

Editorial

PHOTOGRAMMETRY AND INDUSTRY

THIS IS THE SECOND CONSECUTIVE ISSUE OF *The Photogrammetric Record* that contains fewer academic refereed papers than our norm. This is not for lack of submissions; our recently expanded International Editorial Board (IEB) has been working very hard but recent outcomes have often been rejections or substantial revisions. This reflects the quality of papers we wish to showcase in the *Record*: we are not in the business of publishing substandard contributions. On this occasion no apologies are offered for using the available space to publish this extended Editorial (approaching the length of a reviewed paper) on the topic of *photogrammetry and industry*. This is particularly the case as your Editor has managed to solicit substantial and thought-provoking contributions from five eminent academics and business managers, namely:

Ian Dowman – IEB member, Emeritus Professor at University College London and Past President of ISPRS;

Wolfgang Förstner – Professor at the University of Bonn and Past Vice-President of the German Association for Pattern Recognition (DAGM);

Christian Hoffmann – Marketing Manager (Photogrammetry and Remote Sensing) at Trimble Inc. and Chair of the ISPRS International Industrial Advisory Committee;

Franz Leberl – Emeritus Professor at Graz University of Technology and founder of both Vexcel and an Institute for vision and graphics at Joanneum Research; and

Stewart Walker – Product Director at BAE Systems Inc., ASPRS Past President and Chair of the ISPRS Foundation.

The impetus for this Editorial was the report by Franz Leberl to the General Assembly at the 23rd ISPRS Congress in Prague in 2016. Granshaw (2016) notes:

... the report by Franz Leberl (Graz University of Technology) on the ISPRS International Industrial Advisory Committee (I²AC) was notable in its singular dissent. Leberl was scathing about the lack of industry involvement in ISPRS, arguing that industry should have a strong voice, not only in relation to the exhibition but also within the Congress itself and in the choice of the next

FRONTISPICE. **Photogrammetry and industry.** (Previous page) In the Editorial in this issue, Ian Dowman notes that “*at the moment photogrammetry is being led by technology, that is, practitioners adapt to the tools available. In recent years these have been satellites, drones and laser scanning, all developed by industry.*” The Frontispiece images provide examples of industry hardware in these three categories.

Top: Sentinel-3 earth-observation satellite, operated by the European Space Agency and built by ThalesAlenia Space. © ESA/ATG medialab.

Middle: An AscTec Falcon 8 drone equipped with a Sony Nex-5N digital camera, as used by Graz University of Technology as part of a structure-from-motion pipeline (see Rumlper et al., 2017).

Bottom: A Riegl VZ-400 terrestrial laser scanner being used by Chilean company Geocom at the Orongo ceremonial village on Easter Island. © Riegl and Geocom.

Congress venue. President Chen Jun countered that science, users and industry were the three pillars of ISPRS, but one was left with the feeling that Christian Hoffmann from Trimble, the next chair of I²AC, would have an uphill task in making the industry “pillar” as strong as the other two.

The intention of this Editorial is to look at why there is less industry involvement today than in the past, both within specialist photogrammetric journals (such as the *Record*) and with organisations such as ISPRS, and how interaction between academia and industry can be improved. The intrinsic symbiosis between industry and academic research in photogrammetry should be undeniable. Wolfgang Förstner, whose academic credentials in both photogrammetry and computer vision are indisputable, writes:

Though my career was mainly at university, I always tried, and succeeded, in cooperating with government agencies and industry. The motivation is simple: they have questions I would never pose, but which require more than just putting some software together.

The link between photogrammetry and industry is a clear one: photogrammetry is an engineering discipline – now more and more overlapping with computer vision, though having its own scope – and therefore always aims at trying to bring theories into practice, in other words into industry.

All our contributors have some experience in both the academic and industrial sectors. For example, Stewart Walker was a lecturer at East London University before commercial employment with LH Systems and BAE Systems; Franz Leberl has had an impressive career in both academic, government and industrial environments, including Graz University of Technology, NASA’s Jet Propulsion Laboratory and as the founder of Vexcel (acquired in 2006 by Microsoft). They are both members of I²AC (sometimes abbreviated as IIAC), chaired by Christian Hoffmann. Our contributors thus provide an excellent perspective of the challenges affecting the interaction between academia and industry, and the stance that needs to be adopted by organisations such as ISPRS to attract industry.

GREATER INDUSTRY INVOLVEMENT IN THE PAST

One issue related to the articles that the *Record* currently publishes, or that are presented at the quadrennial ISPRS Congresses, is that phrase in the first sentence of this Editorial: *academic refereed papers*. Editor Emeritus Keith Atkinson, in his contribution to the Editorial in the sesquicentennial issue of this journal (Granshaw et al., 2015), noted the former industry contributions to both advertisements and published papers in the *Record*:

... the 50th issue (in 1977) contained 27 pages of advertisements, including five pages from Wild Heerbrugg, four pages from Zeiss (Oberkochen) and three pages from Zeiss (Jena) ...

... in the 1970s, academic authors were outnumbered by others from commercial, industrial, government and military employment. For example, issue 46 (October 1975) contained nine articles, only three of which originated in universities whereas, in March 2015, issue 149 carried six articles which all originated in academic institutions.

Stewart Walker echoes this sentiment:

In my early days, corporate members were heavily involved in the (UK) Photogrammetric Society. David Wallis, CEO of Survey & General Instrument

Co. Ltd., led technical tours to north-west Europe, making the preparations himself. Companies advertised in the Record and these pages provided a chronology of the development of technology still of value to the historian. The same was true in the USA where Photogrammetric Engineering & Remote Sensing has included a similarly rich vein of advertising.

