

India lacks balance as there is significant focus on remote sensing data analysis and GIS development but not much focus on basic subjects like geodesy, adjustment and computation, photogrammetry, laser scanning, land surveying, etc. A further lacuna is that most of the people trained in geomatics in India have only one or two years' worth of training behind them. There are no institutions that provide high-quality three- or four-year-long dedicated training programmes for geomatics. Furthermore, while there are quite a few universities in India which offer PhDs in geomatics, in most of the cases these research studies are limited to exploring the application of geomatics rather than the development of the technology. The net effect of these lacunas is that there are only a few experts in core domains of geomatics. This is a

big challenge and a limiting factor for exploring the full potential of this technology. I believe that Indian universities can play a really important role in improving this situation.

***If students from your university plan to start their own company, what do you advise them?***

A good number of students from our institute intend to start their own company. This has become a very strong trend nowadays, thanks to the positive signals from the government. One spin-off company from our institute is now a leading Lidar company in India; a further company currently being incubated has developed UAV-based solutions for mapping and other applications; and one more company that was recently incubated is developing 3D solutions in the field of geomatics. I interact a lot with these

students and mentor and advise them. My advice to them is to understand the market. India – and a large part of the rest of the world – is a very special market for geomatics as these countries were never mapped at large scale, while there is a high demand now for such data due to modern applications. I advise students to leapfrog in terms of technology to provide data solutions. Furthermore, my advice is to remain focused on research and development while providing services as, in order to remain competitive and relevant, the service-only model will not be sustainable.

**More information**  
[www.iitk.ac.in](http://www.iitk.ac.in)

## 5 Questions to...

# Peter van Oosterom

Peter van Oosterom has been a full professor and head of the section GIS Technology at Delft University of Technology, The Netherlands, since 2000, where he presently teaches Geo Database Management Systems within the redesigned MSc in Geomatics for the Built Environment.

***Attracting sufficient students is a first priority at universities. What is the situation at your university?***

In general over the last 5 to 10 years there has been an incredible increase in student numbers at TU Delft, from about 13,000 to more than 20,000 students today. That is probably due to a variety of reasons such as the Dutch government's campaign to promote technology to primary and secondary-school pupils, the good job opportunities in most technical professions, etc. Our geomatics student numbers are more modest, but these too have developed very positively in recent years; this year we've welcomed 23 new MSc Geomatics students and 37 new MSc GIMA students (a joint master with Enschede, Wageningen and Utrecht), and our colleagues at TU Delft (Geo track within Civil Engineering), Wageningen (Geo-information

Science) and Twente (Geoinformatics) have noticed a similar positive trend. This might be explained by the support activities of the Dutch foundation called Stichting Arbeidsmarkt Geo, the very good geomatics-related career perspectives, the increased visibility of geomatics and, specifically for our own educational programme, the name change from Geodetic Engineering to Geomatics and our new position within the Faculty of Architecture and the Built Environment.

***What impact does the increasingly important role of geomatics have on education?***

Ongoing technological developments make our field more visible, more attractive and more recognisable. Examples of such developments include improved positioning technology (including the EU's Galileo satellites), sensor technology and social media producing ever more data (big geodata and data analytics), spectacular drones for capturing data, very visible web-based (geoinformation) systems, many mobile (map-based) apps, attractive and useful 3D models becoming increasingly popular, more geodata becoming open and used,

mainstream ICT better supporting spatial data (including spatial databases), etc. All of this makes geomatics more visible to the general public and to potential new students, which partly explains the increase in student numbers. Needless to say, a technical university plays a very important role in further technological advancements and innovations. These research activities are reflected in the master thesis phase of the degree. Of course, we also have to continuously update our education to include these latest developments. A few years ago the national GI minor was introduced for non-geomatics students: half a year of geoinformation education within the 3-year bachelor of another programme.

