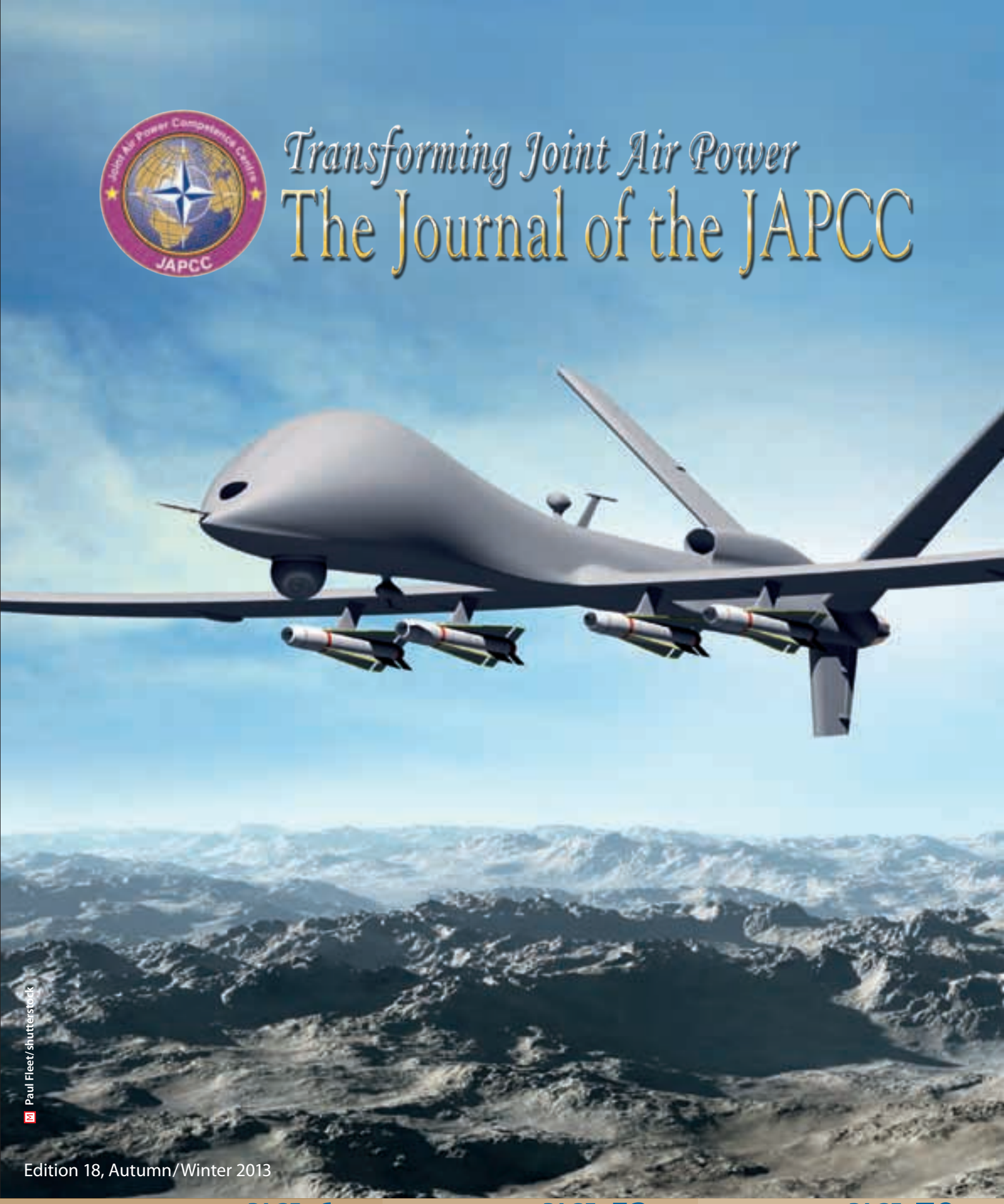
Transforming Joint Air Power
The Journal of the JAPCC



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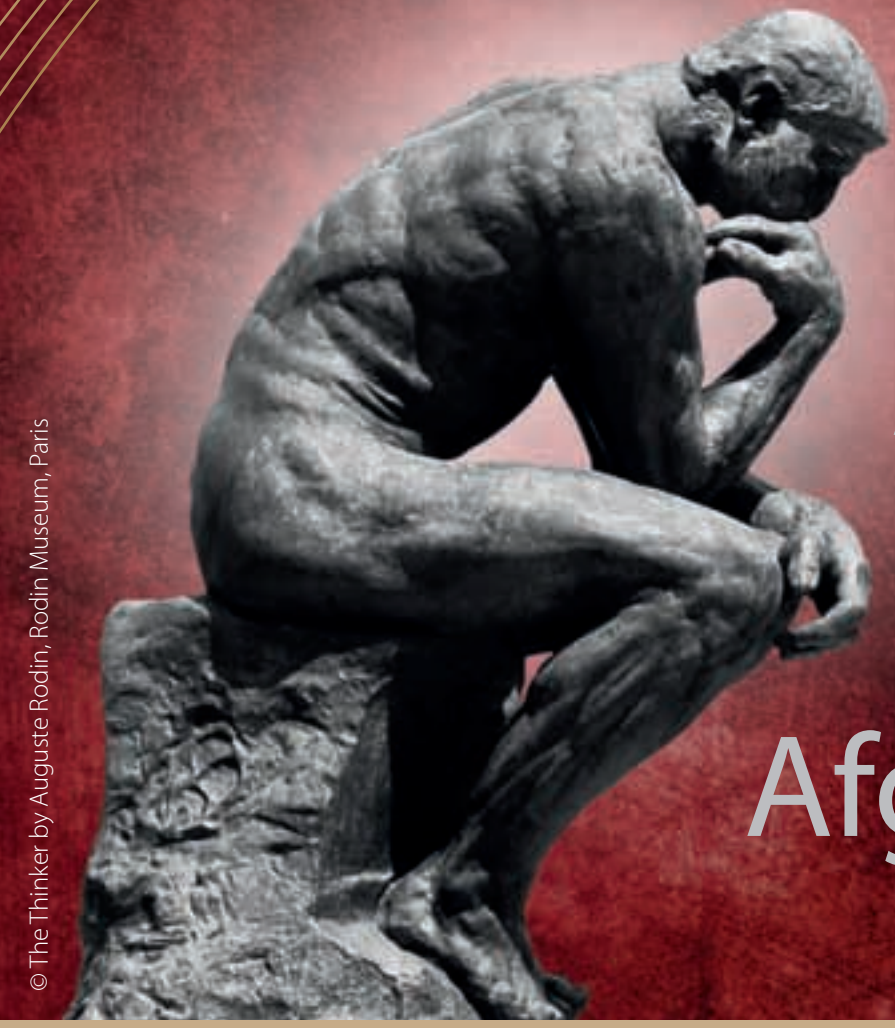

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Air Power Post Afghanistan

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Joint Air Power Competence Centre

"Gentlemen we have run out of money. It is time to think."
Winston Churchill, Prime Minister UK, 1940

This quote is applicable to most NATO nations for the past two decades when governments started to take in the so-called peace dividend and reduced their defence budgets drastically. A lot of thinking has been done how to deal with these budget reductions. But this thinking was always constrained by a purely national approach, with almost no coordination within NATO. This is the reason why NATO still has too many legacy capabilities which never have been used and most likely never will be used in the foreseeable future. Whilst no European nation is able to go to war on its own, in defence policy matters they act on the contrary, consequently keeping up out-dated capabilities, rather than making smart choices. Although Smart Defence and the Connected Forces Initiative sound great on paper, they have so far not generated any urgently needed military capabilities. The time to think is behind us, it is time to act. NATO nations should take a proportionate burden in funding and fielding required capabilities and have the political will to make choices collectively and, if nations act really smart, they can save money.

It's my pleasure to open the 18th JAPCC Journal. First of all I would like to welcome our new Director, General Frank Gorenc. We are delighted to have him as our new boss. I am also very pleased with the interview from our former Director, General Breedlove, since May the Supreme Allied Commander Europe. The use of armed Remotely Piloted Aircraft (RPA) in operations has already led to heated and intensive discussions. Dr. Mark R. Jacobson stresses that NATO has to begin both informal and formal discussions over what role these RPA (erroneously called 'drones') may play in Alliance operations.