This greater involvement of government and industry in the past was still apparent less than two decades ago, and certainly postdates the introduction of digital photogrammetry. For example, although issue 93 (April 1999) of the *Record* (complete with nine pages of commercial advertising) contains papers from the universities of Athens, Newcastle and Otago, there were also contributions from: Ordnance Survey International; English Heritage with Atkins and The Downland Partnership; Aerial Imaging Systems; Intergraph Corporation; LH Systems; and the Fraunhofer Institute for Manufacturing Engineering and Automation with K² Photogrammetry. Additionally, there was perhaps the ideal academic/commercial partnership: a paper jointly by authors from Loughborough University and Erdas Inc. Editor Emeritus Paul Newby (in Granshaw et al., 2015) has noted that the move to a formal peer-review system for the *Record*, in response to the demands of academics, took place in 1998: it may be no coincidence that the decline in papers from industry began shortly after this date (see Fig. 1 and also the later section on “Publications”).

ISPRS involvement at this time can be gauged by the *Record's* report on the 19th ISPRS Congress in 2000 in Amsterdam (Kirby et al., 2001) which noted that six different types of scientific technical sessions included the following two:

6 Special Sessions to enhance the dialogue between scientists, industry, policy-makers and users. Organised by Council members, these sessions included such topics as the availability of spatial data, business opportunities with spatial data, and GIS for sustainable development;

16 Exhibitors' Showcase sessions for presentations by commercial firms engaged in any technology. These were considered a great success.

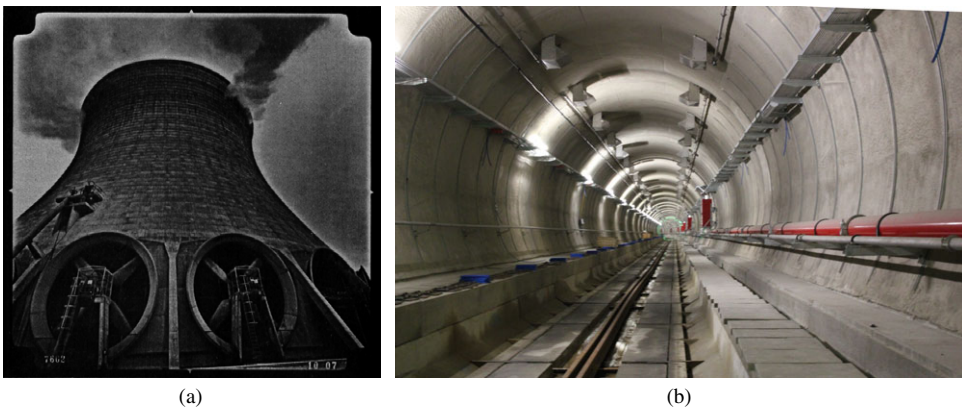


FIG. 1. Papers from industry and academia. (a) A figure from a paper by N. W. T. Chisholm of Fairey Surveys Limited on a photogrammetric cooling tower survey in issue 50 of the *Record* in 1977. (b) A figure from a paper by Nuttens et al. in issue 148 of the *Record* in 2014 on a rail-tunnel construction project in Antwerp, Belgium using laser scanning, which involved collaboration between the University of Ghent and TUC RAIL, Brussels.

Franz Leberl makes interesting observations about this period, especially with regard to ISPRS:

I recall several occasions, going back to my time as a Technical Commission President (2000–2004), where I addressed the ISPRS constituencies as follows:

- (1) Academia (the professors).*
- (2) Governmental mapping agencies (the civil servants).*
- (3) Industry (providers of equipment and tools).*
- (4) Service and data providers (users of equipment and tools, most recently those supporting automated navigation and the location-aware Internet).*
- (5) National and regional learned and professional societies with their websites and magazines.*

(3) and (4) often get combined, although they follow different rules. For example, industry is always global and selling tools, whereas service providers tend to be regional and are selling data. Industry innovates; service providers ride the coat-tails of industry. And if one leaves out the idea of regional and national societies, there remains a triangle of: (1) academia; (2) industry; and (3) civil service (Fig. 4). It is this triangle that could be seen as the ISPRS's unique selling proposition when compared with other organisations claiming to represent the world of geodata.

ISPRS and its regional partners, such as ASPRS, have originally been heavily dependent on industry for their existence. They were driven to be the industry's platforms for technical exhibitions and the innovations presented there. ISPRS budgets were essentially funded by industry. Commercial developments could clearly be associated with photogrammetric expositions. Conference participants often just attended for the exhibitions, ignoring the conference papers.

CURRENT INDUSTRY INVOLVEMENT

So what is the view of our five contributors about the current photogrammetric relationship between industry, on the one hand, and academia together with societies such as ISPRS on the other? As Editor I have tried to group our experts' contributions into common subheadings and I apologise if this has broken the flow of their original thoughts; note that Förstner (2017) provides Wolfgang's full uninterrupted submission. However, before we look at these various categories, I would like to introduce some views from Christian Hoffmann, who warns against hankering after the photogrammetry of a bygone age (as outlined above?) that will never return. Christian notes he is younger than our other contributors and therefore cannot comment on the situation prior to 2004. He also pitches himself as an "outsider" with more of a remote sensing background from his time at a company called Definiens, producing eCognition software:

I've been exposed to photogrammetry only since Definiens was acquired by Trimble. This gave me the great opportunity to work with the Inpho team and forced me to dig deeper into photogrammetry. One interesting aspect is that Definiens had been founded by the Physics Nobel Prize Laureate Gerd Binnig – so by definition an award-winning scientist. In the early years of my career I worked with him regularly and he was always a thought leader to the technical people. But also, we had business people who took care of – yes – business. The finest scientific minds still need business people around to "run the shop",

handle investors' relationships and conduct business development. It can be done by in-company research and development (R&D) – nothing new here. Nevertheless, the fine line between R&D-driven topics and business-driven ones is key for the success of a private, innovative start-up. In the relationship between ISPRS and industry the existence of this fine line might also be something to account for.

