HERE COME THE DRONES

Engineers are rapidly developing systems to manage the flight of drones that need to be integrated into existing air traffic control infrastructure

By Andrew Williams

Drones can occupy the same low-altitude airspace as manned aviation, particularly when flown close to airports - where aircraft take off and land - and in urban areas with dense helicopter traffic.

In recognition of this, there is now a pressing need for unmanned traffic management (UTM) and Air Traffic Control (ATC) systems that eliminate any potential conflict between drones and manned aviation. So, what actions need to be taken to integrate, manage and control drones in the national airspace? In what ways do radar and ATC systems need to change to incorporate drones and combat rogue devices?

Practical Solutions

Recent drone incursions at airports, such as those that occurred at London's Gatwick and Heathrow Airports, and New York's Newark Airport, have led to significant disruption. The incidents caused hundreds of cancelled and delayed flights and affected thousands of passengers the commercial aviation industry is keen to avoid.

If a drone is sighted near an airport and cannot be identified, manned aircraft flights have to be suspended because the planned flight path of the drone and the drone operator's intentions are unknown. Ben Marcus, co-founder and chairman of the drone digital infrastructure and standards company AirMap, says, "Most drone operations are safe and lawful. However, measures must be taken to ensure that all drone traffic is safely managed through comprehensive UTM [Unmanned Traffic Management] systems," he says.

According to Marcus, two practical

Main pic: An autonomous version of SkyWall that can be mounted on a vehicle is under development

Right: The SkyWall 100 is fired from the shoulder and launches a net to capture a rogue drone

solutions that civil aviation authorities (CAAs) and air navigation service providers (ANSPs) can implement immediately to address the use of drones in their national airspace are registry and remote ID. He believes measures such as drone and operator registration, attestation and authentication are also essential to safety and accountability.

UTM systems require registered operators, remote pilots-in-command and aircraft. They also require equipment that has standardised digital interfaces and need to be integrated with national drone registries. The creations of interoperable, networked remote ID solutions will allow CAAs, ANSPs and law enforcement organisations to remotely identify and track drones.

"Real-time tracking and visualization of manned and unmanned aircraft operating in a given low-altitude airspace is essential for safety, deconfliction between unmanned and manned aircraft and drone flight plan conformance monitoring," says Marcus.

"Pleasingly, some steps are now being taken, with EASA recently publishing a common set of rules for the use of drones, including a requirement for the majority of drone operators to register before using one as of 2020," he adds.

Integration and automation

Meanwhile, Yariv Bash, CEO at Israeli drone technology supplier Flytrex, believes that for drones to be integrated into national airspaces it is key that the vehicles and the air traffic system have an integrated detect and avoid (DAA) system that can deal with manned aviation. An example of this is the Low Altitude Authorization and Notification Capability (LAANC) system, a system being developed in the USA by the FAA and private industry to facilitate the sharing of airspace data.

"This initiative gives drone pilots access to controlled airspace at or below 400ft and

Measures must be taken to ensure that all drone traffic is safely managed through comprehensive UTM

Ben Marcus, co-founder and chairman of the drone digital infrastructure and standards company AirMap

provides visibility into where and when drones are operating. It also enables drone operators to receive approval for flights, often within minutes, in controlled classes B, C, D, or E airspace," says Bash.

Elsewhere, anti-drone technology company Chess Dynamics has integrated its AirGuard and AirShield counter-UAV systems into existing ATC monitoring systems. The systems automatically detect and track UAVs and provide real-time information to facilitate security responses depending on the requirements and existing protocols of the airport operator. If a drone is detected, the system can automatically notify airport security and the police or even trigger physical capture systems (see box).

According to As David Eldridge, sales director at Chess Dynamics, "These automated alert systems minimise potential disruption and, importantly, maintain the safety of inbound and outbound aircraft," he says.

"Our systems use proprietary technology that enables multiple sensor cross cueing and automatic target classification, reducing the burden on the operator," he said.

PHYSICAL CAPTURE

UK-based OpenWorks Engineering has developed a range of systems that allow security and defence organisations to physically capture small drones using a net fired from either a shoulder-mounted launcher or a turret-like installation. A key feature of the systems - known as SkyWall - is their ability to capture a drone with minimal damage to both the unmanned aerial vehicle (UAV) and the surrounding area by using a net.