This year's JAPCC Conference theme is 'Air Power Post-Afghanistan'. The future role of Air and Space Power in NATO might have serious impacts far beyond the military community. The JAPCC has the ambition to facilitate discussion across the entire NATO community. In order to lay the groundwork for the upcoming discussions we produced a 'Conference Introduction' (page 42) that can yield thought-provoking and interesting dialogue. Major General Andrew M. Mueller explains that after thirty years of sustained operations the mission of NATO's E-3A Component is still fully engaged in NATO operations today and capable, ready and relevant for NATO operations of the future (page 27). Commander Tim 'Fitz' Fitzpatrick offers a way to work through traditional barriers to international cooperation with Modelling and Simulation. Therefore a unified and standardised M&S position is needed in order to facilitate required standardisation and interoperability (page 79). Other articles cover topics from the modernisation of NATO nation's Air Transport and Air-to-Air Refuelling fleet, developments in future Joint Helicopter MEDEVAC and Force Protection capabilities, to the F-35 as the back bone of NATO's future air operations. I'd like to thank all the authors for their contributions which have made this edition worthwhile reading.

Finally, the JAPCC team greatly appreciates your feedback and thoughts. Please complete our short online survey at
https://www.surveymonkey.com/s/JAPCC

The Journal of the JAPCC welcomes unsolicited manuscripts.
Please e-mail submissions to: articles@japcc.org

We encourage comments on the articles in order to promote discussion concerning Air and Space Power.

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The Journal of the JAPCC Römerstraße 140 | D - 47546 Kalkar | Germany

A.A.H. (Tom) de Bok MA, Air Commodore, NLD AF
Assistant Director Transformation

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Joint Air Power Competence Centre
Gen Frank Gorenc

Executive Director
Joint Air Power Competence Centre
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The JAPCC Interview with the Supreme Allied Commander Europe

Interview with General Breedlove, SACEUR, U.S. Air Force

Prior to becoming SACEUR, you were the Commander of NATO's Allied Air Command at Ramstein. How do you see your time at AIRCOM being of benefit in your new position as SACEUR?

I have spent almost a third of my military career in Europe, but primarily in national positions. Commanding AIRCOM was my first real tour in NATO. Discussing and working together with my counterparts from the land and maritime components and the joint commands sharpened my understanding regarding the value of NATO in safeguarding the freedom and security of its members through military means.

NATO is relying on its integrated military command structure and on the forces provided by the nations in order to be able to plan and execute military operations.

At AIRCOM, I learned more about the nations, who are the foundation for the alliance, and about their national identities and their challenges. I experienced the difficulties of transitioning into a new NATO Command Structure. And I learned from the multinational individuals within the organisation, who are the vital elements in order to be able to fulfil any given mission. In the end, it is all based on the individuals, the brave men and women from the nations, who I had the honour to serve and to lead as Commander of AIRCOM and who I also rely on in my new position as SACEUR.

As the JAPCC's Director, you helped select the JAPCC 2013 annual conference theme of 'Air Power Post-Afghanistan'. What do you think are the most significant challenges for NATO Air Power in the Post-Afghan period?

At present and from a political perspective, placing 'boots on the ground', may not be the preferred option for managing armed conflicts. Public opinion is less willing to accept operations that require the deployment of thousands of troops for long durations of time. In that respect, Air Power may be seen as an effective means to respond to future challenges but, nevertheless, in an effort to cut military budgets, many NATO nations are significantly reducing their Air Power capabilities. Such decisions need to be made in full consideration of the consequences and with a clear understanding of the potential future threats. A full range of capabilities need to be maintained.

Secondly, we need to preserve the high-level of interoperability that we have forged among Allies and partners after over a decade of joint operations in Afghanistan. We are operating at peak performance right now, and we will have to leverage exercises and training opportunities down the road in order to maintain our ability to work effectively together jointly as a team. This includes air interoperability as well as the capacity to work with land, maritime, and special forces.

We also need to continue to improve our ability to use lethal air power with a high degree of precision and due diligence. When you consider the speed and confusion of modern combat operations, NATO does a remarkable job in keeping collateral damage and civilian casualties to an absolute minimum. But we must continually strive to improve our abilities in this area to maintain the trust of the people we are trying to protect.

Finally, we need to do a better job of showing our citizens exactly what air power can do on their behalf, and why such capabilities are necessary. During Operation UNIFIED PROTECTOR, one of the problems we had was declassifying imagery in a timely manner that would have clearly helped us counter the information campaigns of opposing forces. Our future operating environments, even in the poorest of countries, will be 'wired' and interconnected by social media networks that move and shift at a tremendous pace. Misinformation and propaganda will inevitably be used against us virtually every time we decide to engage a target. Therefore we need to take a hard look at how we use imagery and information during air campaigns to our best advantage. We need to be faster, more deliberate, and smarter in how we go about telling our story in today's lightning fast information environment.

How do you view the recently completed restructuring of the NATO Command Structure and the reductions among the nations' armed forces with regard to NATO's effectiveness and efficiency to execute military operations in the future?

There is a temptation during times of austerity for nations to become introspective and focus exclusively on national priorities at the expense of multi-national co-operation. This could potentially lead to losing some of the alliance capabilities. It's a matter of awareness; we should all make an effort to inform our leadership regarding the associated risks that accompany any loss of capability in dealing with potential future threats.

We need, however, to be fiscally responsible and NATO has reduced its overhead in many innovative ways over the past few years, including by reforming and reducing its command structure. This was done to make the structure more affordable, while protecting operational capability and our level of ambition. The reforms have reduced the overall number of staff from 13,000 to 8,800 posts NATO-wide.

The reform has also created a more deployable and streamlined command configuration. ACO's two Joint Force Headquarters are now able to deploy into theatre to exercise command and control up to the level of a major joint operation. The component commands are able to bring a high degree of focus and excellence to their respective land, maritime, and air domains.

Further, the creation of the Comprehensive Crisis and Operations Management Centre (CCOMC) at SHAPE is allowing us to think, plan, and act strategically. The centre collaborates and cooperates in a fully-integrated manner, bringing together military and civilian expertise, and connecting SHAPE Headquarters to the networked world.

The new command structure provides an effective and accurate response to current and more importantly, future security threats and challenges. The new structure better allows NATO to identify emerging threats before they mature into full blown problems. I liken this to a pilot who continually scans the horizon while flying, always looking for the indicators of warning.

But when it comes to cutting capabilities themselves, we have to be much more careful. Right now we are at the height of our ability to operate together, our cohesiveness is high, and our tactics, techniques and procedures are as good as they have ever been. My concern is that we do not lose the edge … clearly we need budgets and capabilities to stay prepared. When I speak to officials during my visits to Allied nations, I continually emphasise that defence spending is important. At a certain point, there comes a time when there is no more 'fat' to trim and you begin cutting into 'flesh and bone'. We've got to guard against that.

Looking at NATO's current Level of Ambition (2 Major Joint Operations and 6 Smaller Joint Operations) and considering the recent changes in the NATO Command Structure as well as the cutbacks in the Force Structure of the Nations, will this not be very ambitious to fulfil?

Given the recent developments in the NATO Command Structure, I don't think so. The newer and leaner command structure better capitalises on the use of more up-to-date technology, and is more operationally orientated. We now have two Joint Force Command Headquarters (Naples and Brunssum) as well as Land, Air, and Maritime Component commands in Turkey, Germany, and England respectively. This structure allows us to be more effective and efficient in the delivery of capabilities and services and maintain our level of ambition. Obviously running several operations at the same time is a challenge. But if you think about it, while we are still in a period of transition, we are managing a major operation in Afghanistan, while simultaneously coordinating KFOR, Op OCEAN SHIELD, Op ACTIVE ENDEAVOR, and PATRIOT missiles deployed in support of Turkey. Our capacity will only increase once we hit full operational capability across all the respective commands.

For the future of NATO Air Power: what should NATO and the Nations aim for to strengthen/enhance their common Air Power Capabilities?