In the beginning of my collaboration with photogrammetrists, I struggled with a community talking a lot about the “good old days”. My first impression was “those guys are really smart but they’re living in the past”. And I’ve recognised a certain fence that this community built against the outside world – the non-photogrammetrists. Without elaborating too much, I would claim that the thought leaders need to make sure they guide their community into the future with an open mind for where their very own technology might steer them.

Stewart Walker offers a similar perspective in relation to ISPRS Congresses:

Even if corporate goodwill and social responsibility to the profession have not declined, they are dangerously diluted compared with a generation ago.

ISPRS will never re-enter its role of being the launching pad, every four years, of new models of stereoplotters, stereocomparators and aerial film cameras – those days are gone and we are in a world mainly of software (though airborne sensors, UAVs, GPUs, GNSS/IMU and AR/VR equipment are no less fascinating), resulting in much, much faster development of new products.

The subheadings that follow are the Editor’s choice and our contributors may not fully agree with such categorisation.

Technology-led Research in Universities and Industry

Ian Dowman introduces this area of research overlap (see also the Frontispiece):

I have maintained for some time that at the moment photogrammetry is being led by technology, that is, practitioners adapt to the tools available. In recent years these have been satellites, drones and laser scanning, all developed by industry, but academics have contributed by developing software tools to use these technologies. This software has frequently been picked up and marketed by industry, so there is a close link between these two.

Wolfgang Förstner expands on this and notes the role of globalisation:

University research in our very small field always had to compete with large companies, especially those who had bosses who looked into the future and allowed for (comparably) risky developments. This is certainly true for all hardware developments, which only to a very small extent are made at universities. Today these large companies, more and more, are global players (Google, Microsoft, Facebook, Apple) who try to get the crème de la crème of the scientists into their research and development groups, paying them excellently. They allow and encourage their researchers to publish: at least 10% of the papers at computer vision conferences come from these companies. They also have booths at the industrial exhibitions, and special evening events – comparable to large ISPRS events or others, such as the (Stuttgart) Photogrammetric Weeks. They have addressed all aspects of mapping over

recent years, for example Google has made public code available for bundle adjustment to be performed locally or in the cloud (Ceres solver) which, of course, was motivated by the need to evaluate street map data.

For more of an industry perspective, Christian Hoffmann relates:

For me this element of technology adoption is a key component in the discussion about, and with, ISPRS because it is important to realise that the questions that are asked towards this domain might have changed by now, especially from an industry's perspective. While the basic algorithms in the early days of digital photogrammetry might have been the major focus then, the industry now talks about "user experience" where usability and visually appealing software tools determine commercial success. Although it also has to be mentioned that this sometimes is a trap, because if accuracies are not sufficient, the user experience quickly becomes of minor importance. So it's not about abandoning the core of photogrammetry and the mathematics behind it, but to also take new elements like user experience and technology transfer into account.

Photogrammetry by Non-specialists

In the "good old days" photogrammetry was a specialist discipline, using specialist equipment and requiring specialist knowledge. This is often no longer the case, and industry has responded positively to the opportunities presented by this burgeoning non-specialist market. The book review of *Structure from Motion in the Geosciences* in issue 156 of the *Record* (Chandler, 2016) is an excellent example of the use of low-cost, user-friendly photogrammetric techniques by those who would never label themselves as photogrammetrists. Another book review, this time of *Photogrammetric Computer Vision* (co-authored by Wolfgang Förstner) in the same issue as this Editorial (Gerke, 2017), also indicates the dangers of photogrammetrists building a fence (using Christian Hoffmann's phrase) against cognate disciplines, in this case computer vision. Christian develops his observations in the previous subsection further in this regard:

A good mental picture I like to use is the life cycle of technology-adoption, where one could say that digital photogrammetry is already a rather mature technology. It has found its place on the technology map and new fields of application have been identified where photogrammetry is used. Other companies make use of this technology without making a big deal out of it (there is no sticker "Photogrammetry Inside"). But does the photogrammetric community perceive this technology adoption positively? Sometimes it appears that it is creating antagonism such as "those people are not photogrammetrists – why are they using our technology and how will they ever be successful?". This is a misconception: it is great that non-photogrammetrists utilise this technology. The growth opportunity lies in the enablement of others to use photogrammetry. I know that basic scientists don't like this discussion but it's a fact that somebody needs to bring in the resources to keep things going.

Take the example of the UAV domain where complete systems are much cheaper than in classical manned airborne data acquisition. The potential of an almost unlimited number of users engaging with this technology lets market-size predictions go through the roof. Why? Because one doesn't have to be a photogrammetrist by education in order to use this technology and create data products with a few mouse clicks. This can be done even without

specific hardware requirements as it's all going into the cloud. On the other hand, the same person might need to have a drone pilot's licence and/or some GIS knowledge to generate a value-added product that a small survey company can make a profit from.

The example in Fig. 2 illustrates a similar point, with a 3D structure-from-motion model created with UAV images.

