

Unmanned Combat Vehicles: Weapons for the Fourth Generation Warfare

GAURAV SHARMA

The Concept of an Unmanned Combat Vehicle (UCV) is mature; a combat vehicle – an aircraft, ground based, surveillance vehicle which is capable of attacking targets and is recoverable and reusable. Current systems are remotely piloted by a controller and are also responsible for conducting any armed engagements. However future concepts focus on UCV's that can operate with a higher degree of autonomy, and conduct missions with little controller influence.¹ The future will also seek micro-munitions, Directed Energy Weapons (DEW's) and a lot more versatile weaponry inducted into a UCV. Also, the next generation UCV's would be best suited in a '4D' mission environment – the dull, dirty, dangerous and deep. Under-listed are five of the next generation UCV's currently under development for fourth generation warfare:

- First Scout – The first VTUAV.
- Talisman M – Protection against Improvised Explosive Device (IED).
- AvantGuard – Israeli ultimate Unmanned Ground Combat Vehicle.
- Crusher – ISR has never been easier for ground combat.
- Predator C Avenger – The ultimateUCAV.
- Taranis – The ultimate BritishUCAV.

Fire Scout VTUAV



Fire Scout VTUAV, - The first Vertical Take-off and Landing Unmanned Air Vehicle (VUTAV)²

In February 2000, the US Navy chose the RQ-8A Fire Scout as its vertical take-off and landing tactical unmanned air vehicle (VTUAV). Northrop Grumman-Ryan Aeronautical was awarded an engineering and manufacturing development (EMD) contract for the Fire Scout, which would provide situational awareness and precision targeting support to the US Navy and Marine Corps. The Fire Scout programme is being managed by the US Navy's PMA-263 Unmanned Vehicles Program Office at Patuxent River, Maryland. In August 2005, Fire Scout was re-designated from RQ-8 to MQ-8 to reflect its multirole capability, including the ability to deploy weapons. The Fire Scout air vehicle is a Schweizer 333 helicopter based on the proven design of the Schweizer 330 commercial lightweight manned utility helicopter. A benefit of selecting the commercially available design is its established worldwide spares and support infrastructure.

Fire Scout has the ability to autonomously take-off from and land on any aviation-capable warship and also at unprepared landing zones close to the forward edge of the battle area (FEBA). It can carry out surveillance, find tactical targets, track and designate targets and provide accurate targeting data to strike platforms such as strike aircraft, helicopters and ships. The UAV is also capable of carrying out battle damage assessment. The navy is currently using the Pioneer UAV and has 21 Pioneer systems operational on its ships.

An enhanced version of Fire Scout, MQ-8B, is for the Class IV-A brigade level UAV element of the US Army's future combat system (FCS). The MQ-8B has a four-bladed rotor, increased payload capacity to 270kg and more than eight-hours endurance with a 90kg payload. The payload includes reconnaissance, surveillance and target acquisition (RSTA) and target designation capability. The first flight of the army variant was scheduled for February 2011 with initial operating capability in 2015.

MQ-8B air vehicles are common for the US Army and Navy but the payload differs. Baseline payload for the USN includes the FLIR Systems AN/AAQ-22D BriteStar II target designation system with electro-optical and infrared sensors and a laser range finder/designator. There are 15 MQ-8B on order for the US Army and nine for the Navy. Fire Scout also possesses two four-packs of 2.75in rocket launchers to fire advanced precision kill weapon system laser-guided rockets.

Payload for the US Army includes electro-optic/infrared sensors, Northrop Grumman COBRA mine detection system (based on the airborne standoff minefield detection system, ASTAMIDS), TSAR/MTI (tactical synthetic aperture/moving target indicator) radar, four-channel joint tactical radio system (JTRS) and signals intelligence (SIGINT) package. The army Fire Scout has weapons, inclusive of the advanced precision kill weapon system or Viper Strike. Northrop Grumman Viper Strike is a precision munition which has GPS guidance and a semi-active laser seeker.

Fire Scout is capable of "beyond line-of-sight tactical UAV communications relay" (BTCR), and can be used to enable over-the-horizon communications relay, allowing ground troops on the move and battlefield commanders to share uninterrupted voice, data and real-time video. MQ-8B Fire Scout also possesses radar capability and can search, detect, and track multiple targets during a surveillance mission.

Fire Scout programme has been granted the operational evaluation (OpEval) status, with VTUAV completed fully autonomous flight operations onboard the USS McInerney (FFG-8) frigate. Thus the US navy, for the first time, operates an autonomous VTUAV aboard a surface combatant vessel.

