FEATURE ARTICLE

UAS in NATO: Fostering Transformation

The JAPCC Perspective of UAS in NATO

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If we want to understand Transformation in NATO we have to go back to the fall of the Berlin Wall. The geopolitical landscape started to change with a very unusual rapidity. The new strategic environment and the more complex threats that our forces were facing demanded a different approach to collective defence and to the way NATO was doing business. Experience gained in NATO operations started to make clear the urgent need to work on some fundamental problems to give the Alliance the capabilities required to deal with an increasing number and variety of operations and to do it in geographical areas out of the territorial boundaries of member Nations.

The Defence Capability Initiative, as a result of the Washington Summit in 1999 and the Prague Capabilities Commitments from the Prague Summit in 2002 addressed the main military shortfalls in terms of equipment as well as concepts. NATO members started to see the problem from a perspective based on capabilities instead of the traditional threat-based approach. The new «formula» is to provide NATO with a well developed and interoperable set of capabilities that allow commanders to work in this new world of globalisation and asymmetrical conflicts.

In this process of transformation, Unmanned Aircraft Systems (UAS)[1] are already playing a remarkable role allowing commanders to be better prepared to meet the emerging demands of modern warfare and to project power in every way we may imagine. The reduction of threats to friendly forces is indeed one of the main factors to be taken into account. Furthermore the increased demand for UAS in NATO is being promoted by the wide variety of tasks that UAS may perform. We can say that UAS are changing the way commanders conduct military operations.

And there is no way back in this process. More than 57 different types of operational UAS are identified in NATO today, along with more than 2000 ground control elements and over 6600 operational unmanned aircraft… and numbers are mounting daily.

What does NATO Need?

A basic set of requirements seem to have a universal level of agreement. Commanders want unmanned aircraft to fly in all types of airspace, to be all weather capable, to be able to carry an extensive range of sensors that provide floodlight to spotlight capabilities, to be multi-role, and be able to find, fix, track, target, engage and assess (F2T2EA) targets. Unmanned aircraft are also expected to have long endurance (the persistent unblinking eye) and stealth characteristics. Last, they have to be manageable in terms of frequency spectrum and bandwidth, they must be interoperable, and have a low cost.

To achieve these requirements, more than 7 years ago NATO started to discuss the issues associated with integration of UAS into the force structure. Today, there are no less than five major NATO organizations and working groups which are addressing various aspects of integrating Unmanned Aircraft Systems into NATO. Despite an intense level of effort, much work must still be done.

Incorporation of UAS into NATO daily operations immediately raised a wide range of questions pertaining to all fields of the military domain. One of the main questions was how can UAS be tasked as manned platforms, fly in strike packages with manned platforms, and provide commanders with the confidence that no matter, manned or unmanned, the mission will be accomplished.

The overarching answer is that we need to integrate UAS technology in a well developed networked environment with mature doctrine, tactics, techniques and procedures. A good level of integration in the airspace is essential for obtaining the full potential that unmanned platforms offer us.

NATO Efforts To Integrate UAS

The Joint Capability Group on Unmanned Aerial Vehicles (JCGUAV) was created to provide a single forum within the Conference of National Armaments Directors (CNAD) to address all UAS issues including the acquisition, design, employment and demonstration of capabilities with the aim of improving their availability, interoperability, utility and operation.

Several Specialist Teams within the JCGUAV have been appointed to manage a number of aspects of UAS in NATO such as standardization, flying in a non-segregated airspace, weaponization, autonomous operations, classification or lessons learned among others. Many initiatives in several work areas are being developed with the following four main objectives[2]:

- Capability Integration for UAS: Emerging requirements from Micro UAS to High Altitude Long Endurance (HALE) UAS as well as capabilities such as weapon employment, advanced payloads, and options for countering improvised explosive devices (IEDs).
- Advancement of UAS Autonomous Operations: Operator workload reduction, reliability improvement, intelligent decision making, air-to-air refuelling and launch and recovery operations.
- Interoperability for UAS: A functional and technical architecture that will provide options for coordination among systems, including control and integration for coalition operations.
- Acceptance of UAS within NATO: In the airspace, in the radio frequency spectrum, in operational planning, and in the logistics structure.