Short-term versus Long-term Research

Wolfgang Förstner offers a perspective on the lack of long-term research within the photogrammetric community:

The small size of our community and the diversity of applications we want to address leads to a lack of depth of developments in many aspects. At the same time all the excellent work which is published needs to be highly appreciated. The gap between the computer vision and photogrammetric industries is difficult to bridge. The requirements of small, mostly photogrammetric, companies are often short term. Researchers think this is fine, motivating PhD theses to cover medium-term research, but sometimes forgetting the risky long-term aspects of research and development. Large companies can afford to have research groups without specific application goals for the next 2–3 years (autonomous driving is a classical counter-example, which requires the will to invest into long-term research).

Pace of Change

Related to the previous section is the current rapid pace of change in industrial photogrammetric developments. Stewart Walker has already noted the *much, much faster development of new products*. From a business perspective Stewart notes:

Probably the world today is more competitive and faster moving, though I have seen an article in The Economist that questioned this. Companies are more focused on the bottom line, however, rather than support of the profession – I'm sure of that. And the intense focus on "short-termism", that is the financial salients for the next quarter, or at best until the end of the financial year, are a reality.



FIG. 2. UAV and structure from motion. In project *Construct* from Graz University of Technology, an AscTec Falcon 8 UAV (right) was used to obtain 242 images. The resulting 3D model used structure-from-motion software where each object point was shown on an average of 19 images. © Christian Mostegel – ICG Graz University of Technology.

Franz Leberl makes a similar point:

The four-year interval between ISPRS exhibitions used to be sufficient for the slow innovation cycles of the field. But this has become vastly more dynamic. Annual and semi-annual cycles are now the norm. However, from a look at the fate of ASPRS, an increase in conference cycles is insufficient in improving relevance to industry.

Christian Hoffmann elaborates:

It seems that there is an increasing gap between an industry point of view and the scientific community that ISPRS is challenged with. If one looked into quarterly thinking of the corporate world, time-to-market considerations and the way products, especially software-related, are being developed in an agile way, the commercial world is accelerating its way of doing things dramatically. Looking into development cycles – two weeks for instance as a standard sprint length in scrum (a flexible product-development strategy) – it seems that the model of quadrennial events is not fitting into this concept anymore. If software existed as a service with a potential release whenever needed, the clocks seem to run at different speeds between a modern software company and a society that gathers every four years. For sure a good algorithm or product is not going to be invented in such short cycles but it is the different time scales that sometimes seem to make the conversations between those two groups difficult. For hardware, this might be different but then again, with a few exceptions (such as Geiger-mode lidar technology), hardware is also changing quickly.

CONFERENCES, EXHIBITIONS AND TRADE SHOWS

Conferences, exhibitions and similar events are a major concern to several of our contributors (Fig. 3). It has already been noted that the days when conferences, such as the quadrennial ISPRS Congresses, were the industry's platforms for new innovations, with industry providing a primary source of funding, are long gone. Franz Leberl makes the following observation of current industry behaviour:

With annual budgets and a fiscal-year planning horizon, industry decides on the exhibitions to attend, the size of the exhibit space and number of employees manning those. The competition between different geospatial events has grown, so decision-making by marketing departments has become more difficult. ISPRS is facing stiff competition for these marketing expenses by exhibitors. Professors



FIG. 3. The quadrennial ISPRS Congress exhibition (left – © ISPRS) has to compete with annual gatherings such as the Esri User Conference (middle – © Esri) and Intergeo (right – © HINTE Messe- und Ausstellungs-GmbH).

and students do not buy geospatial systems and tools, company managers with budget authority do.

Ian Dowman notes the growth of industry-focused events:

There is also the increase in conference and exhibitions concentrating on industry: Intergeo, obviously, but conferences such as Geospatial World Forum which bring together people from industry. This tends to reduce industry participation in the more academic conferences such as ISPRS.

Stewart Walker elaborates:

Indisputably there are too many trade shows and conferences: it is unreasonable to expect companies to support all of these. I remember attending a meeting of Sustaining Members of ISPRS many, many years ago, where the issue of holding exhibitions at every one of the Inter-Congressional Symposia was discussed – so awareness of the blossoming of the trade-show calendar dates back a long way.

Perhaps the above argument can be extended to the role of students. Companies exhibiting at trade shows politely welcome students and professors to their booths, but behind the scenes the feeling is that these individuals are not prospective customers but merely information gatherers. The hunt for immediate revenue is far more important than “winning hearts and minds”. This may vary from company to company because those that offer, for example, software for remote sensing and the processing of synthetic aperture radar data are more likely to have highly educated users, so the software they use during their university years matters. However, those whose customer base is in production mapping or intelligence may see it differently.

Christian Hoffmann presents further illuminating insights:

The vast number of conferences and exhibitions the industry is attending make each individual event less important. In an industry that is global, one marketing team might be planning for international events working with one budget. This leads to a mix of some local people and some globally-acting people that are being sent to such events. Quadrennial events are very tricky to handle because budgets are allocated on an annual basis.

Furthermore, today’s ways of online marketing can dramatically reduce costs for onsite events. In other words, any exhibition or conference these days not only “fights” against other events but also against an online marketing strategy. Social networking at an onsite event is perceived as less important and less relevant by modern marketers than “back in the days”. Today the only question that is relevant for an exhibition booth is: how many leads can we generate and are those leads good ones so they can be pushed through the sales funnel quickly.