The SkyWall systems are deployed with electronic counter-measures to provide a layered defence that is effective against drones which cannot be jammed. The systems can also be deployed independently in environments where electronic attack cannot be deployed because of interference, such as airports and critical national infrastructure sites.

SkyWall100, which fires a net using compressed air from a shoulder-mounted launcher, has been operational for several years and is used at airports, power stations and other critical infrastructure sites across Europe, Asia and North America, including at the Pentagon. SkyWall300 is a remotely operated version that resembles a turret.

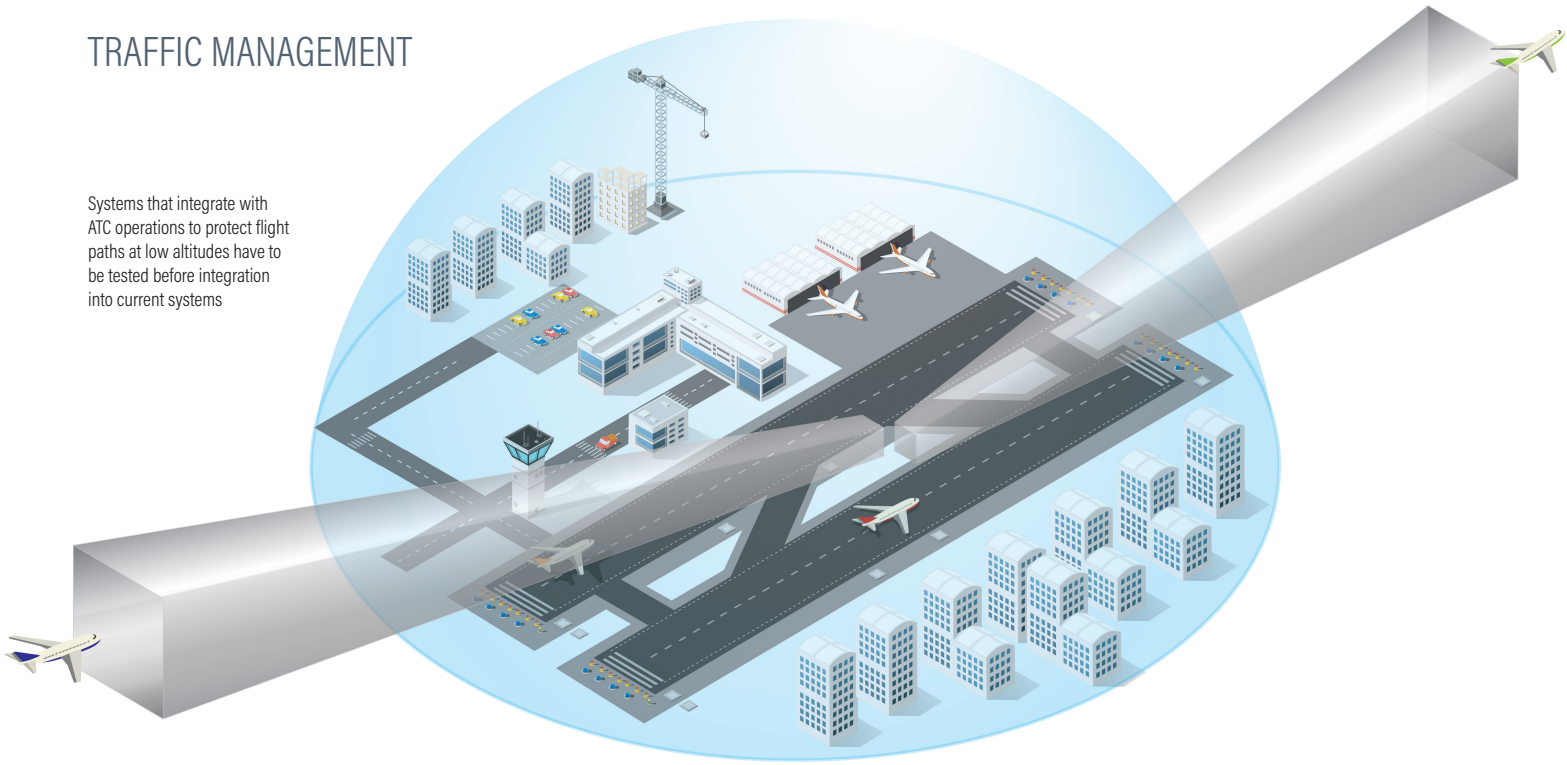
Andrew Charlton, business development and technical sales manager at OpenWorks Engineering says, "SkyWall300 can be used standalone or integrated with a drone detection and a command-and-control system to offer a highly capable and easy to operate counter drone solution. We have already completed integration projects with some of the world's leading full system and detection providers," says Charlton.