Standardization and Interoperability efforts

Representing an important step for the integration of UAS in the future NATO operational environment, STANAG 4586 -Standard Interface of the Unmanned Control System (UCS) for NATO UAV interoperability- was released in 2002

[1] There is no common agreement in NATO regarding the utilization of the terms UAS vs. UAV. In the test UAS are preferred, but sometimes UAV are used depending on the accepted terminology of the organization mentioned.

[2] Terms of Reference for the Joint Capability Group on Unmanned Aerial Vehicles. CNAD NNAG, 7 December 2006.

with the objective of harmonizing NATO member Countries efforts in the development of their national software by providing a standard for the Data Link Interface between the UCS and the air vehicle, the C2 Interface between the UCS and the C4I systems, and the Human Control Interface between the UCS and the operators.
STANAG 4586 describes five levels of interoperability[3] ranging from the mere indirect receipt and transmission of related payload data to a full control and monitoring of the unmanned aircraft including launch and recovery.
Standards are also provided in many other important areas: Command and Control Data Link for UAS (STANAG 4660); Recommended Guidance for the Training of Designated Unmanned Aerial Vehicle Operator (STANAG 4670); Airworthiness Requirements (STANAG 4671) or UAV Operator Medical Standards (Draft).
It is similarly relevant to mention the many standardization agreements dealing with the imagery exploitation cycle:

- STANAG 3377: Text Reports, Annotated Images & Maps;
- STANAG 4545: Secondary Imagery Format (NSIF);
- STANAG 4559: Standard Imagery Library Interface;
- STANAG 4575: Advanced Data Storage Interface (NADSI);
- STANAG 4607: Ground Moving Target Indicator Format (GMTIF);
- STANAG 4609: Digital Motion Imagery Standard;
- STANAG 4633: Common Emitter Reporting Format;
- STANAG 7023: Primary Image Format (NPIF);
- STANAG 7024: Imagery Air Reconnaissance Tape Recorder Standard;
- STANAG 7085: Wideband ISR Data Links.

UAS integration of Flight In Non-segregated Airspace (FINAS)

To fully exploit the unique operational capabilities of UAS in the military and civilian domains and to safely conduct UAS operations, many technical challenges have to be tackled. Before operating unmanned aircraft outside of segregated airspace it will be necessary to assure they will not threaten other airspace users. Unmanned aircraft should have the same level of compliance as manned aircraft with Air Traffic Management, communications, navigation and surveillance requirements applicable to the airspace where they are intended to operate[4].
With this purpose, in November 2003, the NATO Air Force Armaments Group 7 agreed to establish a FINAS working group whose mission is to «recommend and document NATO-wide guidelines to allow the cross-border operation of unmanned aerial vehicles in non-segregated air space.» Similarly the European Defence Agency recently announced that it had awarded a contract with a consortium of defence and aerospace companies to develop a detailed roadmap for integrating unmanned aircraft into European airspace so that they can fly routinely with other air traffic by the end of 2015, at the latest.[5] The project will help airworthiness authorities, air traffic management bodies, procurement agencies, industry and research institutes to develop a joint agenda for common European UAV activities addressing both civil and military uses of UAS[6].

Weaponization

In 2001, armed U.S. Predator UAS were deployed in Afghanistan. In December 2002 the first air-to-air combat involving an unmanned aircraft occurred when a Predator and an Iraqi MiG-25 fired missiles at each other. Predators armed with Hellfire missiles have also been used in Afghanistan to destroy ground targets. Despite the fact that the main effort in UAS is still dedicated to the basic competences of surveillance, reconnaissance and targeting, history is repeating itself. Like manned aircraft at the beginning of the aviation era, UAS are evolving from merely surveillance to multi-purpose flying platforms.
The NATO JCGUAV Weaponization Specialist Team is currently working alongside with other NATO organizations in the definition of standards and requirements for armed UAS with the following objectives[7]:

- Recommend appropriate changes to the applicable requirement documents for the use of weapons on UAS in conjunction with the NSA;
- Identify the critical interfaces in the targeting-to-weapon release chain for unmanned aircraft;
- Define the sets of technical standards to support the weapon's employment process from mission planning to weapon delivery;
- Identify those interfaces that are not being addressed and identify, modify or develop appropriate standards for those interfaces; and
- Identify and coordinate with responsible authorities for required interfaces outside of JCGUAV responsibility.