Additionally, I’ve been looking at some conferences, including ISPRS in Prague, and had the impression that the industry is not really welcome to present papers because it is assumed that it is going to be a commercial promotion. Certainly, the industry has not always been doing a good job in presenting a scientific paper: contributions were at best pseudo-scientific and at worst a sales pitch. But I would think that some kind of compromise needs to be found here as otherwise the scientific community would lock itself into a space where the industry is not interested in participating anymore.

Sometimes just simple little things could help. Let me mention a few ideas how the exhibition at ISPRS could be set up in a more industry-friendly way: (1) a limited number of exhibition days; (2) more hands-on presentations and workshops; and (3) product demonstrations at a specific demonstration area (that are well-attended because it's not locked in a dark corner or overlapping with other events). All these could limit the investment of an individual company (because a smaller booth is sufficient) but might boost the total number of companies willing to be present.

INDUSTRY INVOLVEMENT IN INTERNATIONAL AND NATIONAL SOCIETIES

It is clear that the nature and extent of the support from industry for society events has changed substantially from its role at the turn of the century, as noted above. The International (ISPRS) and American (ASPRS) societies will be used as examples.

ISPRS and Industry

It will be recalled that it was the report on I²AC at the ISPRS Prague Congress by Franz Leberl that sparked this Editorial. Here Franz reflects on the changes over the past couple of decades affecting ISPRS:

The original involvement of industry in ISPRS has now shifted to the Esri User Conference and Intergeo, and also to a number of commercial journals and associated secondary conferences. Simultaneously, academia has given birth to computer vision as an innovation driver par excellence. These changes have eroded the relevance of ISPRS events to industry and conference participants looking for new tools, data products and business models. ISPRS had to rethink its role and oriented itself more fully towards academia. It now is a “learned” society for professors and their students. The industrial exhibit at ISPRS Congresses has become a side-show, to be given attention during breaks between technical/scientific sessions.

When Christian Heipke (now President of ISPRS) called for the creation of an I²AC, and some managers were asked how ISPRS can better serve industry, it was to be expected that the main message would be “become more relevant to industry”. The I²AC report (Leberl, 2016) summarises some ideas. However, the members of I²AC are not burning with ambition to assume roles in ISPRS, since they have a well-oiled process, all of them, to decide on annual exhibitions to attend. There is no shortage of options: ISPRS is but one of many, and with a four-year interval for its International Congress, this figures only on the periphery of industry's radar.

The sustaining membership programme of ISPRS has been shown a rather sporadic interest by industry to be involved and supportive. It remains unclear what would make that programme more relevant to industry so that more geospatial commercial concerns join in.

Christian Hoffmann, as the current Chair of I²AC (Table I), has important views on the quadrennial ISPRS Congresses:

Most likely, there won't be anything new that a company has to demonstrate to an audience once every four years. Release dates are geared to Intergeo, the Esri User Conference or some other annual shows. “Time to market” and

TABLE I. Current membership of ISPRS International Industrial Advisory Committee (I²AC).

Member	Company	Country	Member	Company	Country
Christian Hoffmann	Trimble	Germany	Tadashi Sasagawa	Pasco	Japan
George Vozikis	Airbus	Germany	Steve Cooper	PhaseOne	Denmark
Ke Li	Beijing Geoway	China	Christian Strecha	Pix4D	Switzerland
Lennart Flem	Blom	Norway	Victor Adrov	Racurs	Russia
Kumar Navalur	Digital Globe	USA	Christian Sevcik	Riegl	Austria
Lawrie Jordan	Esri	USA	Michael Sitar	Teledyne	Canada
Huug Haasnoot	Fugro	Netherlands	Stewart Walker	TIF	International
Ed Parsons	Google	USA	Keith Beckett	UrtheCast	Canada
Hartmut Rosengarten	Leica	Switzerland	Yun Raizman	VisionMap	Israel
George Percivall	OGC	USA	Franz Leberl	Support	N/A

TIF = The ISPRS Foundation.

“window of opportunity” are terms that describe how companies think when they are planning their releases – knowing that their competitors are doing the same and trying to release products as early as possible. So again, there is very little motivation for a company to have something special going on at ISPRS.

So it comes down to the question: why should companies continue going to this event and spending a lot of money on a booth or for sponsorship? To give the right answer, first the right question needs to be asked: it is not about how industry can be brought closer to ISPRS, it’s about how ISPRS could move closer towards industry. The industry will go where markets and revenue potentials are. There are certainly different ways on how to innovate but a meeting every four years to discuss the “latest and greatest” doesn’t fit into the time frames of today’s development and innovation cycles. Nevertheless, the industry needs those great minds that drive technology forward to keep a competitive advantage. But in a globalised world, any new technology is discovered at the very next conference somewhere around the globe – and if it’s relevant, such technology might be quickly acquired by a larger commercial company. Again, the quadrennial turnaround time of ISPRS doesn’t fit into today’s fast-spinning business world.

So what could ISPRS do to come closer to the industry? The first thing is that the value proposition of ISPRS for the industry should be made clearer. It’s not enough to state that the industry funding is necessary if great research outcome is expected. Recent developments, such as the formation of I²AC or Trimble’s Vice President Ron Bisio joining the Board of Trustees of The ISPRS Foundation and getting a voice, are going in the right direction. But it also needs to be more than giving the industry a platform to state its opinion. It’s about finding ways for ISPRS to take the advice and move towards the industry.