***How do you co-operate with manufacturers of geomatics hardware, software and geodata?***

In our Geoinformation Technology and Governance (Geo-TG) research programme we have two centres in which we collaborate explicitly with these partners. One is the Geo-Database Management Centre (GDMC) with partners such as Oracle, Bentley and Safe Software, and the other is the Knowledge

Centre Geoinformation Governance (KC Geo-Gov) with partners such as TNO, Ministry of Infrastructure and Environment, Municipality of Rotterdam, Kadaster, CBS, KNMI and RIVM. We have long-term partnerships with Geonovum, Rijkswaterstaat and Kadaster (including staff exchange). We also quite often involve partners in research projects. The massive point cloud project is done in collaboration with Fugro, Oracle, MonetDB, Rijkswaterstaat and Netherlands eScience Center, For example, and in our vario-scale geoinformation project there is an explicit user board with members from ISpatial, Esri, the municipalities of The Hague and Amsterdam, and some above-mentioned partners such as Oracle, Rotterdam, Kadaster and Rijkswaterstaat. Last but not least, there is an important role for and close collaboration with manufacturers via the education programme: internships (GIMA, GI minor), MSc thesis projects and guest lectures. There is a long tradition within the MSc Geomatics for open guest lectures. These have included representatives from Google, Microsoft, Oracle, Deltares, Geodan, Rijkswaterstaat, Geonovum and Kadaster as well as guest lecturers from foreign universities.

***What do you regard as the biggest challenge in the geomatics sector and how can universities contribute to tackling it?***

Given that the developments in our field are happening at increasing speed there are many R&D challenges, so it is very difficult to name the single biggest challenge. Semantic technologies are needed for better machine processing of geodata, including real-time GIS applications (such as during disaster management), but also to obtain better results for 'classic problems' such as automated map generalisation. Clearly, the processing and use of sensor network data is crucial for smart cities, smart dikes, smart highways, etc., and results in significant geodata processing challenges. The big geodatasets include point clouds (from laser, multibeam echosounders, dense-matching stereo images, etc.) for spatiotemporal modelling, which should be as well-supported (in terms of functionality) as the regular gridded/raster and the object/vector representations. For this to happen, standardisation is crucial but that in itself is a major challenge; it should stimulate and enable new developments, rather than slowing them down by favouring the status quo. A good innovative standardisation



▲ *Peter van Oosterom*

example is the ISO 19152:2012 Land Administration Domain Model standard which included support for 3D parcels (well before they were used in practice). Internationalisation is also a big challenge. We have been cooperating with leading geoinformation universities across the globe for a long time. Three years ago, TU Delft developed the policy of a limited number of strategic alliances which resulted in the Joint Research Centre (JRC) Wuhan-Delft. The activities include student and staff exchanges, joint projects, publications, events, etc. It is becoming harder to attract research funding as government budgets for education and research are under pressure in The Netherlands and the percentage of funded projects available for research proposals is declining every year. And despite the current success of our educational programmes, it remains a challenge to further boost student numbers and transform them into the young professionals that are so needed and wanted in our field. In summary, there are many 'biggest challenges'...

***If students from your university plan to start their own company, what do you advise them?***

In general I advise the students to broaden their career development options and not just follow the obvious path by staying within their familiar environment. For example, even if a student enjoys university research it is very good to first work in industry or government. And if a student wants to do PhD research directly after finishing their master, I advise

them to switch universities and/or look abroad to change their perspective, which in turn will enable them to learn more. Although many of our geomatics graduates do indeed start their own companies, I don't give them specific advice on that aspect but I always hope that they will stay within the field (and 95% of them do). The geomatics graduates who have already started their own companies are probably much better advisors. Our students have set up the student association called GEOS, which also involves alumni, and TU Delft's annual Geomatics Day is another great opportunity for students to gain inspiration from small start-ups and larger companies alike (and vice versa). ◀

**More information**

- Geo-Database Management Centre: [www.gdmc.nl](http://www.gdmc.nl)
- Geoinformation Governance Knowledge Centre: [www.otb.tudelft.nl/opendata](http://www.otb.tudelft.nl/opendata)
- MSc in Geomatics: <http://geomatics.tudelft.nl>
- Massive point cloud project: <http://pointclouds.nl>
- Vario-scale geoinformation: <http://varioscale.bk.tudelft.nl>
- GEOS student association: [www.geostudelft.nl](http://www.geostudelft.nl)
- Wuhan-Delft Joint Research Centre: <http://jrc.tudelft.nl/spatial-information>