



What will civilian drones look like in 2035? A panel discussion

Moderated by Co-Chairs Adam Holloway MP and Baroness Vivien Stern with:

- **Elaine Whyte**, Director and UK Drones Leader at PwC. Whyte is part of PwC's Intelligent Digital team and a member of the PwC UK defence team.
- **Dr. Yoge Patel**, CEO of Blue Bear Systems Research, maker and designer of drones. With more than two decades of experience in aerospace, she sits on multiple tech and defence boards.
- **WO2 Simon Baker** works on Unmanned Air Systems (UAS) and Counter UAS in the Trials and Development Department of the UK Army. Baker is an UAV military pioneer, has held command, control and intelligence positions, and is the expert on UAVs in the initial working groups on Smart Cities.

Elaine Whyte: Skies without limits

Already, drones are used by some companies to provide services at a lower cost and risk than manned methods. As technology enabling surveillance and inspection matures, drones can be used to monitor infrastructure, provide large scale security surveillance with fast reaction time, monitor agriculture, provide support in the planning and exploration stages of mining as well as transport people and goods. (Today, drones are used to inspect oil and gas platforms.) Coupled with artificial intelligence and deep machine learning, information can be processed rapidly, from the big picture to detail.

PwC asserts that drones have the potential to contribute £42 billion, nearly 2% of GDP, to the UK economy by 2035. This contribution will come from manufacturers, designers, security specialists, lawyers, insurance and consultancy, to name some. By 2035 drones will not only surveil the Palace of Westminster, but the entire city. They will graduate from the occasional inspection of oil and gas platforms to surveilling transmission lines across the country, automatically sending back information and reporting on faults. Moreover, we could take advantage of the empty space above the Thames or train tracks to transport goods and people, alleviating the congested London roads.

To reach the potential of a £42 billion drone economy, three areas will need to change. First, technical advancement will have to ensure against negatives, such as accidents, noise pollution and that drones carry out their tasks with precision. Second, the regulation must expand and ensure safety. However, the fact that drones already have a regulator - unlike other emerging technology - is a benefit. Finally, it is essential to increase the social acceptance of drones.

Dr Yoge Patel: Can the UK be a world leader in the drone market?

A decade ago, the UK were ahead, but now we are lagging behind. In 2018 there was a massive expansion of the use of civil drones, from the delivery of medicines to remote



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places, to search and rescue. Moreover, there are even more opportunities, from agritech, to energy, inspections, maintenance robotics and parcel delivery. Capacity and efficiency drive the development of urban, aerial vehicles. Like most developed countries, the UK should aim to have unmanned cargo transportation by 2025, because it is essential to deliver the demands of the population and it is a multi-billion pound market. Transportation by air has many benefits, it is rapid, convenient, safe, cheap and can access hard-to-reach places. In order to accomplish this, new infrastructure, more regulation, work on harmonisation and government endorsement is crucial. Safety is crucial to the expansion of the drone industry. Whereas a 100 years of aviation and harmonisation provides the foundation, the creation of an ecosystem that can approve technology for all platforms and equipment, removing the sector specific regulatory bodies, would significantly speed up the approval process.

Drones are the latest manifestation of a human drive to see where engineering can take us. Since the very first aircrafts, there has been a move towards a single European sky, hopefully complete by 2025. This will make the operation of drones easier. A profitable UK market should look to move 95% of the supply chain to the UK. Today competitors, like China, are able to turn-around a product in 3-6 weeks, a timeframe the UK is unable to match unless production is moved. British companies need to move into the plug-and-play business by manufacturing accessories that are compatible to all drone. In the UK alone, sensors and cameras form a multimillion dollar market, multi-billion in global market. Export will have to be an important platform, as domestic demand is too small to sustain the business. This process will start from government endorsement, as Obama did in the US. In addition to innovation in technology, process, autonomy and AI, - the UK is innovative and good at managing risk - safety is an important marketable commodity.

To enable a profitable UK drone market, the industry and government should support the development of a traffic management system, harmonise industry standards, testbeds, training and safety, and improve infrastructure, including the protection of no-fly zones and landing platforms.

WO2 Simon Baker: drone capabilities and counter-drone technology

The idea of using drones in smart, as well as regular, cities, is driven by a wish to protect humans and reduce the financial and time costs. Smart cities are designed to use existing or slightly modified technology to tackle current problems. Surveying an area is cheaper and transporting medicine from one London hospital to another faster, with the use of drones. Moreover, the risk of human harm is lower. Today, the police, fire service and communication services use drones. Going forward their use in communications will increase. High bandwidth is dependent on a line sight connection. The deployment of a drone high above all geographic structures will provide communication at a much faster rate than building a mast. Tether drones, linked to the ground, will enable drones to provide surveillance or communications to an area over a long time, circumventing the small onboard battery. All of this technology is in service, or very close.



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Current systems are limited by the size of payload they can carry. Maritime or mountain rescuers for example, use small payloads - 5-10kg - to provide lifesaving equipment to victims. As soon as the hardware changes, military and emergency services will be looking towards drones carrying out casualty extraction.

There is a massive overlap between civilian and military use cases, which are both about surveying, or transporting an object, in an area rapidly and with precision. Only the payload differs the two. This is also true for the commercial market.