Talisman M



Talisman M: The Protection against IEDs:³

The latest weapon to help counter the threat posed by Improvised Explosive Devices (IEDs) and mines in Afghanistan was unveiled by the British Ministry of Defence on 23 June 2010. Talisman was unveiled at the MOD's annual Defence Vehicle Dynamic event at Millbrook Proving Ground in Bedfordshire.

Talisman is a suite of vehicles, operated by the Royal Engineers that clears routes of IEDs and mines. It was bought as an Urgent Operational Requirement (UOR) worth more than £180M.

Each Talisman system consists of:

- A MASTIFF 2 protected patrol vehicle.
- A Buffalo mine protected vehicle, with a rummaging arm.
- A JCB high mobility engineer excavator.
- A T-Hawk micro air vehicle.
- Talon tracked remote control vehicle.

Talisman has been designed as a flexible manoeuvre support capability that can be quickly re-tasked and rearranged to meet different mission tasks, operating independently or alongside other bomb disposal systems dependent on the threat. It is now part of a wide range of tools, techniques and tactics that the British armed forces have to help mitigate the risk from the threat of IEDs.

Avant-Guard UGLV



G-NIUS AvantGuard Unmanned Ground Combat Vehicle

G-NIUS Unmanned Ground Systems unveiled its AvantGuard UGCV to the International Defence Forum. It is a jeep-like robot that takes the place of human soldiers in testing out dangerous territory. Already trialed and certified by the Israeli army the system relies the technological strength and capabilities of the Guardium UGVTM system as well as building on the Tactical Amphibious Ground Support (TAGS) vehicle which provides excellent maneuverability in harsh terrain environments. The AvantGuard UGCV significantly expands the applications envelope to encompass Counter IED (CIED) and ground maneuvering combat missions.⁴

Employing a set of modular payloads such as: Ground Penetrating Radar, Counter IED Jammer, Mini-Pop cooled thermal surveillance camera, Counter Human and Vehicle Detection Radar, AvantGuard can be effectively deployed in a variety of combat missions including: Counter IED, Advance Guard, Armed Sentry, Combat Logistic Support, CASEVAC and more.⁵ It is controlled by a mobile or portable Operational Control Unit (OCU), and can also operate in a Follow-me mode, where it is autonomously trailing a guide-foot soldier or guide vehicle. The rapid and effective integration of the Guardium's autonomous kit to the TAGS platform underscores the robustness and adaptability of G-NIUS' strapped-on autonomy approach.⁶

SCHOLAR WARRIOR

Some of the key system and mission level characteristics of AvantGuard are as listed under:

- Tele-operation or semi-autonomous mission execution with real-time, self-ruling, obstacle's detection and avoidance, proven safe-system and all terrain maneuverability.
- Easy to operate, dedicated command & control application, in complementary operational versions; mobile and portable and also has built-in debriefing and training capabilities with variety of customer tailored wireless communication solutions.
- Modular selection of payloads for comprehensive situational awareness and different mission requirements: EO/IR camera, radar, remotely operated weapon systems, electronic counter measures, Hostile Fire Indicator (HFI), RFID vehicle specification and performance data.
- Engine: Kubota - V3800DI-T; 4Cylinder Turbo Diesel, 100 horsepower (maximum intermittent).
- Hydrostatic Drivers (No Gears or Chain) and a Maximum Speed: 20 kph / 12 mph.

CRUSHER UGCV



PerceptOR Integration:⁷ CRUSHER

The Crusher vehicle was created as part of the UGCV PerceptOR Integrated (UPI) program at the National Robotics Engineering Center (NREC) of Carnegie Mellon University. The UPI program features quarterly field experiments that

The use of overhead data via terrain data analysis will continue to be utilized for global planning.

assess the capabilities of large scale, unmanned ground vehicles (UGV) operating autonomously in a wide range of complex, off-road terrains. UPI's aggressive mobility, autonomy and mission performance objectives required two additional test platforms that could accommodate a variety of mission payloads and state of the art autonomy technology. Crusher represents the next generation of the original Spinner platform, the world's first greater-than-6-ton, cross-country UGV designed from the ground up.

Crusher offers more mobility, reliability, maintainability and flexibility than Spinner, at 29 percent less weight. Crusher has a new space frame hull designed and made from high-strength aluminum tubes and titanium nodes. A suspended and shock-mounted skid plate made from high-strength steel allows Crusher to shrug off massive, below-hull strikes from boulders and tree stumps. The nose was completely redesigned for Crusher to sustain normal impacts with trees and brush while also absorbing the impact of major collisions.