A key pillar of NATO's deterrence is the strength, flexibility and high quality of its air power across all services. The end of the Cold War brought not a decrease but an increase in NATO's reliance on Air Power. Time and time again, NATO and the Alliance nations have turned to Air Power as their first, and in some cases only, military response option. The need for NATO to maintain its proven air assets has not diminished. Thus, for me, the need for responsive and flexible forces remains crystal clear. NATO must retain and improve its air power if it is to successfully meet future challenges.

Therefore, I believe NATO must adopt a bi-focal approach to pro-actively further the development of its Air Power. The short term perspective must focus on retaining the required capabilities and on meeting, where possible, priorities of shortfall areas to ensure NATO air power remains ready and capable despite the current period of economic uncertainty. The long term perspective must focus on preparing for the future by looking out beyond the current planning horizon. Within the context of the future security environment, NATO Air Power must adapt to the speed and unpredictability of strategic and technological developments that will emerge in the coming decades. To support such an approach, I believe a comprehensive air power study is required to chart the path forward to guarantee that air power continues to contribute to the security and success of NATO and its Allies. Therefore, I asked the JAPCC to conduct such a study within the concept of the Connected Forces Initiative, rather than a focus on force structure.

What do you see as ACO's biggest challenges in the near term?

I believe the key issues threatening global security today are: failing states, restive populations, and ungoverned spaces.

In order to ensure the Alliance is positioned to meet these challenges, I have established the following priorities for Allied Command Operations:

a. Ensuring NATO forces are Prepared, Agile, Capable and Interoperable.
b. Successfully transitioning ISAF to Operation Resolute Support post-2014.
c. Maintaining our cohesion and professionalism in everything we do.
d. Countering the cyber threat by protecting our networks and collaborating to meet emerging threats.
e. Maintaining, and strengthening, our shared Trans-Atlantic bond.

My first and enduring priority is ensuring NATO remains vigilant and prepared to meet the challenges and threats of the future with agile, capable and interoperable military forces. This fundamental priority, securing our future together, lies at the core of the military alliance and it will remain front-and-center while I am the commander.

The transition in Afghanistan also remains a top priority as the Afghan National Security Forces take responsibility for security across the country and NATO moves into a supporting role. SHAPE staff are currently developing operational plans that will specify how NATO, with the support of the international community, will fulfill our commitment to Afghanistan with a new train, advise and assist mission named RESOLUTE SUPPORT.

Concurrently, we are transitioning our NATO Force Structure while involved in operations around the world. We will continue building on the gains in cohesion and professionalism which we, the Alliance, contributing nations and our Afghan partners, have made over this past decade. We will continue getting better as we transition from being 'deployed' to being 'ready'.

Of particular importance to staying ready for future challenges is the NATO Response Force. This force is comprised of three parts: a command and control element from the NATO Command Structure; the Immediate Response Force, a joint force of about 13,000 high-readiness troops provided by Allies; and a Response Forces Pool, which can supplement the Immediate Response Force when necessary.

The NRF will become even more important post-2014, after the NATO-led International Assistance Force (ISAF) has completed its mission and we have transitioned to a non-combat and advisory role in Afghanistan.

Another challenge we face today is the emerging cyber threat. NATO has the largest gap between our level of preparedness and the threat of damage from a severe cyber attack. We have a defensive effort to strengthen our ability to protect our networks, and we will continue developing this capability because we recognise these threats continue to evolve.

Finally, I'm working with my European colleagues and other partners to emphasise the strength and the vibrancy of our trans-Atlantic linkages. Our security is deeply interwoven and supported by deep roots in both economic and cultural shared values with our neighbours in Europe. These relationships have endured for decades and will continue to thrive through all of our challenges, whether they are economic or military.

How do you plan to continue to develop the NATO missile defence initiative?

The NATO missile defence program will protect NATO European populations and territories from the threat posed by missile proliferation. Ballistic missiles pose an increasing threat to Allied populations, territory and deployed forces. Over 30 countries have, or are acquiring, ballistic missile technology that could eventually be used to carry not just conventional warheads, but also weapons of mass destruction.

As such, the Alliance has a responsibility to take this into account as part of its mission to protect its populations.

NATO currently has an interim capability, which is under the command of AIRCOM. The radar station in Turkey has also been placed under NATO command and a number of Allies – the United States, Germany and the Netherlands – have made clear that they would be ready to provide interceptors if needed.

The United States is providing the majority of the assets for the interim capability. But many European nations are already contributing too. And their contributions will increase in the coming years. So this is about NATO Allies working together to defend NATO Allies.

We are now working towards our next goal: initial operational capability, which I would expect in the second half of this decade. This will require work in many areas, such as technology development, additional national contributions, military planning, and staff training.

Once fully operational, the system will allow NATO to gather information from satellites and radars at sea and on land, put that information together and pass it on to our interceptors. This will give NATO commanders a fuller picture and an earlier warning, and allow them to maximise the effectiveness of our defences. The capability also includes rules and procedures agreed by all 28 Allies, so that NATO commanders can plan and position their assets, and have the legal authority and clear rules on how to react if necessary.

Much remains to be done in this regard, but I think we are on the right track to continue to move this important project forward.

Sir, thank you for your time and your comments.

General Philip M. Breedlove

assumed duties as the Supreme Allied Commander Europe and Commander of U.S. European Command in May 2013. He was commissioned in 1977 as a distinguished graduate of Georgia Tech's ROTC program and was raised in Forest Park, Ga. A Fighter Pilot by trade, General Breedlove is a Command Pilot with over 3,500 flying hours primarily in the F-16. He has flown combat missions in Operation JOINT FORGE supporting the peacekeeping operation in Bosnia and Operation JOINT GUARDIAN to implement the peace settlement in Kosovo. From 2012–2013, he was Commander, U.S. Air Forces in Europe; Commander, U.S. Air Forces Africa; Commander Headquarters Allied Air Command, Ramstein; and Director, Joint Air Power Competence Centre, Kalkar Germany. In addition to General Breedlove's command assignments he has served in a variety of senior leadership positions for the U.S. Air Force.

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Italian army and amphibious troops train together with ITA Aviation AB-205 helicopters in the MEDEVAC configuration at the Cellina-Meduna training area.

Forward MEDEVAC Challenges

The Italian Army Implementation Programme

By Lieutenant Colonel Andrea Lopreiato, ITA Army, JAPCC

The Afghan scenario in RC-West revealed two main challenges related to Medical Evacuation (MEDEVAC): the distance between the wounded and the Medical Treatment Facility and the non-permissive nature of the rescue sites. These operations are half way between the 'classic' Forward MEDEVAC and Joint Personnel Recovery mission, and often require the recovery of injured soldiers inside a combat zone. How did the Italian Army deal with these challenges? The purpose of this article is to start a discussion on how to solve or mitigate these challenges in the (near) future.

Two Problems

Current military operations have shown that medical support is a fundamental capability for an expeditionary military force. This operational requirement has been emphasised in theatres such as Afghanistan, where local medical facilities have been completely depleted by war, rendering host nation medical support less than adequate according to Western standards. In addition, the Afghan tactical situation consists of several bases and Combat Outposts (COP) scattered all across the Country, making mutual support extremely difficult. Improvised Explosive Devices (IEDs) and Small Arms Fire (SAF) attacks strike military convoys far away from the Main Operating Base (MOB) leaving the casualties in mortal danger if not quickly rescued by medical personnel. In the Afghan Operational Theatre, the rescue in the forward zone usually benefits of helicopters in order to respect the golden hour policy[1]. In accordance with NATO STANAG 3204[2], Forward MEDEVAC[3] is "the phase of evacuation which provides airlift for patients between points within the

battlefield, from the battlefield, as far forward as the point of wounding, to the initial point of treatment and to subsequent points of treatment within the combat zone". This means highly skilled medical crews rely on helicopters for a rapid ingress directly to the wounded, regardless of their proximity to enemy positions. But not all services are able to deploy these kinds of highly skilled medical personnel and, often, the medic, doctor or nurse on board has only basic trauma skills, which are not enough to treat the severe traumas IED/SAF victims suffer.

Consequently, the two main issues found in Afghanistan are in assisting patients in-flight and being ready to rescue personnel inside the combat zone.

In 2010, to solve this problem, the Italian Army decided to begin a Forward MEDEVAC implementation programme in order to conduct critical care rescues. Meanwhile, new tactics have been developed by the deployed Aviation Battalion to relieve units in distress or under fire. However, because this tactics update is only applied by the Army Aviation, it's now necessary for the wider application of Forward MEDEVAC as part of a joint approach together with Medical Services and the Air Force as well.