The latest development is for SkyWall300 an auto reloader, which when integrated with a drone detection and security system provides a fully autonomous anti-drone solution able to target multiple threats. The use of multiple SkyWall300s offers the capability to defend against a drone swarm. A SkyWall300 vehicle mount is also now in the build phase and planned for completion before the end of the year. "This system is ideally suited to the protection of critical national infrastructure, especially airports, where a vehicle can be rapidly deployed to an area to extend a defensive position - for example at one end of the runway," says Charlton.

Although SkyWall100 is already in use testing activities to enhance its capability are ongoing. SkyWall300 has also been "extensively tested", says Charlton at a variety of military events in Europe and North America and is "likely to see its first operational deployment before the end of 2019".

"SkyWall300 has completed testing and two production units are being built, with one of these expected to be operationally deployed before the end of this year," says Charlton. "Future development of the systems will include an extended range projectile (SP40-ER) that will be manoeuvrable in flight with the capability to capture drones at ranges potentially in excess of 1,000m."

SkyWall physically removes a rogue drone without destroying it



Systems that integrate with ATC operations to protect flight paths at low altitudes have to be tested before integration into current systems

ATC Changes

According to Marcus, traditional air traffic management (ATM) systems are not designed to handle the scale and complexity of hundreds of thousands of drone flights a day. Moreover, when drones rely on digital information and services for automated decision-making related to flight planning, execution, and deconfliction they are not suited to be directly integrated into ATM systems. He agrees that a UTM solution should provide the bridge between manned and unmanned aircraft and fulfil obligations about registration and authorisations.

"Ultimately, a UTM platform brings safety, efficiency and scalability to drone traffic management in order to help countries realize the full economic and societal potential of complex, high-volume commercial drone operations," he says.

Meanwhile the aviation authorities continue to develop regulations and standards to ensure that drones stay within their designated operational areas and away from manned aviation. The FAA for example, is attempting to do this through regulating drone design and manufacturing in a similar way to how manned aircraft are constructed. Simultaneously it is working on an ID system for recreational drones and collaborating with drone manufacturers to developing geofencing features that will trigger an action when a drone violates a restricted flight zone'

"These restrictions on recreational drones are what will really move the needle regarding widespread drone use, as off-the-shelf UAVs pose a greater risk of going rogue than those flown by certified commercial drone operators, who adhere to strict operative and maintenance standards," he adds. ❖

THE DRONE OPERATOR'S PERSPECTIVE

According to Gavin Wishart, chairman of the Association of Remotely Piloted Aircraft Systems UK, drones operating in a controlled airspace must be clearly identifiable and able to react to ATC instructions as manned systems, as well as to follow similar emergency procedures in the event of occurrences such as system failures. As is the case with manned aviation, unmanned aerial systems need to fly accurately within defined tolerances, react in a timely manner to ATC instructions and meet the demands of the associated operational requirements.

Wishart says, "When drones operate in uncontrolled airspace, the same rules apply as to manned

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aviation, and approvals need to be sought from the aviation authority. The key element here is the detect and avoid system they use. It needs to be demonstrated to be at least as capable as manned see and avoid capabilities."

However, Wishart does not believe that legally-operated drones pose a greater risk to life than other forms of aviation - and argues that the opposite is probably true because more dangerous flights can be conducted without any crew.

"The problem posed to other forms of aviation is that drone operations are more cost-effective than manned flights as well as potentially safer, because there is no second-party risk," he says.

As far as necessary changes to national airspace are concerned, Wishart believes airspace capacity is only constricted around key airports and some upper air corridors, "where technology limits what can be assessed as safe separation distances". Nevertheless, he admits the integration of a large number of additional aircraft, such as drones, into the airspace will require a "radical change in how we control and deconflict traffic and maintain safe separation".

"It is clear that voice enacted management is not sustainable and can be imprecise. We therefore need to consider more automated systems and artificial intelligence could well have a useful role to play here, if we can build confidence in such systems as well as assure their integrity levels," he says.

"In the short term, before approved detect and avoid systems become the norm, there may be an opportunity to allocate a discrete flight level for drone operations to reduce the mid-air collision risk with manned aviation," he adds.