PATHFINDER
AIR POWER DEVELOPMENT CENTRE BULLETIN

Issue 8, October 2004

ARE UNINHABITED COMBAT AIR VEHICLES COMING OF AGE?

In late November 2002, a Predator Uninhabited Air Vehicle (UAV) created history of sorts. This UAV—armed with two Hellfire missiles; controlled by commanders in Saudi Arabia; fed data from Washington; piloted from the ground in French-garrisoned Djibouti; cued by observers on the ground—attacked and killed a top Al Queda leader and four of his aides as they drove along an isolated road in north-west Yemen. Does this indicate the beginning of a radical shift in the way aerial attacks on targets of opportunity will be carried out?

MQ-9 Predator with GBU-12

Although the term Uninhabited Combat Air Vehicle (UCAV) was coined barely a decade ago, a great deal of work is being poured into its further development. The largest single effort is the Pentagon-led Joint Unmanned Combat Air System (J-UCAS), budgeted at more than US$4 billion over the next five years.

The original concept of the UCAV was of a small aircraft, stealthy by virtue not only of its shape but also its size, and inexpensive enough to be expendable in high-risk missions. The employment concept was one of being airlifted into theatre from long-term storage for use as the 'first day of the war' assault equipment in short-duration missions, aimed at breaking down enemy air defences to ensure survivability of manned aircraft that would follow.

Recent experiences have impacted on these concepts, mainly because of the difficulty in obtaining convenient air bases. This situation necessitated the UCAVs being designed to have long range and endurance to be able to provide the required persistence over the target area. The classic design feature of small size to enhance stealth, and cost-effectiveness to the extent of it being expendable, were both somewhat diluted in this effort. In addition, UCAVs are also being considered for electronic attack missions, which further increases the overall weight while making them some of the most sophisticated air vehicles—inhabited or uninhabited.

Boeing is working on the X-45C and the X-45CN (US Navy derivative) and Northrop Grumman is developing the X-47B. Both the vehicles are scheduled for their maiden flights in 2006, with operational assessments to commence in 2007. The X-45C is a 16,300kg flying-wing vehicle with a wingspan of 15m, powered by a General Electric F404-GE-102D engine, and capable of carrying a weapon load of just over 2000kg. The X-47B is larger, with a 19,050kg gross weight and a Pratt & Whitney F100 engine.

An interesting concept that is common to almost all UCAV development is that they do not carry any defensive sensors, active countermeasures or decoys. They are designed for range and endurance rather than speed and agility, and are completely dependent on stealth for their survival. There are technological difficulties in enhancing stealth in small vehicles, especially with the positioning and design of inlet and exhaust systems. Another potential problem that is being addressed is in-flight refuelling of UCAVs, because the fidelity (accuracy and responsiveness) of the automatic flight control systems in use with UCAVs is not as good as in manned aircraft. In-flight refuelling tests are not expected to commence before 2007–09.

Currently there are no plans that have been disclosed by any non-US defence agency to produce UCAVs, but in mid-June this year Dassault and EADS have announced plans to collaborate in the development of a European UCAV demonstrator to be named Neuron. Saab and Hellenic Aerospace Industries have also signed agreements with Dassault to be part of the program.

While the technological developments are proceeding at a reasonably fast pace, there are some philosophical and moral problems that operational deployment of the UCAVs will bring out.

X-45A on its sixth test flight - December 2002

From a warfighting perspective, it can be seen that a UCAV will produce data and images that are at the tactical level—live, but at the 'small world' lowest level. There will be an inherent problem of determining how high the data should be allowed to flow upward, considering the purely tactical resonance of the information. Conversely, there will also be a tendency for senior commanders to interfere with the lower levels and operate 'down in the weeds'. This is a philosophically difficult dilemma that will need to be clearly addressed.

From a moral perspective, the first requirement is to be able to assess the proportionality of an attack in accordance with the Law of Armed Conflict (LOAC), which is currently done by the human being at the end of the delivery chain. This basic necessity may place a natural limit to the uninhibited independent development of UCAVs as well as their operational employment. The basic question that needs very clear articulation is the quantum of human oversight that is required for the unhindered operational employment of a UCAV, and how this can be achieved.

The commander of today is perpetually wrestling with ambiguity, despite the increased situational awareness that is provided to him by a plethora of sensors. Conflict has moved on to become a complex arena requiring constant human interference and interface with artificial intelligence. This is ever more important in offensive missions. The level of human interaction required with UCAVs may be different, dependent on the mission vis-a-vis its basic defensive and offensive content. Answers have to be found to both the philosophical as well as the moral issues that will come up with the increased use of UCAVs.

Another human factor issue that designers are grappling with is how to allow one operator to control several vehicles, rather than having multiple people to one vehicle as is the current situation. The legal factors associated with determining the onus of responsibility for misdirected attacks are yet another unresolved debating point. Speeding up the kill-chain while reducing the analysis of available information may have very serious repercussions.

With the enormous amount of resources being made available for developmental work on UCAVs, some of these problems may be solved in the near-term. But a majority of them will take several years to be ironed out, and even then some may continue to be contentious in the operational employment of these vehicles.

"Air power will remain a major instrument of national power well into the 21st century and Australia must maximise its potential."

- Air Marshal Angus Houston, 2004

'Pathfinder' is a fortnightly bulletin from the Air Power Development Centre. Its title is a tribute to the Pathfinder Force which operated within RAF Bomber Command from August 1942. The original Pathfinders were an elite navigational group with the role of preceding each raid and accurately lighting up the target area with incendiary fires to permit visual bombing by the main force. The first commander was Group Captain (later Air Vice-Marshal) D.C.T. Bennett, a Queenslander who trained with the RAAF in 1930-31 before transferring to the RAF, and many other Australians also flew with the force.

The emblem we have adopted is 'Fiery Mo', the unofficial insignia carried on No. 6 Squadron's Hudson aircraft in New Guinea during 1943.

Air Power Development Centre
Level 3, 205 Anketell Street
TUGGERANONG ACT 2900

Ph: 02 6266 1355 Fax: 02 6266 1041
Email: airpower@defence.gov.au
Web: www.raaf.gov.au/airpower