Together with medical and technical issues, there are also organisational and interoperability issues. Due to the multinational nature of today's contingencies, MEDEVAC supports more than one nation's Army, Navy or Air Force branch and must closely coordinate the efforts of the involved medical corps, ground units and flight crews.

Army Initiatives

To minimise losses, medical support to military operations is composed of two components. The first relies on the first responders or Combat Life Savers (CLS), who are part of the infantry and are specially trained for buddy-aid and first aid; while the second is based on medical professionals belonging to the Medical Corps. Enhancing the soldier's basic skills in buddy care and permitting them to call in a MEDEVAC via a correct 9-line report was the first step in improving the chain of events.

Following this improvement, in early 2010, Italian Army Aviation (ITAAVN), together with the Medical Corps, developed an implementation programme to update MEDEVAC helicopters. The nature of the Afghan scenario and the diffusion of airmobile/air assault operations required an improvement in almost every factor of the DOTMLPFI[4] process.

Realising that the Medical Corps wasn't able to address the complex problems alone, a Working Group was formed consisting of pilots, flight engineers and medical officers. At the completion of the project, some important guidelines were established as a foundation for the new Forward MEDEVAC Team (FMT)[5], a unit with a strong combat mission orientation and enhanced

medical capabilities. The guidelines are focused on personnel selection, flight training for medical crews, equipment and aircraft interoperability.

Aircraft and MEDEVAC Equipment

Excluding the US Armed Forces, it's almost impossible for other NATO nations to put in service standing flight units with helicopters exclusively equipped for MEDEVAC service, with electro-medical devices and medical crews. In every other case without the US engagement we find a build-up of Task Forces with dedicated helicopters that, for a specific operation, are diverted to the MEDEVAC role.

This is what occurs in Italian Army Aviation; consequently, easy reconfigurable medical equipment was required in order to equip all the aircraft currently in service. At the moment, ITAAVN operates the UH-1 family, CH-47C (soon F) and NH-90 in utility and cargo duties in which the medical equipment has to fit.

The medical equipment comprises everything needed for in-flight stabilisation, resuscitation and intensive care and fits into the Patient Transport and Support (PTS) system. The PTS stretcher is a modular system that allows quick setting of the desired combination of electro-medical devices. The system lists all the state-of-the-art devices. The STARMED Company delivered the equipment with a Joint Aviation Requirement

Italian MEDEVAC crew involved in an exercise as part of a MEDEVAC course.
ITA crews now operating in Afghanistan on NH-90 tactical transport helicopters.

certificate for in flight movement using the NATO stretcher bearer. In addition, Army Aviation conducted a series of flight tests in order to use all the devices, to include the defibrillator in flight.

Personnel Selection and Training

Personnel forming MEDEVAC crews are doctors and nurses mainly belonging to Rome's Military Hospital intensive care unit and having consolidated experience in pre-hospital, intensive care. The crews are reinforced with Army Aviation medical personnel employed in the airfields as emergency teams; these people have confidence with rotary wing assets but lack pre-hospital care skills. To improve their capability in this matter, the Army created several agreements with local civilian hospitals allowing the use of military personnel on board civilian ambulance and Helicopter Emergency Medical Service (HEMS) aircraft.

To allow medical personnel to operate on-board military aircraft as aircrew, specific procedures have been applied consisting of an in-flight physical examination, a two week course, pre-deployment training and evaluation exercises.

The Army Aviation MEDEVAC course focuses on aircrew skills in order to ensure the successful achievement of both aircrew and medical duties side by side with flight engineers and door gunners. An aim of the course is to not be a 'burden' on normal flight operations. In addition, the medical crew should be able to operate when emergency procedures are conducted and after an emergency landing. Finally, MEDEVAC personnel must be familiar with the specific electro-medical devices and the rescue equipment on Army helicopters.

A specific part of the training focuses on the so called 'non-technical skills' regarding both flight safety and medical procedures, since the pilots, Physicians and Nurses are required to operate in according to the principles of Crisis Resources Management, to reduce the Human Factor errors and maximise communication and safety.

Due to the hostile nature of the rescue areas, all the medical personnel have qualified Survival, Escape/Evasion, Resistance and Extraction (SERE)[6]; meaning they are able to use survival equipment, to perform tactical ground navigation, to use infantry weapons and to be rescued by Combat Search and Rescue (CSAR) assets. Before being sent overseas, the medical

crews are grouped with the mounting flight unit in order to bring together airmen and doctors for a final cycle of exercises, concluding with the Aviation Battalion evaluation.

New Tactics

The Italian Aviation Battalion deploys a daily Quick Reaction Force (QRF) organised with attack, heavy transport, Forward MEDEVAC helicopters and an infantry riflemen unit. The QRF can operate with attack helicopters alone when only fire support is required, otherwise it can react en masse if a unit in distress is under attack by a large enemy formation. When the attack helicopter intervention is not enough to repel insurgent attack, the infantry unit has to land nearby to maximise friendly firepower. During this kind of action the Forward MEDEVAC Team is embedded with the infantry unit, aboard the same helicopter, to be ready when required. This concept might be considered the extreme interpretation of the term 'forward'. To operate in such close proximity to the enemy, the medical crew needs strong combat skills and special fighting equipment. These requirements don't align with current medical practice procedures.

Conclusion and Recommendation

After two years of experience in Afghanistan, the Italian Army has a functioning Forward MEDEVAC organisation, thanks mainly to an internal reorganisation of existing resources rather than expensive technology. This was accelerated by urgent needs of the current operation. MEDEVAC is often perceived as 'medical stuff' but actually only with a clear understanding between flight and medical crew it is possible to achieve mission success. This synchronisation happens during the operational daily routine and ends when the expeditionary units are sent back home and disbanded.

Furthermore, Forward MEDEVAC is the first step in the evacuation chain, having communality also with Tactical MEDEVAC (movement inside the Area Of Operations [AOO]) and STRATEVAC (movement outside the AOO). Usually air forces handle the latter step since STRATEVAC is undertaken by multi-engine transport planes, however this is often seen by Air Force personnel as the only part to focus upon. In reality, the Joint Personnel Recovery (JPR) system, for instance, needs a strong MEDEVAC component, as recent JPR operations are more close to a 'combat' MEDEVAC than classic CSAR activity. This begs a serious question:

Who should take the overall responsibility for the MEDEVAC chain and the Tactics, Techniques and Procedures involved? Air Force, Army? At least it should be a Joint, and in future Combined, approach. ●

1. The term 'golden hour' is commonly used to characterise the urgent need for the care of trauma patients. This term implies that morbidity and mortality are affected if care is not instituted within the first hour after injury.
2. STANAG 3204 Aeromedical Evacuation.
3. The concept had been often confused with CASEVAC (CASualties EVACuation), referred as the sudden evacuation of casualties by improvised means. CASEVAC could not be planned but can only be done if MEDEVAC is unavailable.
4. Doctrine, Organization, Training, Materials, Leadership, Personnel, Facilities.
5. Strictly observation of NATO STANAGs 2087, 2546, 3204 and AJMedP-2; flight medical crewmembers must be volunteer; flight medical crew have to be trained as a flight crew; flying medical personnel must have a well-defined status; the MEDEVAC flight course must focus on aeronautic matters; medical equipment must be officially test for in flight use; the medical personnel must be taken among the intensivists/anesthesiologists or other medical officers/NCO with a great experience in pre-hospital intensive care belonging to Rome Military Hospital.
6. STANAG 7196 NATO SERE Training.

Lieutenant Colonel Andrea 'Fulmine' Lopreiato

attended the Italian Army Military Academy and graduated in 1991. After 7 years in the parachute brigade he joined the US Naval Aviation Flight School in Pensacola, Florida where he graduated as a naval aviator on multi-crew, multi-engine aircraft in 2003. After completion of Staff College he was assigned to the Doctrine and Procedures Branch in the Italian Army Aviation Headquarters in Viterbo. As Branch Head, Lt Col Lopreiato ran several capability development projects including the implementation of a Forward MEDEVAC capability and the national interface of the EDA Helicopter Training Programme. Since September 2012 he has been working as a subject matter expert in the Concepts and Development (CD) branch of the JAPCC.