There are two strands of counter-drone measures; detect and track, and; affect or defeat system. Today radars and radio frequency direction finding and human detection are both used. The latter is most successful, especially when accompanied by artificial intelligence and machine learning. Electronic jammers, nets and kinetic options are used to effect or defeat the systems, but all face problems. If the drone is off-the-shelf, jamming it essentially means jamming a network used by many people and services. A kinetic approach is not without problems either. If successful, the drone will fall from the sky, and if unsuccessful, the ammunition will. The most effective approach is therefore through cyberspace, by taking control of the platform.

Questions and Answers

When thinking about transporting goods internationally, what can we expect to be the future payload of drones?

Dr Yoge Patel: Today you can carry payloads from several grams, people are building vehicles that can transport tonnes.

What are the major barriers of societal acceptance?

Elaine Whyte: Standards and how we operate are key. Most important however, is that people see the good use cases, such as drones used by emergency services to rescue people.

We've had very little discussion on about standards, how important is this for the industry?

Dr Yoge Patel: Group standards are absolutely key. We already have guidelines from the CAA and MAA, but there is a gulf in standards that needs to be developed quickly.

Where is the priority within the UK ecosystem?

Elaine Whyte: I don't think you can outline a priority, as systems are interlinked.

Dr Yoge Patel: Testbeds. The challenge in the UK is not to build drones, it is to test them, including beyond visual line of sight.

Do you believe the government or the industry have the will to develop the changes necessary to achieve this development by 2035?

Dr Yoge Patel: Every change introduced internationally has met resistance. I am reminded that when the car was introduced, a man with a red flag had to walk in front of it.



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Neither of the talks includes security and the realm of possibilities for criminality and terrorist use of drones. Does the 42bn you talk about include criminal activity?

Elaine Whyte: It doesn't include criminality. However, the APPG is hosting an event on terrorist use of drones in the next months. Security is a big issue, especially cyber security. If people want to break the law, they will.

How do we square the societal acceptance of automation or autonomy and the difficulty of coordinating the nefarious use of that type of technology?

Elaine Whyte: The answer is test beds, demonstrating the safety of this technology but it is actually having the systems that support it, being able to show best use cases that gradually build the 100 years experience of aviation that we can translate to over into the drone world.

What is the range and endurance of drones today and in the future and what will they look like?

Dr Yoge Patel: Today a minidrone has an endurance of about 90 minutes, the next generation will be able to fly for 20 hours. You can expect similar markups on large drones. If we get urban mobility right, I expect, in the future that, like cars, you will have very human-centric vehicles that are tailored towards different preferences.

Are there any lessons learned from massive US companies like Amazon and Google?

Elaine Whyte: They have got to share it for us to learn it.

Dr Yoge Patel: Remember, Amazon and Google are both in the UK because they want to get the regulation sorted in the UK before they move to the US. That is something we should listen to, we are seen as *the* country that can lead on regulation.

You touched upon the importance of people, training and adapting their skillset, how do they have to change and who will be operators?

WO2 Simon Baker: I will offer you a bit more of my experience. The default by the civilian and military aviation authorities are that you must adhere to the rules of manned aircrafts. As such, it makes sense to retrain pilots. We will have to prove why the manned aviation rules don't apply to unmanned platforms, even when they are simple platforms conducting small tasks. There needs to be a societal acceptance across the board. The public, regulatory community, decision-makers and government all need to be dragged along.

Dr Yoge Patel: I think we will have more Xbox players operating swarms of drones, because that is where technology is going.

What are we doing when it comes to collecting and using data, to ensure we don't play catch up at a later date?

Elaine Whyte: I'd add on the skillset, we are thinking very much about hardware here, we also need to mention the software and what we do with that data because the drone is almost the gimmick from today's perspective and getting that bird's eye view, but actually it is what you do with the data that is collected and how you exploit that from a business perspective where the real value is, leading to a new wave of jobs.



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Baroness Stern: Do you think that by 2035 all the narrow-minded and boring people who think, and the people who like to see the sky and the trees, and not something flying and blocks the view of the street, and the idea of somebody flying over my back garden, might, do you think that all the people who think like that may be extinct?

[A lot of laughter]

Elaine Whyte: How do we stop the doubters? Is there anyone in this room who hasn't got a smartphone? We have them because they are useful, convenient, sometimes a pain, but they are now part of our lives. I think by 2035 drones will be a part of our life because we will see the benefits they deliver for the way that we live.

Final remarks

Dr Yoge Patel: We already have manned aircraft, and unmanned are on the doorstep. Unmanned technologies, if we get them right and provide automation and autonomy, this can be used on manned and unmanned aircraft. Why not enhance and improve the capacity of vehicles we use today?

Elaine Whyte: Look out for good news stories, of someone who got rescued much faster because of a drone, and share them. Let's increase awareness of good news stories, and put Gatwick behind us. Drones are a technology that can be used for good.

WO2 Simon Baker: We talk about new hardware, but if the software is developed first, we should think about how and if this can be applied to existing platforms. Second, when I talk about safety, it is the system of systems. Both that the hardware is safe and not going to fall out of the sky, and that the software is safe, including the data. This links back to societal acceptance. People think that if you are flying a drone, you must be peering at them and collecting data of them. Unless you are doing something wrong we [the military] probably are not, although I cannot speak for the commercial world. If we do accidentally collect data, it is deleted.