



on Photonics

Minutes

20th MARCH 2018, 14:30 – 15:30 hrs.
Portcullis House, Room O

Attendees: Carol Monaghan, MP; Chair APPG on Photonics;
Iwan Davies, IQE; David Leigh-Pemberton, representing Edward Vaizey, MP; John Lincoln, UK Photonics Leadership Group; Nick Martin, BAE Systems; John Parsons, Thales UK; Philip Pratley, Leonardo Systems; Craig Steele, SNP; Alex Stewart, Oxbotica

Excused: Joanna Cherry, MP;

Minutes taken by: Karin Burger, SPIE Europe

Chair Carol Monaghan welcomed the participants. Photonics has a footprint in every constituency in the UK, so it is good to see that all areas are covered by the guests.

Presentations by Industry representatives:

Oxbotica:

Oxbotica is a developer of fully automated vehicles. Their Customer base includes three of the top 10 car companies. The company is not just about UAVs which currently translates into self-driving cars, but pursues the bigger picture, which includes large mining vehicles, on-road, off-road, and even off-planet. Self-driving should be defined as anything that moves. The customers are end users of lidar technologies. The value of the lidar equipment in the self-driving car is £80-100,000, around 3x the value of the car. Lidar enables robots to actively perceive the world in 3D. A company called Velodyne is the largest company for lidar sensors and is the leader worldwide. Those lidars are very old technology; Oxbotica is excited about this APPG meeting, because UK is a leader in photonics research and robotics. Combining the two should result in the UK becoming a leader in lidar; UK needs to recognise that this is important and needs to make it happen.

BAE Systems:

BAE Systems is a big multinational company; its UK business makes large military platforms, ships, submarines. It is less well known that all of these use photonics and success depends on this. Electronic Systems division represented here is slightly different, as it provides equipment to go on

platforms. Key products include advanced cockpit displays, head up display helmets (as used on Typhoon aircraft), the next generation of which is in development, and highly dependent on photonics; embedded sensors are in those devices. This division also manufactures flight control systems in aircraft, including for Boeing 777. Connectivity of between these systems is also increasingly using photonics (optical fibre) rather than wires and copper, saving weight. This allows to introduce new dimensions of control of aircraft architecture. The division works closely with BEIS to foster development more autonomy into those systems, flight deck, aircraft, all of which depends on sensing and Artificial Intelligence. Enhanced safety resulting from this is a benefit; longer term aim would result in fewer crew on aircraft, which is an economic driver for airlines. The goal of autonomous flights is still a long way off, but is being pursued. Having enhanced vision system can allow airlines to land in airports without full infrastructure when normally they would have to divert. If BAE systems is to access the civil aviation world, the industry needs lower-cost sensors, good choice in supply chain; the industry wants to buy British (US supply comes with ITAR caveat, and restricts exports). BAE is heading towards more intelligent & autonomous systems which drives need for sensors and is interested in adjacent markets; advanced photonics sensors for next gen products and platforms is on everybody's mind. Accessing UK supply chain is very important.

Thales:

Thales is a large French Headquartered company, which employs 600,000 in UK. The area covered by the company's is very broad and not limited to just defence; French HQ does seat-back entertainment on 838 airplane; Thales UK covers military defence platform to fly autonomously; integration into whatever platform in the normal world is important. The UK branch also produces autonomous ships, includes sonars. The photonics capability is based mainly in Glasgow, and supply equipment to BAE Systems air, sea and land platforms. As an example, Thales already produces thousands of laser range finders, are working on drones and have lidar systems working to look through clouds etc. The future challenge is to scale down the cost and increase the volume of these technologies for the autonomous automotive and civilian aerospace industries

Leonardo Systems

Leonardo Systems has an extensive portfolio of radar capability in UK. In lasers, there is a large capability in laser designation and laser range finding and in broader optoelectronics capability is sensing and protective capability; critically dependent on Infrared sensing capability based in Southampton. Not just applicable to defence the latter is used in BBC and ITV nature programmes BBC Africa, Springwatch, Big Cats and will be vital for future autonomous vehicles

IQE:

IQE manufactures compound semiconductor wafers, which are at the bottom of supply chain. Headquartered in Cardiff, the company operates multiple international locations, and is expanding in Newport, Wales. The company reported today increased sales of 26% globally, of which roughly 1/3 are now photonics. This has grown from 10% in three years. Photonics is nearly 100% of business in the UK. The new facility in Newport will be ten times bigger and have the capacity of 10:1 for manufacturing wafers. In 2017, Photonics business increased by 190% in IQE; in the latter half of 2017 even 160% compared to 2016. IQE has a very good relationship with the Welsh Assembly, who supported creation of both the Compound Semiconductor applications Catapult and a new Compound Semiconductor Institute in Cardiff University, support the development of the world's first compound semiconductor cluster in South Wales.