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Strength, Weakness, Opportunity and Threat (SWOT)

Analysis of Using Aerostats for Surveillance in Counter Terrorism[1]

By Captain Hüseyin Çetin, TUR AF

Abstract

Terrorist activities are the most compelling issue for modern defence forces in maintaining homeland security, especially protecting against terrorist elements that may penetrate a country's sovereign borders. This harm can be minimised by preventing terrorist penetrations of homeland borders through increased Intelligence, Surveillance and Reconnaissance (ISR) capability and by employing this capability over twenty-four hour periods.

Aerostat is the ideal platform to provide this capability. It is aerodynamically shaped balloon that is stationary and fixed to the ground by cables. The aerostat is made of a large fabric envelope that is filled with nonflammable helium gas. Aerostat is different from the other manned and Unmanned Aerial Vehicles (UAVs) because of the aerostat's capabilities such as long endurance and cost effectiveness.

This article explains the technical capabilities, usage areas and purposes of aerostats. There is a comparison chart that compares UAVs with aerostats. Finally this study provides the strengths and weaknesses of aerostats, opportunities and future threat areas in a SWOT analysis table on the next page.

Introduction

The increase of the terrorist activities since the last decade of 20th century around the world confirmed that future military conflicts will not be conventional like those in previous centuries. As a result, counter terrorism emerged as a problem area for many states.

At the same time, there have been differences on the meaning of 'threat'. Threats have evolved and have become more unconventional, unpredictable and ubiquitous. Certain groups or non-state actors have formed terror networks outside of what used to be state-sponsored violence. Therefore, terrorism is the most challenging issue for defence forces due to its unpredictable nature.

Homeland Border Surveillance in Counter Terrorism

Surveillance gaps that emerge because of rough geographical conditions are an important issue. The geographical conditions of homeland border areas and potential instabilities in neighboring countries can adversely affect border security. Borders, with mountainous areas and harsh weather conditions force defence forces to take further precautions against enemy penetration.

Border surveillance must be continuous and uninterrupted. The aerostat is an aerial vehicle, which can adequately carry out this mission. Aerostats are suitable for surveillance because of their long endurance operating capability.

General Characteristics of Aerostats

Aerostats are unmanned and aerodynamically shaped balloons that remain stationary and fixed to the ground by a single, high-strength tether made of steel or fibre. Fibre tethers derive their strength through engineered fibres. The aerostat is made of a large fabric envelope that is filled with nonflammable helium gas, which provides the lifting force. The cables serve to supply electrical power and fibre optics to the aerostat systems and to conduct data relay between the aerostat and ground station.[2] Some tethers can carry up to 100 KW of power for the largest aerostats.

An aerostat system is composed of three major packages: an aerostat platform, a variety of sensors and operational centres.[3] It can climb up to approximately 20,000 feet Mean Sea Level (MSL).[4] Its maximum detection range and coverage is approximately 200 to 300 Nautical Miles (NM). Its mission duration time can be several weeks. It is a large, stable platform that creates an ideal environment for electronic sensors. Its payload weight capacity can be up to 5500 lbs.[5]

SWOT Analysis of Aerostats

SWOT analysis is a method that stands for strengths, weaknesses, opportunities and threats. It is a way of summarising the current state of a system and helping to devise a plan for the future, one that employs the existing strengths, redresses existing weaknesses, exploits opportunities and defends against threats.[6] The main issue in this study is SWOT analysis of aerostats so a SWOT analysis chart has been generated (see Table 1).

SWOT Analysis	Positive	Negative
INTERNAL	**Strengths** a. Cost effective b. Easy installation c. Minimal Crew d. Long time and persistent performance e. Advanced sensors and surveillance systems f. Wide variety of tasks/missions supported	**Weaknesses** a. Limited useful payload b. Limited altitude
EXTERNAL	**Opportunities** a. Sensor innovation and integration b. Composite material innovation	**Threats** a. Bad weather conditions b. Limited survivability

Table 1: SWOT Analysis of Aerostats.

Strengths

Cost Effective. Cost effectiveness makes a huge difference between aerostats and other Unmanned Aerial Vehicles (UAVs).[7] With a small portion of a UAV's cost, an aerostat can be produced.[8] It is not cost effective to use UAVs in surveillance missions for homeland border security. Aerostats can be used as an alternative platform for these missions.[9] "Aerostats cost as little as $200 an hour to put up. This compares to tens of thousands of dollars per hour for a UAV and with a UAV, you still have a crew and an aircraft to maintain" said Lon Stroschein, Vice President at Raven Aerostar Company.[10]

Easy Installation. Installation of aerostats is relatively simple and takes only four hours to make ready for operation (for small sized aerostats).[11] Tactical aerostats can be installed quickly and transportation is easy because of their lightness. Mid-sized and large aerostats can be ready for operations after a few hours more of installation. There are many types of mid-sized and large aerostats which can be transported by trucks, helicopters, or aircraft.[12]

Minimal Crew. Two staff can complete the installation of small-sized tactical aerostats. Mid-sized and large aerostats' installation and operation readiness can be completed by five staff.[13] The maintenance-operation of aerostats can be ensured by very few people, and their staff requirement is less than that of manned and UAVs' requirements. Thus, an effective surveillance mission can be performed with fewer personnel and associated cost. Also the training time for staff is shorter because there are few lessons to learn.

Long Time and Persistent Performance. Aerostats, which may cover more territory than manned or UAVs, stay aloft for days or weeks when the manned or UAVs stay aloft for only hours.[14] There is little debate that aerostats have better surveillance capability because of their long duration oversight capability.

One of the most important capabilities of aerostats is its uninterrupted and persistent data transfer. Thus, persistent surveillance without gaps can be accomplished and terrorist penetration of borders can be prevented.

Advanced Sensors and Surveillance Systems. Infrared (IR) and high resolution optical video cameras, more than one radar, high powered computers for processing data coming from sensors and communication equipment for data transportation to ground users are some of the equipment used with aerostats.[15] In addition, persistent surveillance aerostats may cover very wide areas with their wide area movement image sensors that take more than one photograph per second. Surveillance of very wide areas helps users observing territories and increases awareness of potential targets.[16]

"Cost effectiveness makes a huge difference between aerostats and other UAVs."

Wide Variety of Tasks/Missions Supported. Aerostats can be used effectively for many surveillance tasks. Within aerial early warning missions, aerostats take a leading role in assuring the sovereignty of crucial airspace dominance and providing early warning and airspace control. In terms of providing national security and aiding counter-terrorism, aerostats enhance security against terroristic acts, provide improved coverage of the airspace, support build up of a database over time for identification of irregular events and provide increased coordination between surveillance and response units.[17]

Aerostats can be used as a radio antenna relay with the radio antennas mounted on them. They can stay aloft with high antennas inexpensively and improve line-of-sight radio coverage over long distances, as well as, congested urban areas and mountainous terrain.[18]

As a result of this study, a comparison chart has been generated. It compares the general capabilities of UAVs with aerostats. Consequently, although UAVs are more effective than aerostats in certain categories such as altitude, mobility and survivability, it is evaluated that the aerostats can be used rather than UAVs in ISR missions because aerostats are more effective and advantageous in payload, cost effectiveness, training period, coverage, staff number and endurance categories. In short, the light blue areas

The Comparison Chart		
SYSTEMS & CAPABILITIES	**UNMANNED AERIAL VEHICLES**	**AEROSTAT SYSTEMS**
Altitude	More	Less
Mobility	More	Less
Survivability	More	Less
Payload	Less	More
Cost	More	Less
Training Period	More	Less
Coverage	Less	More
Crew	More	Less
Endurance	Less	More

Table 2: The Comparison Chart.

are the preferred capabilities and the grey areas are non-preferred (see Table 2 above).

Opportunities

Sensor Innovation and Integration. Integrating new technologies on aerostat systems is easy with universal payloading stations. Currently, many companies study and produce sensors that will enhance the effectiveness of aerostats.[19] In the very near future, new sensor technology will be mounted on existing aerostats.