Stewart Walker, Chair of The ISPRS Foundation, makes the following observations: *How can ISPRS attract more system suppliers and data suppliers? National mapping agencies and other government departments have a role here – if they exhibit and otherwise participate, their suppliers may do so also. ISPRS has enabled exhibitors to talk about their wares in different kinds of trade-show presentations over the years (as have the superb Photogrammetric Weeks). How can it supplement this with technical sessions devoted to practical projects, with*

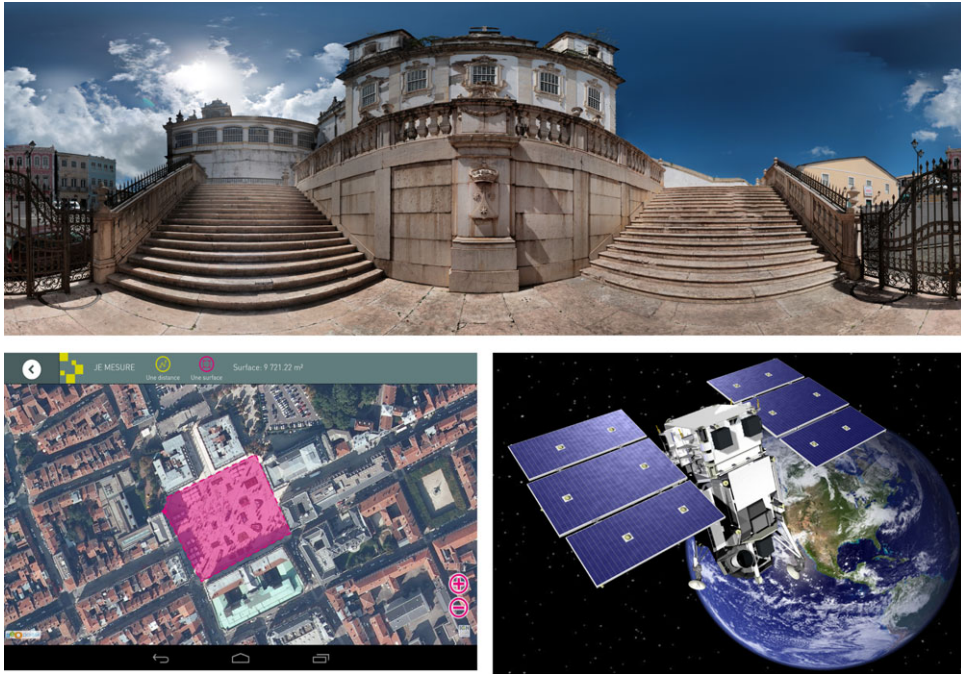


FIG. 4. The three constituencies of academia, government and industry. Top: Academic research on spherical panoramas (image: G. Fangi and C. Nardinocchi). Bottom left: Government derivation of measurements from an aerial image by IGN, France (© IGNcommunication). Bottom right: Industry hardware illustrated by the WorldView-1 imaging satellite (© Digital Globe).

some insight into the decisions and special circumstances that engendered success? In some cases, academics are participants in these projects, helping to address the challenges, so joint presentations with industry professionals are easy to arrange. Of course ASPRS can do this and if the result is growth of the Congresses, so much the better – success will be rewarded by success!

ASPRS and Industry

Stewart Walker, as a recent Past President and current Interim Treasurer of the American Society for Photogrammetry and Remote Sensing (ASPRS), has a unique perspective on this important national society, noting that joint events may be the way forward:

ASPRS has been fighting some financial issues recently and has been experiencing lower and lower attendances at conferences. This is a descending spiral, because as attendances fall, exhibitors lose enthusiasm, so one of the attractions of the conference declines. I am writing this at this year's annual conference in Baltimore, where an appeal was made to corporate members, asking them to exhibit and to improve the conference experience for participants. They dug deep and several were able to squeeze another event into their tight marketing budgets, so their support for the profession won the

day. ASPRS, however, has recognised the persistence of the decline of the annual conference and pursued a solution through a joint event. Thus an announcement was made at the International Lidar Mapping Forum (ILMF) 2017 conference in Denver by Diversified Communications (organiser of ILMF) and ASPRS that their annual geospatial events will take place together in Denver in 2018. ILMF was a vibrant event that this year had 80 exhibition booths – exhibitors are attracted because their booth traffic includes many prospective customers – so in 2018 ASPRS members and prospective members will enjoy a superb exhibition, with the possibility for registering for the ILMF or ASPRS events or both. The benefits of a larger conference, with well over 1000 participants, and both an attractive exhibition and a strong technical programme, plus traditional ASPRS components such as workshops and the awards ceremony, are obvious. ASPRS also plans to join with Diversified Communications at their Commercial UAV Expo in Las Vegas in October 2017, since ASPRS's own UAS Mapping Technical Demonstration and Symposium, after enormous success in Reno in 2014 and 2015, was very subdued in Palm Springs in 2016.

PUBLICATIONS

The Editor and Editor Emeritus Keith Atkinson have already noted the move away from papers written, or co-authored, by company employees or those in government to submissions almost exclusively from academics in universities or research institutes (Fig. 1). This is perhaps inevitable when a full peer-review system is introduced. Let us see how our contributors view the current publishing perspective in traditional journals. Ian Dowman writes:

What has been lacking are contributions from practitioners, probably due to the increased pressure of work and less time to write journal articles; but parallel to this has been an increase in the number of industry “magazines” which do carry reports from practitioners. So do learned societies and their publications offer anything to industry?

Franz Leberl also notes the dichotomy that exists between academic and industry publications (Fig. 5):

The focus and readership of different publications reflects the dilemma of a learned journal not being of interest to industry, and that product debates, project discussions and business issues, as well as advertisements, are a no-no for professors and their students with their focus on impact factors and citations.