IQE is passionate about establishing a UK supply chain. Of its UK sales 90% are currently exported. If supply chain was supported, they could supply into UK more. Lidar for autonomous vehicles is one of

biggest if not the biggest growth area. IQE feels they have the technology to provide sensors for lidar; they also have similar technology for other aspects like environmental monitoring, detection of chemicals, etc. There is a very big market pull in 3D sensing. The largest recent growth has been driven from smartphones employ 3D sensing, facial recognition using IQE wafer manufactured in South Wales, and this is probably one of the main reasons why the photonics business has grown. Connectivity (chips in smartphones) is also very important.

Materials technology, getting supply chains in place, using right tools & mechanisms, grants, other challenges are only some of the key elements. Another of the key element, which helped IQE to get to where they are today, are Pilot lines to drive scale. For example an Eu funded pilot line project with Phillips enabled IQE to demonstrate it was viable to scale from small to large the large volume , crucial to explore these opportunities.

Photonics Leadership Group

The real opportunity is to mix the people here together. According to the Economist, lidar sensors are still too expensive to put into cars; the car market is 2 trillion USD; market for personal transport is 10 trillion USD; photonics components need to work together to succeed.

Discussion:

Monaghan: Can industry representatives comment on the incident in Texas in which an Unmanned Autonomous Vehicle (UAV) killed a woman?

Oxbotica: The U.S. authorities for road safety have opened investigation; because it is a UAV, they have all data from all systems on board the car and will find the underlying cause of why it happened. We do not know how the car was designed, most recent news indicates that the police chief did not think the UAV or its driver were at fault. Over 5,000,000 miles have been driven by autonomous vehicles in the USA is almost without incident; in contrast, in 2016 6,000 pedestrian died in regular traffic accidents. In a modern car road accidents aren't caused by mechanical failure, but in. by people, a problem addressed by autonomous vehicles.

Monaghan: Where is the volume of data produced as a result of UAV captured? If everything was to become autonomous, do we have capacity to capture & process data?

Oxbotica: Uncompressed, the data capture results in about 8-10 terrabytes/day from one vehicle, due to capture of high rate camera data. Lidar data is comparatively sparse. We are able to capture & store information, and store everything for some time. The decision to store or not depends on what is important to the company. Companies need to be selective about data to be stored.

Monaghan: Is it correct that BAE gets rid of wires to lose weight?

BAE: The modern Typhoon aircraft collects a huge amount of data; diagnostic ability is built into system giving a $1/10^9$ probability for errors. Military aircraft tend to store data on board, whereas a civil aircraft has a lot of data beamed to and from it; eg. Rolls-Royce monitor engines constantly so they know exactly what maintenance is needed when aircraft lands.

Monaghan: BEIS is looking for pull factors; how do we overcome that?

Leonardo: Because of the way research is funded, government scientists are not exposed to technology in development phase.

- PLG: Strong resistance in BEIS to visit supply chain “would love to meet industry, but can’t leave London.” Photonics get dismissed as Technology Push, because it is so broadly enabling
Will having Innovate UK within UK RI improve that? Possibly. Devolved admins slightly more flexible and taking ownership of their region.
- Monaghan: Is it worth writing to Greg Clark about this “we’ve had this raised, is there a process to encourage visits in companies”?
- PLG: Innovate will re-structure around four pillars of industrial strategy; currently no place to place enabling technologies, which cuts across all of the pillars. Where enabling technologies will be supported is extremely important.
- BAE: BEIS feedback: their contacts are in the Aerospace growth partnership. The Aerospace Growth Institute reports UK Aerospace strategy and UK roadmaps. BEIS are incredibly interactive there, a much more positive example. Aerospace is “more sexy”.

Chair Monaghan called the meeting a close and thanked all participants for their time.

Minutes taken by Karin Burger, APPG Secretariat/SPIE Europe Ltd