Composite Material Innovation. A company is currently manufacturing a new fabric called High Strength Laminated Aerostat Material (HSLAM) that will be used for the aerostat's outer cover. They intend to reduce the weight of the material anywhere from 35 percent to 45 percent.[20] The companies want to produce stronger and lighter composite materials used on the aerostat's outer frame. There are new developments every day about these materials and the competition between companies will make aerostats lighter and stronger in the future.

Weaknesses

Limited Useful Payload. The aerostat's payload capacity increases in direct proportion to the volume of the aerostat. However, their ceiling altitude and endurance time decreases in direct proportion to the payload carrying capacity. Because the payload capacity of small sized aerostats is less than the payload capacity of larger volume aerostats, small sized aerostats will have to use smaller sensors and so their effectiveness of surveillance will be less than the larger ones.

Limited Altitude. The ceiling altitudes of aerostats are low and middle-level altitudes. Large-sized aerostats can climb to approximately 20,000 feet MSL altitudes. When calculating these altitudes Above Ground Level (AGL) they will be lower, especially in aerostats deployed in border areas with high altitudes above sea level. Aerostats cannot reach the required altitude in extremely hilly and mountainous territories, therefore they will be ineffective at surveillance and unable to perform the task as well as increase the possibility of staying within the range of light arms fire.

Threats

Poor Weather Conditions. In poor weather conditions, aerostats cannot perform missions effectively unless they are large. The most concerning issue is possible damage due to strong winds or heavy rain. In the event of excessive winds (faster than 60–70 mph for small sized aerostats) or other bad weather conditions, the data cables, fibre or steel cables that connect tethered aerostats to the ground may stretch and

set the aerostat free.[21] As a result, the aerostat will be lost and uncontrollable. In stormy weather, both the aerostats and the sensors may sustain damage, resulting in problems with data transfer and surveillance.

Limited Survivability. Large-sized aerostats can perform their missions out of the range of small arms fire because of their altitude, but smaller aerostats used at lower altitudes may stay within the range of small arms fire.[22] Terrorist elements could easily disrupt or destroy small, low altitude aerostats.

Aerostats have been used in moderate and secure environments since 2003. They are suitable for using in an environment with relatively low threat level, but the aerostats would get damaged quickly by the adversary's improved air defence systems when they are used in less benign environments where security has not been achieved fully.[23] Ensuring the survivability of aerostats may be the most important problem in intense threat environments because aerostats are immobile systems and need protection.

Conclusion

In homeland border surveillance missions performed by manned or UAVs, there will be some constraints. Even if large numbers of aerial vehicles are used, some territories go unseen. As a result, the mission cannot be performed completely effectively and the costs will be high. When cost effective aerostats are used in similar missions, effectiveness increases. The endurance time of an aerostat is up to hundreds of hours, and aerostats may be used to cover farther distances with their advanced sensors, making aerostats a good alternative to manned or UAVs.

Aerostats have some weaknesses, such as limited survivability, mobility and climbing altitude. These properties make aerostats more disadvantageous than other manned or UAVs. On the other hand, aerostats have many opportunities in the near future to improve upon these negative aspects, such as, stronger composite material and sensor innovation. It is concluded that aerostats will be used frequently as primary platforms in surveillance missions within homeland security.

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Captain Hüseyin Çetin

was born in Kocaeli, Turkey, in 1980 and graduated from the Turkish Air Force Academy in 2002. He has accumulated 900 flying hours on the F-4E, 400 flying hours on the T-37 B/C as a Flight Instructor and is currently studying at the Turkish Air War College. Captain ÇETİN is married with no children.

The Extended Air Defence Task Force

From Task Force to Competence Centre

By Lieutenant Colonel Eric Verweij, NLD AF, JAPCC
By Lieutenant Colonel Jurgen van Keulen, NLD AF, EADTF

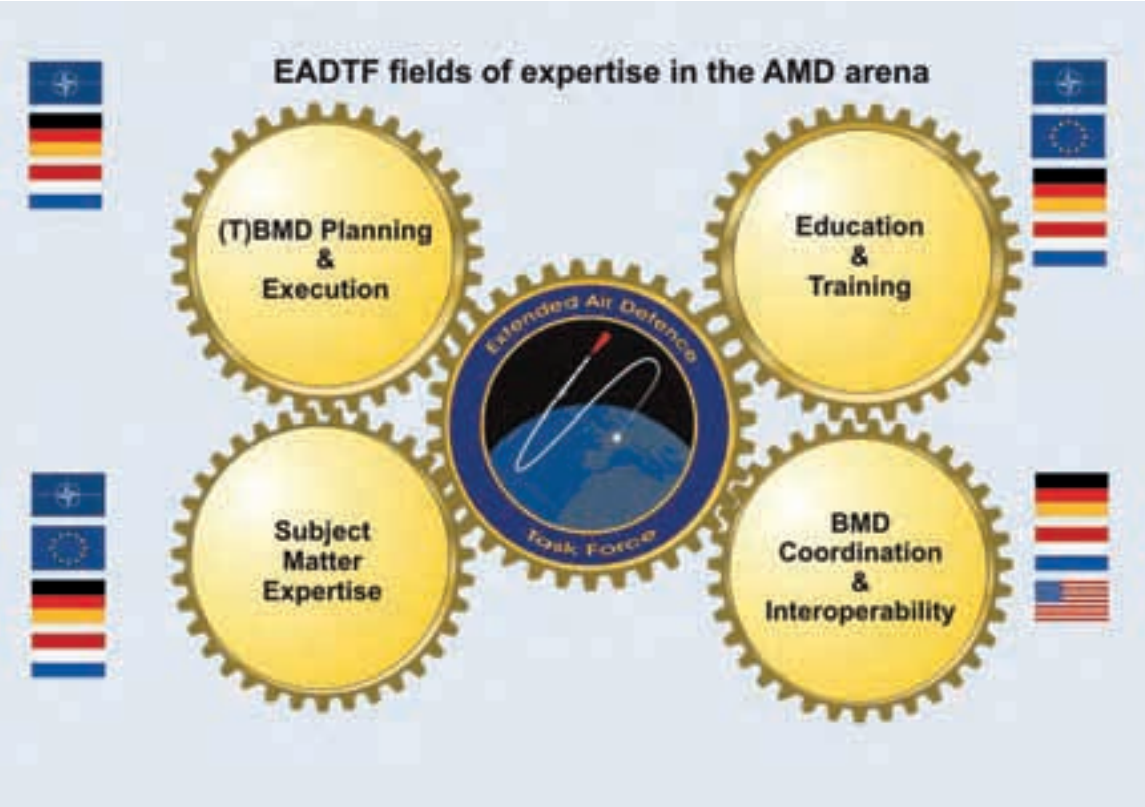
History

The Extended Air Defence Task Force (EADTF), comprising Germany, The Netherlands and the United States, was formally established on the 3rd December 1999 in Burbach, Germany. The principal reason for the formation of the EADTF was the frank admission that more robust cooperation was required amongst the NATO PATRIOT weapon system user community. More specific was the requirement for greater levels of interoperability between the nations and in the development of common Training, Tactics and Procedures (TTP's). The original mission of the EADTF was defined as: "Planning and coordinating combined air defence activities, including training, exercises and interoperability tests. On order, the EADTF will assume mission related command and control functions and/or augment Air Defence/(Theatre) Missile Defence organizations". In 1999, the EADTF's manning was just 34 personnel provided by the three countries.

In 2003, U.S. and Dutch personnel from the EADTF took part in Operation DISPLAY DETERRENCE, to complement NATO's Integrated and Extended Air Defence System in the defence of Turkish territory; Due to internal political reasons, German personnel were not allowed to participate.

"The proliferation in the ballistic missile threat has become of increasing concern to NATO, and the adoption of … the Air and Missile Defence (AMD) concept by nations, has potentially increased the requirement for the EADTF's expertise."

In July 2004, due to major restructuring within the German Air Force, the facilities in Burbach were closed and the EADTF was relocated to Heidelberg, adjacent to the Headquarters of the U.S. Army in Europe. However, in 2008, a reorganisation of the U.S. Ground Based



Air Defence forces in Europe signalled the withdrawal of the U.S. from the Task Force, resulting in another move to their current location at Ramstein. After finalisation of several efficiency measures, the EADTF's current staff is comprised of 16 personnel from Germany and The Netherlands with additional observers from France, Poland and the U.S.