Wolfgang Förstner explores the inward academic focus of many journal papers and the need for separate, non-reviewed, industry reports:

Journals can improve awareness by soliciting stimulating reports (not too short) at local and international conferences, not just photogrammetric ones but other conferences attended by photogrammetrists. This awareness also impinges upon the quality and openness of the papers published (which implies accepted by reviewers). Often papers are published which use method X applied to Y in context Z. This is interesting to the authors and those who want to have an overview, but does not provide any meaningful insight for readers and progress



FIG. 5. Examples of society academic journals (left) and industry publications (right).

within our field since generalisation is either not possible or not provided by the paper. The quality of reviewing has greatly improved over the last 20 years, but I fear developers in industry still need to perform their own benchmarking before being able to judge whether the result of scientific papers is useful for them.

I think we need to clearly distinguish between, and make explicit the goals of, two groups: (i) those publishing papers as part of their duties in a scientific career; and (ii) people publishing in an engineering discipline, be they at university, industry or in other application fields. I do not see a dilemma here: this is just reflecting diversity. Researchers need to publish in peer-reviewed journals. Most journals and conferences proceedings do not accept pure reports on projects or on software and hardware. Yet industry reports and applications need to be published in order for innovations in hardware and software, and interesting projects to be widely disseminated. They often contain challenges for research. Exceptions, where both (i) and (ii) are incorporated into a single article do exist, but these are relatively rare.

Stewart Walker provides an insight into the line taken by the ASPRS journal *Photogrammetric Engineering & Remote Sensing (PE&RS)*, which attempts to address this dichotomy:

Trade journals and e-zines all expect advertising, generally at the expense of traditional professional journals. The latter are indeed more aimed at

academics, with their highly scholarly content, impact factors and so on. ASPRS's founding principles emphasise the three constituencies discussed by Franz Leberl – academia, government and private industry (Fig. 4) – so we must cater for these in our publications as well as our events, certification and other activities. ASPRS's journal, PE&RS, under Alper Yilmaz, is focused on publishing high-quality, peer-reviewed articles and seeks to increase its impact factor. Nevertheless, the non-peer-reviewed "front matter" in PE&RS – regular columns, news, book reviews and so on – is very popular and will grow, with no plans whatsoever to put this in a separate publication. Furthermore, this provides a vehicle for publishing articles about successfully completed projects: many commercial mapping companies or national mapping agencies may not engage directly in research, but their industriousness and ingenuity in delivering projects to specification and on schedule make good reading. The interest in practical projects is further underlined by the interest in the presentations at ILMF and various UAV conferences, as well as the annual awards of MAPPs (the Management Association of Private Photogrammetric Surveyors).

The sharing of information about practical projects is a critical component if industry, whether system suppliers or photogrammetry and remote sensing practitioners, is to remain highly committed. This point is worth emphasising. I could give numerous examples, but three suffice. I have never forgotten Craig Molander's presentation at the 2003 Photogrammetric Week in Stuttgart about mapping companies teaming up to execute a massive United States Department of Agriculture contract (Molander, 2003). More recently, at the 2016 ASPRS UAS event in Palm Springs, Rebecca Morton (the current President of ASPRS) gave a compelling presentation about the trials, tribulations and ultimate success of the first job won by her UAV-services start-up, GeoWing Mapping. There was lively follow-up discussion, featuring quite striking audience participation. Then at ILMF 2017, a presentation by Michael Meiser of Woolpert on lidar data collection in the Kuskokwim Delta, Alaska was equally enthralling. Conference participants and journal readers want this type of material, which perhaps does not fall readily into ISPRS activities.

PE&RS needs to make more effort to attract further contributions in the section which is not peer-reviewed. Maybe one of the drawbacks is the modern trend at conferences to give a PowerPoint presentation, which may become part of the "proceedings", as is the case at ILMF. Private mapping companies and some government agencies are proud of what they have accomplished, but need to be persuaded to take time to write about it.

Christian Hoffmann has already made the point about the industry needing to do better in presenting scientific papers without a sales pitch. However, given that many society publications have doctoral students as lead authors, Christian offers the following reflections on the other side of the coin, namely, perceived negativity towards industry:

What's with students interested in joining a commercial company? Why not a speed-dating event for students and industry getting together? Maybe this is also a topic for the thought leaders at ISPRS: are students prepared and encouraged to take a career in a commercial company? I often see resistance as long as students are working in research, sometimes with a really negative attitude towards commercial companies. After completing their studies, they

miraculously find their love for the industry and apply for a job – but they are not sufficiently prepared. As important as scientific integrity may be, it is also essential that students are prepared for commercial careers.

OUTLOOK

So what is the way forward to greater industry involvement with publications and societies, especially ISPRS? Wolfgang Förstner provides a positive academic's view of interaction with industry:

Universities have the privilege of following natural curiosity within basic research (Flexner, 1939). In an engineering discipline such as ours, the links to industry are natural and can be extremely fruitful. The long and broad bridge between university research and industrial developments needs several pillars to carry the knowledge traffic in both directions.

Ian Dowman highlights two issues for the future:

*(1) Do learned societies and their publications offer anything to industry?
(2) What needs to be done to attract industry to be more involved in society activities?
The main need for IAC is to bring industry closer to ISPRS. Let us hope that this works as it would be a shame if ISPRS moves further towards becoming a learned society for academics alone.*

Stewart Walker notes the importance of industry support in his own role within ISPRS:

My own work as Chair of the Board of Trustees of The ISPRS Foundation is dependent on the willing involvement of the private sector. The recent addition of Ronald Bisio of Trimble to the Board is an example of the readiness of private companies to engage if they can identify with the goals.