Employment of armed UAS offers a complete new field of capabilities to the planners and commanders. Armed UAS also present new technical, military and political challenges that have to be addressed. For example, there is no NATO doctrine that states who has the authority to direct unmanned aircraft to employ their weapon.
One must not forget the threat brought on by the possibility of hostile armed UAS used against NATO forces. The capability to detect and identify enemy UAS is a challenge for all command and control systems currently in place. The fact that UAS are small, fly at low altitudes and at slow speeds makes their detection extremely difficult in many circumstances. The issue of identifying enemy unmanned aircraft should be addressed from the perspective of identifying the friendly ones first.

[3] Interoperability is the ability of a UA to operate with disparate agencies, forces, and levels of command. Establishment and enforcement of effective standards for data transmission, communications, and UA tasking are crucial to interoperability. Currently, the level of interoperability among UAS varies widely, from systems that can pass full control of the aircraft and/or payload from one operator to another to systems that can only transmit sensor data to various recipients. (Joint Concept of Operations for Unmanned Aircraft Systems, March 07. Joint Unmanned Aircraft Systems Centre of Excellence, Creech Air Force Base, NV (USA))
[4] http://www.eurocontrol.int/mil/public/standard_page/atm_mil_uav.html WgCdr. Michael Strong. EME-MIL Unit. O5 July 2007
[5] http://www.eda.europa.eu/newsitem.aspx?id=312 08 January 2008, Press Release
[6] The contract was awarded to the Air4All consortium, consisting of BAE Systems with BAE Systems Operations Platform Solutions, Alenia Aeronautica, Dassault Aviation, Diehl BGT defence, EADS CASA, EADS Defence & Security Germany, Galileo Avionica, QinetiQ, Rheinmetall Defence Electronics, SAAB AB, Sagem Defence systems and Thales Aerospace as Co-contractors.

Standardization of own means is of greater importance here to be able to discriminate and defend against enemy assets.

UAS In NATO Operations

Since 1992 NATO has been involved in the Balkans. The first activities were related to the monitoring and enforcement of the UN-imposed arms embargo against the former Yugoslavia and economic sanctions against Serbia and Montenegro as well as a flight ban over Bosnia and Herzegovina. Implementation Force (IFOR) was the Alliance's first large scale operational peacekeeping mission. Deployed in Bosnia and Herzegovina in December 1995, IFOR oversaw the military aspects of the Dayton Peace Agreement. Afterwards, an international Stabilisation Force (SFOR) was also led by NATO in Bosnia and Herzegovina between December 2004 and December 2006, to secure and facilitate the country's reconstruction.

After more than a year of fighting in Kosovo and in view of the failure of international efforts to resolve the conflict and to halt the humanitarian catastrophe by diplomatic means, NATO launched Operation Allied Force, in March 1999. The NATO-led Kosovo Force (KFOR) was deployed in the wake of the 78 days of bombing and is still in place[8]. From 2001 to 2003 three operations led by NATO have been conducted in the former Yugoslavian Republic of Macedonia to assure stability in the area and to help the country to become fully integrated in Euro-Atlantic structures.

Unmanned aircraft presence in this theatre of operations dates back to 1994. In 1995, US Predators flew operationally for the first time over Bosnia. In October and November of 1998 US Air Force RQ-1 Predators flying from Hungary supported the Organisation for Security and Co-operation in Europe (OSCE) Verification Mission over Kosovo. The German Army followed with CL-289 drones, based in Macedonia. Soon afterwards several other NATO countries deployed their own assets.

