Te Matataua

Issue 4, Jan 2017

RNZAF

Air Power Development Centre Bulletin

Counter UAS Technology

"Now, these pilots, just to give you a little colour on this, fly six days in a row. They are working 13 to 14 hours a day on average. And to give you a contrast, an average pilot in one of our manned Air Force aircraft flies between 200 and 300 hours per year."

State of the Air Force press briefing by Secretary James in the Pentagon Briefing Room, 15 Jan 2015.

The basis for development of pilotless aircraft came from the Sperry gyro stabiliser, or automatic pilot, developed in 1912. This technology led to experiments with pilotless aircraft in America and Britain as early as 1915. The Earliest American effort was the Sperry aerial torpedo that used a gyroscope and barometer to provide direction and altitude corrections.

The British began by developing radio control pilotless aircraft as aerial targets and to drop bombs on enemy forces. More investment and development continued through the 1920's and 1930's producing the Queen Bee and Queen Wasp landplanes and seaplanes that could be recovered and re-flown[1].

Fast forward to the current era where the world is awash with cheap civilian radio controlled aircraft operated by children; to small multi-rotor drones fitted with stabilised cameras used for land surveying, videography, to delivering parcels to private addresses. The first fully autonomous flight of an aircraft (from take off to auto landing) in NZ was conducted using the DTA developed Kahu aircraft in February 2007.

Military developments in small aerial drones, large Uninhabited Aerial Systems (UAS) and Vehicles (UAV), and long-range Remotely Piloted Aircraft Systems (RPAS) are technologically advanced and underpin many operational capabilities. For ease of reading, all references to UAS, UAV, drones and RPAS have the same meaning.

The primary air power role of UAS aircraft is surveillance and reconnaissance. This can take the form of a small hand-thrown aircraft looking over a hill in support of an army offensive, videoing military exercises for training purposes, or detecting insurgents massing to attack a forward airbase. Larger UAS are used for long duration maritime surveillance of a country's exclusive economic zone or reconnaissance of enemy activity in urban or remote territory. Some UAS aircraft may be armed to strike an enemy position in a timely manner if a target is identified.

From a defence perspective, it is becoming more difficult to camouflage equipment and cover activities from the prying eyes of the enemy. UAS are vulnerable to imagery being hacked in real time by a third party to gain intelligence from another country's reconnaissance missions. Terrorist organisations are starting to use small drones for reconnaissance, using footage of their attacks for media purposes, and there are media reports of terrorists developing simple UAV based improvised explosive devices.

UAS technology, whether cheap, small and crude or expensive, large and advanced, is incredibly diverse and is being exploited at every level of military tactical and strategic operations. The training, support systems and capabilities of UAS is growing fast and over time could be comparable to the time, effort and cost devoted to flying traditional aircraft.

Clearly, there needs to be a range of defensive measures to protect forces from the threat implied by aircraft from the smallest short range drone, to medium sized UAS aircraft, to large high altitude RPAS aircraft.

Passive defensive measures take the form of simple regulations preventing drones from overflying military installations and training areas. Airports in particular are sensitive to drones encroaching airspace as they could collide with aircraft or distract pilots from concentrating on the task at hand.

Active countermeasures include some innovative civilian measures being developed to counter small drones such as using catch nets and training hawks to grab them in-flight.

Large military UAS may be defeated by traditional anti-aircraft weapons. However, a range of sophisticated military counter UAS (C-UAS), or

Anti-UAV Defence System (AUDS) technology focuses on the detection, tracking, identification, targeting, and disruption or attack of all sizes of UAS. Smaller drones present the greatest difficulty of detection and identification as their cross sectional area is very small and they operate at low altitudes.

Deployable radar technology is being developed to detect and track UAS aircraft. When used in conjunction with optical or infra-red imaging technology the encroaching UAS can be identified and monitored and if required it can be disabled or targeted for destruction.

Disabling UAS can be achieved by jamming the radio signals controlling the aircraft and its data transmissions. High energy lasers or radar controlled guns can be used to destroy the UAS. Large complex C-UAS systems are expensive and require significant logistic support and operator training to work effectively. But the cost may be small compared with the personnel and assets they are protecting or the military objective being undertaken.

The Blighter AUDS System[2] is a useful example to illustrate some of the technologies used to counter UAS, though other products and technologies exist that could be equal or superior to this particular product.

The Blighter is a modular system that can be fitted with radar components sensitive enough to detect and track small UAS up to 10km. Operators use high resolution optical and thermal cameras to visually track and identify a UAS detected by the radar. If the UAS is deemed hostile, then the operator can destroy it using a high intensity laser or disable it using directional radio frequency inhibitors to jam data and flight control signals. A promotional Blighter AUDS configuration is shown in the illustration.

C-UAS technologies are likely to spur counter-counter technologies within UAS themselves making them harder to detect and be disabled. Alternatively, swarms of drones may be deployed to overwhelm the protective system.

A new industry is forming and expanding rapidly to develop new technology to defend military and public assets from UAS incursions. The C-UAS market is currently worth about 2.5 billion dollars and that is likely to increase exponentially in tune with the deployment of UAS aircraft. Modular and integrated C-UAS systems provide a comprehensive defence against UAS and are likely to be the mainstay of development. Smaller detection systems will be developed that will be ideal to assist the defence of manoeuvring sections.

C-UAS technologies are important defensive measures, but they also remind forces that their own UAS aircraft are vulnerable to detection and attack. Static and manoeuvring forces need to ensure they can deceive enemy intelligence by ensuring any surveillance imagery cannot identify their true strength, intent or location of vital assets. Military forces must retain the ability to operate safely when their UAS are denied access to the local airspace.

UAS and C-UAS technology is putting pressure on military forces to equip, train and develop doctrine to exploit their own UAS technology and defend themselves from enemy UAS.

Key Points

- Pilotless aircraft first flew in 1915 and continue to develop rapidly.
- UAS are becoming an integral capability of military forces.
- Deployment of C-UAS technology is vital to defend static and manoeuvring forces.

References

1. History of aviation, part 54, Ian Allen Group.
2. Blighter AUDS fact sheet.

RNZAF Air Power Development Centre
RNZAF Base Ohakea
Private Bag 11033 Palmerston North
Ph: 06 3515781 DtlN 368-7781
e-mail: ohapdc@nzdf.mil.nz

AIR FORCE
TE TAUAARANGI O AOTEAROA