Christian Hoffmann looks forward to more industry involvement, perhaps with ISPRS being an arbiter of integrity:

Provided collaboration between ISPRS and industry can be boosted, one could go a step further and promote research laboratories that are industry-funded. Is that something ISPRS could be facilitating to bring industry together with science institutes? Such programmes would define a much clearer direct outcome for the industry (and they exist already). If ISPRS, by being an independent evaluator, could ensure that scientific integrity is not jeopardised, such bilateral collaborations might grow from a solid foundation.

Let us conclude with Franz Leberl, who set the ball rolling for this Editorial, with his views on industrial involvement of ISPRS:

Globalisation, a higher innovation dynamic, computer vision, commercially-focused technical events, plus a plethora of websites, commercial magazines and journals, are a fact of life. An ISPRS response to these changes must be found. One unique selling proposition remains this intersection between academia, industry and the national mapping agencies (and global geospatial data providers for the location-aware Internet and for navigation in vehicles). Is this sufficient to draw industry towards ISPRS events?

ISPRS must broaden its appeal, of course, and the industry is an obvious target. For this, conference participants must include managers with purchasing authority. A look at the most successful competing events will be helpful in this regard.

RECOMMENDATIONS

Our contributors have pointed to the vibrancy and popularity of events such as the Esri User Conference and Intergeo. They are aware of professional conference organisations without any learned-society association (such as with lidar and UAVs), and have noted the plethora of industry-slanted magazines. The following are offered as suggestions for discussion:

- (1) Ensure that everybody understands the unique selling proposition of ISPRS events, namely, the interaction between industry, academia and government.
- (2) Plan ISPRS events to emphasise a major annual meeting which rotates between regions and, ideally, in the same cities. Examples might be Asia (Beijing), Europe (Amsterdam) and North America (Baltimore), and could be held in conjunction with other organisations (such as ASPRS at the Baltimore venue).
- (3) Be very clear about the differences between geospatial innovations/applications and computer science innovations (vision, graphics, databases).
- (4) Generally publish separately for a scientific audience (with a focus on impact factors) and for the geospatial industry (with a focus on commercial developments and advertisements). However, it is possible for a single publication to have two clearly distinguished parts: (i) peer-reviewed research papers; and (ii) non-reviewed industry and applications reports.
- (5) Have the global outreach of ISPRS (which exists today) reflected in a fellowship programme, project support, award structure and regional events, but abandon the desire to be everywhere on all occasions.

CONCLUSIONS

The Editor extends his wholehearted thanks to our five expert contributors for their insights into photogrammetry and industry. The length of this Editorial is exceptional, but it is hoped that this is justified by the thought-provoking views it airs. It must be emphasised once again that the headings and subdivisions were selected by the Editor by collating common themes *after* receiving all five contributions. The Editor also has sole responsibility for the order and choice of content in the hope of providing a coherent flow of views for our readers.

Much of the content of this Editorial has been directed towards the choices facing ISPRS in its future relations with business and commerce. Industry remains a pillar of ISPRS: the argument is over degree, attitudes, enthusiasm and willingness to interact.

A final reflection is offered concerning the mutual benefit of constructive collaboration between commercial companies and academic research scientists. Wolfgang Förstner, in his contribution in the “Outlook” section, has brought to the Editor’s attention the article by Flexner (1939). Part of this treatise concerns a conversation between Flexner and George Eastman, the entrepreneur who founded the Eastman Kodak Company (of great historical relevance to photogrammetry). Flexner relates:

I ventured to ask him whom he regarded as the most useful worker in science in the world. He replied instantaneously: “Marconi.” ... I shall not forget his astonishment (when) ... I replied to him ... “Mr. Eastman, Marconi was inevitable. The real credit ... in the field of wireless belongs ... to Professor Clerk Maxwell, who in 1865 carried out certain abstruse and remote calculations in the field of magnetism and electricity. ... The scientific problem

still remaining – the detection and demonstration of the electromagnetic waves which are the carriers of wireless signals – was solved by Heinrich Hertz, a worker in Helmholtz’s laboratory in Berlin. Neither Maxwell nor Hertz had any concern about the utility of their work. . . . What did Marconi invent? Merely the last technical detail . . . almost universally discarded.”

However, Gardiol (2011) notes that Hertz only managed to transmit signals about 5 m whereas Marconi eventually broadcast across the Atlantic Ocean. Many claim that Marconi: . . . only took advantage of other people’s ideas to start a commercial venture. Marconi himself agreed that he had made use of known ideas . . . academic researchers were not looking for applications . . . none of the transmitters developed by others at Marconi’s time would have been able to transmit messages further than 100 m. . . . If Marconi became so famous, it is . . . because he took wireless out of the lab and into the wide world.

Surely the message is that industry needs scientific research, both pure and applied, but that scientific and technological research also needs industry to put ideas into practice in the real world. The Oxford English Dictionary defines “symbiosis” as *a mutually beneficial relationship between different people or groups*. Is symbiosis not the message of this extended Editorial?

Feedback

It is hoped that this Editorial will act as the basis for further discussion. ISPRS I²AC is an obvious forum but the Editor would welcome comments on this topic of photogrammetry and industry from our readers, who are reminded that the *Record* still maintains a Correspondence section to air further views. Our more academic contributors are all elderly and, although this Editorial has benefitted from their vast experience, they have themselves admitted that it would be interesting to hear the views of younger researchers in both academia and industry. Such contributions would be particularly welcome and may indeed provide a different perspective.

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