The EADTF is neither part of the NATO Command Structure nor the NATO Integrated Air and Missile Defence System (NATINAMDS), however, can support and reinforce existing NATO Headquarters or assume command of/or assist a multi-national Task Force.

The EADTF Today

The EADTF's current main effort, within the Air and Missile Defence arena, is focussed on Ballistic Missile Defence and Theatre Ballistic Missile Defence operations, notwithstanding the importance of the more-accustomed threats posed by Cruise Missiles (CM), Anti-Radiation Missiles (ARM), Unmanned Aerial Vehicles (UAV) and Aircraft.

Based on current capabilities, the General Officers' Steering Committee (GOSC), consisting of the Deputy Chiefs of the Air Forces from both nations, is developing the EADTF's annual program of work, categorised under four major activities:

1. Planning and Execution of BMD Missions

The EADTF can field three planning and execution teams at the same time. Based on political and military guidance, these teams are capable of planning command and control structures, Air & Missile Defence (AMD) sensors and weapon systems. Furthermore, these teams are also capable of executing operations in defence of territory, and its assets, against missile and rocket threats whilst utilising current NATO systems. This is demonstrated by the use of EADTF personnel in support of the deployment of PATRIOT systems to Turkey under the NATO Standing Defence Plan called ACTIVE FENCE.

2. Providing AMD Expertise

The EADTF has gained a level of expertise and knowledge to support NATO (SHAPE and HQ AIRCOM) in

developing AMD policy and doctrine, concepts, plans and other AMD-related documentation. The EADTF further supports NATO in the development of new C^2 systems (ACCS, PLATO[1] and AIRC2IS[2]). This expertise also enables the EADTF to contribute to the respective national Missile Defence decision-making processes.

3. Education and Training of AMD Personnel

NATO is currently working hard to realise an appropriate education and training capability regarding AMD. Historically, the EADTF has trained NATO, the EU and national personnel on AMD operations and is now supporting NATO's effort in building up their own organic expertise.

4. Multinational Co-operation

The EADTF has gained experience and expertise in multi-national co-operation through a number of NATO-centric exercises and projects (Nimble Titan, Joint Project Optic Windmill, Joint Project Optic Alliance) and also within the framework of the NATO Russia Council. This level of knowledge has enabled the EADTF to assume leading roles in co-operative efforts.

The EADTF in Future

The proliferation in the ballistic missile threat has become of increasing concern to NATO, and the adoption of (but not necessarily a contribution to) the Air and Missile Defence (AMD) concept by nations, has potentially increased the requirement for the EADTF's expertise. Whilst the EADTF is well known, it was decided, in December 2012, by the General Officers' Steering Committee to transform the Task Force into the Air and Missile Defence Competence Centre (CCAMD).

The CCAMD will maintain, if not improve upon the capabilities already established by the EADTF in the

"The EADTF's current main effort, within the Air and Missile Defence arena, is focussed on Ballistic Missile Defence and Theatre Ballistic Missile Defence operations, notwithstanding the importance of the more-accustomed threats posed by Cruise Missiles (CM), Anti-Radiation Missiles (ARM), Unmanned Aerial Vehicles (UAV) and Aircraft."

fields of operations, concept development, experimentation, intelligence, coordination, and education and training. The CCAMD offers a significant knowledge base for the benefit of participating nations, the NATO Alliance, the EU and other international organisations and scientific institutions e.g. IABG, TNO; this includes the provision of AMD planning & execution support to the NATO Command Structure (NCS). The knowledge and expertise of the CCAMD will contribute significantly toward the emerging European AMD capability, and with a correspondent benefit to the participating nations.

The CCAMD is an Memorandum of Understanding organisation with multi-national control and tasking in response to both NATO's and national requirements, whether in peacetime or crisis. The current intent is for the CCAMD to provide expertise for AMD projects and program support and to act as a repository of knowledge and a human resource pool of experts for the multiple 'business' areas of Air and Missile Defence. ●

1. Planning and Training Tool for (T)MD.
2. Air Command & Control Information System (NATO information tool for Operational level and above).

Lieutenant Colonel Jurgen van Keulen

is a professional officer of the Netherlands Air Force and currently the Deputy Commander of the Extended Air Defence Task Force (EADTF). Lt Col van Keulen started his career in 1981 as an Army conscript in an Anti-tank unit. In 1983 he shifted to the Air Force to become a Ground Based Air Defence Officer. He performed several command and supportive functions at unit and staff level, like leading competence centres on Air and Missile Defence. Lt Col van Keulen served additionally in Air Force related and joint positions on the tactical and technical level. He also served as a National Voluntary Contribution to the Integration and Test Branch of the Ballistic Missile Defence Programme Office. During his active duty he fulfilled five real world missions.

Lieutenant Colonel Eric Verweij

graduated from the NLD Royal Military Academy in 1986. After basic training he was posted to the 3rd NLD Missile Group as Battery Control Officer on the HAWK Ground Based Air Defence system. After several operational posts, he became Squadron commander of the 327 Patriot Sq. in 1992. In 1998, he was posted to the RNLAF HQ in the GBAD/Force Protection Branch. As Flying Branch Instructor he was posted to the Tactical Leadership Programme in Florennes Belgium in 2002. After this tour he returned to the RNLAF HQ where he served in the Operational Requirements and Plans Section and, again, at the GBAD/FP Branch where he was responsible for the operational management of the Patriot weapon system. Lt Col Verweij is currently employed as Subject Matter Expert in Air and Missile Defence at the Combat Air Branch of the JAPCC.

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Capable, Ready and Relevant

The NATO E-3A Component

By Major General Andrew Mueller, USA AF, Commander, NATO E-3A Component

Introduction

In 1978, 12 member nations of the North Atlantic Treaty Organization (NATO) joined together in a one-of-a kind agreement to provide an Airborne Early Warning and Control (AEW&C) capability to the Alliance.[1] Originally procured to overcome a serious deficiency in the air defence system of the time, over the past thirty years the NATO E-3A Airborne Warning and Control System (AWACS) aircraft has evolved into a highly capable airborne Command and Control (C^2) platform. Now 16 nations strong, the NATO E-3A Component, which employs NATO's 17 E-3A AWACS aircraft, has evolved and remains a capable and ready force, still relevant to the employment of NATO airpower.

Given the genesis of the E-3A Component as a counter to the low fast-flying air threat of the 1970s one may ask, "How can an organisation built to counter a 1970s air threat remain relevant to airpower employment today?" Although this might be a subject for debate, it is difficult to dispute that since 28 June 1982, the official activation date of the E-3A Component, NATO commanders elected to employ the NATO AWACS in nine different operations. With NATO Operation ANCHOR GUARD in 1990 and NATO Operation UNIFIED PROTECTOR in 2011 is a window of more than two decades of NATO AWACS missions providing sustained support to on-going operations. Between 1992 and 2004 the E-3A Component flew over 10,000 mission sorties supporting NATO operations in Bosnia and Herzegovina. This appetite for NATO AWACS capability was fuelled by one overarching factor – location.

Areas of Interest

Where these NATO operations were conducted clearly drove a requirement for the employment of NATO AWACS. Six of the nine NATO operations supported by the E-3A Component were conducted outside the territory of NATO nations. Two of the remaining operations were conducted inside the airspace of NATO nations but focused across the border on non-NATO states. For example, in 1990 NATO AWACS were operated

Mission crew personnel reviews the surveillance plan aboard the E-3A AWACs.

along Turkey's border with Iraq. In 1992, NATO AWACS could be found operating in international airspace along the border of Libya and in the sky above Bosnia and Herzegovina. In 2011, NATO AWACS were on-station over Afghanistan and once again operating along the border of Libya.

Based on the location of these operations, existing NATO ground based surveillance and C^2 systems could not support the associated areas of responsibility. Almost unexpectedly, NATO commanders had an operational requirement to extend the reach of both their surveillance and C^2 capability beyond the boundaries of the NATO nations. By 1992, delivering a capability to fill this requirement became an important part of the mission of the E-3A Component.

As a result, in a relatively short timeframe, the E-3A Component evolved from an organisation focused on employing the NATO AWACS above NATO nations to provide low-level radar coverage to augment NATO ground based air defence systems to an organisation skilled in extending the reach of NATO C^2 and surveillance capabilities beyond the borders of the NATO nations. This evolution has produced an E-3A Component with a mission much different than the mission envisioned in 1978.