Suspensions support 30 in. of travel with selectable stiffness and reconfigurable ride height. Crusher can comfortably carry over 8000 lbs. of payload and armour. Crusher's hybrid electric system allows the vehicle to move silently on one battery charge over miles of extreme terrain. A 60kW turbo diesel engine maintains charge on the high-performance SAFT-built lithium ion battery module. Engine and batteries work intelligently to deliver power to Crusher's 6-wheel motor-in-hub drive system built around UQM traction motors. A combination of ladar and camera systems allow the vehicles to dynamically react to obstacles and travel through mission waypoints spaced over a kilometer apart. The use of overhead data via terrain data analysis will continue to be utilised for global planning. Over the next year the vehicle will analyse, plan, and execute mobility missions over extreme terrains without any human interaction at all.

As a core building block in the Army's future force, tactical UGVs enable new war-fighting capabilities while putting fewer soldiers in harm's way. The full benefit of this new capability can only be achieved with field-validated understanding of UGV technology limits and consideration of the impact to Army doctrine, personnel, platforms and infrastructure.

Predator C Avenger



Predator C Avenger UAS:⁸

Predator C Avenger was developed through the foresight and funding of GA-ASI with the objective of performing high-speed, long-endurance, more covert multi-mission Intelligence, Surveillance, Reconnaissance (ISR) and precision-strike missions over land or sea. Its unique design, reduced signature, and speed increases its survivability in higher threat environments and provides potential customers with an expanded quick-response armed reconnaissance capability. The first flight of Predator C occurred in April 2009. The aircraft is currently in an expanded flight test program.

The high-speed, multi-mission Avenger is a long-endurance, medium-to-high-altitude Unmanned Aircraft System (UAS) that can perform wide-area surveillance, time-sensitive strike missions over land or sea, and a host of other challenging military missions. The aircraft has much higher operational and transit speeds than the current Predator-series aircraft, resulting in quick response and rapid repositioning for improved mission flexibility and survivability. Avenger is a highly advanced, next-generation UAS. The jet-powered Predator C is equipped with a Pratt and Whitney PW545B turbofan engine capable of producing 4,800 lb installed thrust. The engine is designed for greater fuel economy and features class-leading fuel consumption components. Avenger can operate at speeds up to 400 KTAS, a maximum altitude of over 53,000 ft, and 20 hours endurance. Its significant payload capacity enables it to carry multiple sensors, while its internal weapons bay can house 3,000 lb of precision munitions.

The next-generation Avenger employs the same materials and avionics as Predator B and is likewise controlled from and fully interoperable with GA-ASI Ground Control Stations (GCS) used for operating Predator-series aircraft.

Avenger's low cost and advanced capabilities make it the optimum choice for employment in "swarm" tactics where affordable quantities count in a successful outcome.



TARANIS COMBAT AIRCRAFT⁹

A prototype unmanned combat aircraft of the future, Taranis, was unveiled by the UK Ministry of Defence at BAE Systems' Warton facility in Lancashire, UK on 12 July 2011. Named after the Celtic god of thunder, the concept demonstrator will test the possibility of developing the first ever autonomous stealthy Unmanned Combat Air Vehicle (UCAV) that would ultimately be capable of precisely striking targets at long range, even in another continent. Should such systems enter into service, they should be placed under the control of highly trained military crews on the ground.

Representing the pinnacle of UK engineering and aeronautical design, Taranis is an informal partnership of the MOD and industry talents including BAE Systems, Rolls Royce, QinetiQ and GE Aviation. Nigel Whitehead, Group managing director of BAE Systems'

The Taranis prototype will provide critical knowledge on the technical and manufacturing challenges and the potential capabilities of Unmanned Combat Air Systems.

Gaurav Sharma is a Research Assistant at CLAWS.

Notes

1. Michael Franklin, Unmanned Combat Air Vehicles: Opportunities for the Guided Weapons Industry?, http://www.rusi.org/downloads/assets/Unmanned_Combat_Air_Vehicles.pdf
2. Fire Scout UTVAV, United States of America, <http://www.naval-technology.com/projects/fire-scout-vtuav/fire-scout-vtuav4.html>
3. Talisman set to Tackle Afghanistan IEDs, <http://www.army.mod.uk/news/20763.aspx>
4. Meet the Israeli Unmanned Ground Combat Vehicle – AvantGuard, <http://www.israelnationalnews.com/News/News.aspx/140569#.T1DiL4dl9ks>
5. G-NIUS Avantguard Unmanned Ground Combat Vehicle, http://www.spacedaily.com/reports/G_NIUS_Avantguard_Unmanned_Ground_Combat_Vehicle_999.html
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