The NATO UAS activity as well as the whole air campaign was directed from the Combined Air Operations Centre (CAOC) in Vicenza, Italy. Efficient utilization of the capabilities provided by the different unmanned systems proved to be challenging with, in some instances, a tendency for micromanagement by senior commanders. Every single unmanned mission over the Balkans had to be included in the daily Air Tasking Order (ATO) with the consequent difficulties of co-ordination. Another important obstacle to overcome was deconfliction. The situation got even more complicated after the deployment of KFOR and the increased helicopter and air transport activities.

The unexpected high level of losses is one of the most interesting aspects to study. The Serb air defence forces showed a good level of preparation to counter NATO UAS operations after studying the Alliance's behaviour since 1994. Political and geographical constraints made UAS operations over Kosovo very predictable and thus somewhat risky. The Serbs claimed more than 25 unmanned aircraft downed during the war. At a certain stage, the use of helicopters to kill unmanned aircraft was a rather innovative tactic.

In August 2003 NATO took command of its first mission outside the Euro-Atlantic area: the International Security Assistance Force (ISAF). ISAF operates in Afghanistan under a UN mandate and its role in general terms is to assist the Government of Afghanistan and the International Community in maintaining security within the area of operations[9].

The lessons identified and analysed from the employment of UAS over the former Yugoslavia, the positive contribution of unmanned aircraft to the successful outcome of NATO operations there and no least importantly, the evidences brought from different scenarios outside NATO made UAS a new priority for many European NATO member countries. As a matter of fact, operations in Afghanistan are seeing several NATO nations procuring and deploying UAS for the first time to offer greater protection to their troops.

Meanwhile, NATO is also conducting Operation Active Endeavour. NATO ships are patrolling the Mediterranean Sea, monitoring shipping and providing escorts to non-military vessels through the Straits of Gibraltar to help detect, deter and protect against terrorist activity[10]. This is one of the measures taken after the invocation of Article 5, NATO's collective-defence clause, for the first time in the Alliance's history, following the terrorist attacks against the United States of 11 September 2001.

The employment of the Automatic Identification System (AIS)[11] on NATO airborne platforms and the exploitation of the data provided is potentially one of the major contributions to the success of the operation. Airborne AIS (AAIS) is already in use by several member nations

7 NATO Standardisation Agency (NSA): NATO UAV Weaponization Technical Paper, 6 March 2008.

8 Following Kosovo's declaration of independence on 17 February 2008, the Alliance reaffirmed that, unless the Security Council decides otherwise, KFOR shall remain in Kosovo on the basis of UN Security Resolution 1244, as agreed by Foreign Ministers in December 2007. http://www.nato.int/docu/pr/2008/p08-025e.html Statement by the North Atlantic Council after Kosovo's declaration of independence. 18 Feb 2008

9 http://www.nato.int/issues/afghanistan/040628-factsheet.htm

10 http://www.nato.int/issues/active_endeavour/index.html

11 AIS is a system used by ships and vessel traffic systems (VTS) to improve safety at sea and to monitor maritime activity. AIS helps to resolve the difficulty of identifying ships when not in sight (e.g. at night, in fog, in radar blind arcs or shadows or at distance) by providing a means for ships to exchange ID, position, course, speed and other ship data with all other nearby ships and VTS stations. It works by integrating a standardized VHF transceiver system with a GPS receiver and other navigational equipment on board (Gyro compass, Rate of turn indicator, etc.). The International Maritime Organization (IMO) Safety Of Life At Sea (SOLAS) requires AIS to be fitted aboard all ships greater than/equal to 300 gross tons for international voyages. It is estimated that more then 40,000 ships currently carry AIS class «A» equipment.

in support of ongoing NATO operations across the full spectrum of maritime related missions.[12]
Undoubtedly AAIS on board unmanned aircraft will provide a valuable addition to improve the Maritime Situational Awareness, thus becoming an excellent asset to collect significant amounts of data during extended periods of time, contributing to fill the gaps in this field.

NATO Owned Or National Business?

