technology research;
- provide free geomatics resources to schools; and
- place 21st Century technology in the hands of school students.

The project remains largely web-based but there is an awful lot going on behind the website which was explored later in the lecture.

(Slide 21 – Geomatics.org.uk) The project remains largely web-based although the website has been completely rebuilt and greatly expanded since the original site set up by the RICS. Today's site can be thought of as having three sections.

The *Public Area* is open to all. It is made up of several sub sections that allow people to explore what geomatics is, what it is used for in the real world, the types of jobs, backgrounds and career paths of the people involved in geomatics and finally, a large links library that will allow people to explore the world of geomatics further.

The other two sections of the website, the *Teachers'* and *Members'* areas are open to all but they work on a username and password basis. Securing these sections of the site is primarily a means of keeping track of how many people are using the site and its resources, information that is valuable if we are to secure further support for the project. Obtaining a username and password is free and can be obtained by either registering online or contacting the project by phone and/or email.

As explained during the previous slide, geomatics.org.uk is now supported by a variety of groups across the UK geomatics community. The *Members Area* of the website is used to coordinate and liaise between the day to day project management team and the project supporters.

The *Teachers' Area* (TA) is dedicated to people working in education. Exercises, ideas, articles and information to print are freely available to those who register to use the TA. The TA is also the portal to the free equipment and field resources offered by geomatics.org.uk. It is at this point that the lecture moved to looking at what the project does behind the website.

(Slide 22 – Equipment Loans) When the project became a much larger, community wide effort, it was felt that something more than a website needed to be realised. Geomatics is a very hands-on, visual science and so to provide the best possible geomatics-based resources to schools, this needed to be built upon.

The project team were aware that geomatics was already being used by schools to support teaching and learning, however some of the techniques and equipment being employed are quite outdated. To modernise these techniques would require a budget beyond that which is available to most schools. It was decided that geomatics.org.uk would, therefore, make a pool of 21st Century surveying equipment available to

schools to borrow at no cost to provide modern, work-related, kinaesthetic experiences for students.

The loans have had a very positive reception from schools over the last four years. Every teacher that has borrowed equipment has said that they would do so again and there are now several schools borrowing the kit year on year.

So what equipment can schools borrow?

(Slide 23 – Equipment Loans) The most popular items available are handheld GPS receivers. There is a suite of 14 available for schools to borrow. There are a variety of uses for the GPS receivers including:

- recording position – collect coordinates of points of interest during fieldwork or to augment field sketches (i.e. Where were you stood when making this sketch? Were you looking North, South, East, West? The GPS receiver can tell you) The receivers can also be used to record your own data to add into a GIS;
- map reading – use the GPS receiver to navigate to pre-selected points and practise relating what you can see in the real world to how that is depicted on a map. What about using grid coordinates or latitudes and longitudes? The receivers will make coordinate work a kinaesthetic experience;
- navigation – upload a route that you wish to follow and use the GPS receiver to navigate from point to point. Use it on fieldwork to move from worksite to worksite, from point of interest to point of interest; or
- geocaching is a term used to describe GPS orienteering. It is a popular activity for GPS users is to navigate around some trail to collect or identify little trinkets or markers of some sort. Setting up a course to collect letters from various markers around a school's site is a quick, easy and fun exercise to do.

(Slide 24 – Equipment Loans) Levels are tripod mounted instruments that allow the operator to view along a perfectly horizontal line of sight. By combining the instrument with a surveying staff (which is basically a big (up to 5m long) ruggedised ruler!), students can determine changes in height from point to point. Levels have been very popular for completing beach and river fieldwork where students often collect elevation profiles of their worksite. The instruments can also be used to make digital terrain models (digital contour maps) although this is an advanced exercise.

(Slide 25 – Equipment Loans) Theodolites are instruments that measure angles very precisely in both the horizontal and vertical planes. Being able to measure angles in the vertical plane means that the instruments can be used to analyse gradients in a worksite e.g. how steep is the section of river that students are working on.

Working with angles and subsequently with trigonometry, make the theodolites a great tool to potentially realise some cross-curricular work with mathematics.

There are also eight 30m tape measures and 4 field computers available from the equipment pool.

(Slide 26 – S.O.S) Geomatics.org.uk is also in the process of developing the S.O.S network – Surveyors' Outreach to Schools. The idea is that schools, should they so desire, have access to a local geomatics surveyor who can work with the school staff to maximise their use of geomatics. There are a variety of ways in which the network could be used. Initially the network was proposed to support school teachers who have borrowed equipment from the pool with instruction and tips. The network has also been called upon to attend school careers events and "fly the flag" for geomatics study and career opportunities. There is the possibility, too, of surveyors supporting school enrichment days with talks, displays, show-and-tells and maybe even field activities.

(Slide 27 – Blank Slide) That concluded a brief overview of the geomatics.org.uk project.

(Slide 28 – Summary) In the course of the short lecture, the science of geomatics and some of its disciplines were introduced. Free support that is available to schools from the geomatics.org.uk project, particularly the resources available for fieldwork, were also introduced.

(Slide 29 – Blank Slide) The session moved into the discussion phase of the Lecture-Plus format.

(Slide 30 – Discussion) There was no set format for the discussion but four points that the audience may have wanted to consider using as starting points were offered.

(Slides 31 – 34 – Detailed description of discussion points)

(Slide 35 – Contact details)

Discussion Summary

Some sections of the audience were curious about the **availability of training and support for teachers** wishing to use geomatics.

The Teachers' Area (TA) of the website contains a wide variety of materials that teachers can use to maximise the benefit of using geomatics. From information to support preparing risk assessments and equipment instructions through to ideas and case studies of other successful school activities, the TA has been written and structured to be an online point of support.

Geomatics.org.uk has, in the past, offered INSET days for practising teachers at a variety of venues throughout the UK. Sessions have also been undertaken with PGCE students. Recently, there has been a good deal of interest in INSET days and so this is something the project team will look into further.

There is a virtual INSET day in the TA of the website.

The S.O.S network, as described during the lecture, is also a potential point of support.

During the talk, the presenter cited some examples of geomatics.org.uk resources being successfully used with schools. This included mention of sessions for **Gifted and Talented** (G&T) school students. Some members of the audience picked up on the potential of geomatics for use with their own G&T students and asked whether or not the G&T materials were ready to go, off the shelf.

Currently, no, the G&T materials are not online but two could be made available as off-the-shelf exercises. Again, this is something that the project team will now look into.

More Information

For more detailed information about this lecture, geomatics, geomatics.org.uk and the use of geomatics in school, please contact the geomatics.org.uk project team:

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