Procuring NATO's own unmanned systems to ensure availability when needed in operations with a similar concept to the one used with the NATO Airborne and Early Warning (NAEW) fleet is one of the most attractive Alliance projects today. It is however not easy to implement as NATO countries have their own programmes and priorities. Nevertheless, in addition to the many national and multinational procurement efforts ongoing, NATO itself is in the process of acquiring its first unmanned aircraft system that will provide capabilities similar to the US Joint Surveillance Target Attack Radar System (JSTARS). The Alliance Ground Surveillance (AGS) system should have its first capability in 2013.
The AGS will be able to look down with his radar to track moving objects on the ground to provide situational awareness before and during NATO operations. This is an essential capability for political decision makers and military planners, and will be a key enabler for NATO Response Force [13]. The system will consist of up to 8 Unmanned Aircraft and will be based on the Global Hawk System.

The Way to the Future

Unmanned Aircraft Systems are, as said before, on the cutting edge of the new capabilities brought to NATO. Along with Network Enabled Capabilities, UAS are perhaps the two most fundamental tools for NATO's military transformation[14]. However, new capabilities based on modern technologies are not always the answer to every problem and there still many issues. The main areas that will need to be addressed to pave this way can be summarized as follows:

- Command and Control (C2) architecture: A NATO standardized guidance regarding C2 of unmanned aircraft in the battle-space is needed.
- Integration and Interoperability: Nations have to achieve a minimum level of interoperability in NATO[15]
- For full integration of UAS, sense and avoid is paramount.
- Force development: Development of weapon systems and personnel is essential for development of UAS capabilities. NATO countries need to fulfil the requirements stated in planning documents[16] and then make them available to NATO when needed. Personnel need to be trained and experienced regarding the proper employment of such systems.
- Air Space Management (ASM): Given the fact that the numbers of unmanned aircraft are expected to increase and knowing that segregation of airspace is not acceptable, we cannot afford to step into the future with our current procedures. There is a need for ASM tools allowing manned and unmanned aircraft to operate in the same airspace.

Transformation in NATO is focused to provide commanders with the capabilities required to deal with an increasing number and variety of operations in many different challenging environments. But in Military Transformation we may find several distinct faces. We may tend to believe that modern technologies may get us to win wars in weeks or even days. The Kosovo campaign proved it not to be that simple and the conflict in Afghanistan is teaching us, once more, that today's asymmetrical conflicts may make it very difficult, painful and time consuming to win the peace in some conflict areas. With insurgencies, guerrilla warfare, terrorism, irregular warfare, etc., we are seeing our military trying to cope with situations for which they are not well prepared, mainly because traditionally they have been getting ready for a «regular» war. And, we may be confused by the fact that despite the reduction of manpower that these modern technologies were initially supposed to bring, every day more and more military personnel are required to be deployed in conflict areas.

NATO continues to work the many issues associated with UAS. The Alliance looks forward to working with all international partners to find solutions to our many common problems.

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[12] NATO Mission Capability Group 4 (MCG/4) on Maritime Air Delivered Superiority draft working paper in the potential for the use of the AIS by airborne platforms.
[13] http://www.nato.int/issues/ags/index.html
[14] Pierre Claude Nolin, «Transforming the Future of Warfare: Network-Enabled Capabilities and Unmanned Systems», report to the 2007 annual session of the NATO Parliamentary Assembly.
[15] Levels of interoperability (STANAG 4586):
- Level 1 - Indirect receipt/transmission of UA related payload data.
- Level 2 - Direct receipt of ISR or other data («direct» covers reception of the UA payload data by the RVT when it has direct communication with the UA).
- Level 3 - Control and monitoring of the UA payload in addition to direct receipt of ISR or other data.
- Level 4 - Control and monitoring of the UA, less launch and recovery.
- Level 5 - Level 4, plus launch and recovery functions.

Minimum requirements should be level 2 or 3. At degree two, there is structured data exchange. It involves the exchange of human-interpretable structured data intended for manual and/or automated handling, but requires manual compilation, receipt and/or message dispatch. Degree three of interoperability is the seamless sharing of data. It involves the automated sharing of data amongst systems based on a common exchange model.
[16] According to planning documents, NATO needs approximately 50 HALE and 20 MALE unmanned aircraft.