Today, the mission of the E-3A Component supports the overall mission of the NATO Airborne Early Warning and Control Force (NAEW&CF) which is

"To provide an Airborne Early Warning and Battle Management Command and Control capability trained and equipped to participate in NATO approved operations worldwide, available at graduated levels of readiness, to support nominated Joint Force or NATO Response Force (NRF) commanders."[2]

When compared with an early version of the E-3A Component mission statement which read in part, "to deliver a surveillance and/or control platform whenever directed … by SACEUR",[3] the evolution is seen in three areas; the shift from a pure surveillance and control platform to an Airborne Early Warning, Battle Management and C^2 capability, the addition of the E-3A Component to the NRF, and the expansion to worldwide operations.

Evolution

The evolution from the mission of providing a surveillance and control platform to the mission of providing Battle Management and C^2 in support of Joint Force commanders has increased the spectrum of mission

elements supported by the E-3A Component. No longer are NATO AWACS missions exclusively linked to supporting air defence systems with surveillance and control. Instead, NATO AWACS aircrews are tasked to be proficient and ready to conduct ten different mission elements under the umbrella of surveillance and airborne early warning and 19 capabilities identified for airborne air battle management and Command and Control as described in Allied Command Operations Forces Standards Volume III.[4]

Be certain, providing air surveillance and control to support the employment of NATO airpower remains the core mission of the E-3A Component. However, these increasing number of mission elements reflects the reality that NATO airpower is employed in NATO operations to conduct a wide range of mission sets beyond air defence. Further, it reflects how NATO AWACS systems are easily adapted to other mission sets, important to on-going NATO operations as well. For example, the maritime radar receiver on the E-3A aircraft has not changed in 30 years. Yet NATO AWACS is still an effective asset for NATO counter piracy operations.[5] Maritime Operations is one of the ten mission elements tasked to NATO AEW&C.

Further, Tactical Directors, officers who hold overall responsibility for the execution of the NATO AWACS mission, are trained to accept delegation of specific tactical battle management functions to support the C^2 of airpower. Inherent in this delegation is a degree of autonomy where NATO AWACS aircrews are delegated tactical authorities which enable tactical action based on real-time information. This delegation allows NATO AWACS aircrews to operate independent of the NATO air C^2 structure and the traditional command arrangements employed through the NATO Combined Air Operations Centres. During Exercise RIMPAC 2012, NATO AWACS aircrews demonstrated the ability to operate independent of the NATO air C^2 structure while supporting many mission elements supporting airpower employment.

In response to the rapid employment concepts required of the NATO Reponses Force, and the requirement for worldwide operations, the E-3A Component has improved overall readiness in areas beyond aircrew flying training. Civilian and military members of the E-3A Component maintain an annual currency in a set of common core skills necessary to sustain operations at an austere location. Expeditionary deployment concepts are established which could enable NATO AWACS operations from any operational air base.

On-going E-3A Component operations supporting the NATO International Security and Assistance Force in Afghanistan are, perhaps, an acknowledgement of the evolution the E-3A Component has made. Aircrews are conducting operations in support of ground and Special Operation Forces (SOF). (An additional expansion of the AEW mission elements beyond the ACO Force Standards). The E-3A Component has adapted an expeditionary mind set, sustaining a very high mission effectiveness rate from a Deployed Operating Base (DOB).

"… providing air surveillance and control to support the employment of NATO airpower remains the core mission of the E-3A Component. However, these increasing number of mission elements reflects the reality that NATO airpower is employed in NATO operations to conduct a wide range of mission sets beyond air defence."

Throughout this evolution there has been an enduring constant – the people. Creating and maintaining an environment where men and women from 16 NATO nations work side-by-side to deliver NATO AWACS capability is in intangible quality of the E-3A Component. The professionalism of the men and women who represent their nations by serving in the NATO AWACS program is extraordinary and has carried the E-3A Component forward thirty years. In many ways, the 19,000+ people who have been assigned to the Component have enabled success in an underlying mission of the NATO AWACS team, fostering multi-national cooperation among 16 NATO nations. The E-3A Component stands as an excellent example of the capability which can be delivered by through cooperation among airmen, under the umbrella of the NATO Alliance.

Nevertheless, as in the past, this multi-national effort must continue to evolve to enable the E-3A Component to remain a capable AEW&C force for NATO commanders. Based on the current E-3A Component mission this evolution should include two important areas.

Capabilities Improvement

First, the NATO AWACS aircraft should be modified with capabilities which improve support to the mission areas beyond air surveillance and control. The NATO-Mid Term upgrade introduced computer technology which automates many surveillance functions. Today, the recognised air picture produced by the NATO AWACS is largely a product of the Multi-Sensor Integration Computer (MSIC). This computer is able to accurately correlate sensor data to produce air and surface tracks within the entire surveillance area available to the E-3A sensors with minimal aircrew input. This automation enables NATO AWACS aircrews to support simultaneous operations across several mission elements.

Future modernisation efforts should bring more real-time sensor information to the NATO AWACS aircraft. Information from systems such as Automatic Identification System and NATO Air Ground Surveillance system should be injected into the MSIC to produce a more comprehensive air, surface and ground picture. This will enable NATO AWACS aircrews to support to operations involving ground, maritime and SOF forces with real-time information.[6]

Proficiency Training

Second, to maintain proficiency in the increasing number of mission elements identified in the NATO Force Standards the E-3A Component must develop a Distributed Mission Training (DMT) capability. Without question, the best training for NATO AWACS aircrews is still found in live flying arena. Large scale combined forces exercises involving the integration of airpower is invaluable to training battle management and C^2. Unfortunately these opportunities are rare. A DMT capability, fully supported with simulators from as many NATO nations as possible, is essential to sustaining the readiness of the E-3A Component aircrew across the increasing mission sets which NATO operations demand.

Conclusion

In 1978, it would have been impossible to justify the need for NATO AWACS based on any requirement beyond air defence. The requirement to extend the reach of NATO surveillance, C^2 and battle management capabilities to support NATO operations in Afghanistan was unthinkable. After thirty years of sustained operations the mission of NATO's E-3A Component has certainly evolved to meet the requirements to support the employment of NATO airpower in many scenarios. This evolution has produced a NATO E-3A Component which is fully engaged in NATO operations today and capable, ready and relevant for NATO operations in the future. ●

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Major General Andrew M. Mueller

is the Commander, E-3A Component, Geilenkirchen, Germany. He leads an international military and civilian staff, representing 16 NATO nations which provide an airborne early warning, command and control and battle management capability to support NATO commanders. General Mueller is a master air battle manager with more than 3,800 hours flying on both U.S. and NATO AWACS aircraft. He has served in 3 NATO assignments and was Deputy Commander, Combined Air Operations Center 6, Allied Air Forces Southern Europe, Eskisehir, Turkey. Prior to his current assignment he was assigned as Commander, 81st Training Wing, Keesler Air Force Base, Mississippi.

Double Counting or Counting Double?

The Future of NATO's Tanker Transport Fleet

By Major Chad Taylor, USA AF, JAPCC

Introduction

NATO nations are in the process of a much needed modernisation of their Air Transport (AT) and Air-to-Air Refuelling (AAR) fleets, and in many cases, are choosing airframes that can perform both missions. For strategic applications, nations are procuring versions of the Airbus A330 Multi Role Tanker Transport (MRTT) or a variant of the Boeing 767, while on the tactical side, the A400M is being selected to fulfil AT and AAR requirements. These new aircraft have the capacity to support AAR and multiple AT missions concurrently. The question NATO nations must ask is whether the planned inventory of these new aircraft can satisfy NATO's full need for both AT and AAR at the same time or only fulfil the needs of only one of these missions at a time? Also, if these new aircraft are going to be used to their full potential, NATO must have doctrine and procedures in place to ensure their efficient and effective use.

Really Something New?

One might argue that Tanker Transport aircraft are nothing new. NATO has had this capability with KC/KDC-10s and Tristars for quite some time now, however, these aircraft account for only a small part of the Alliance's total AT and AAR fleet. Indeed, all NATO tanker aircraft have at least a limited AT capacity, but few can effectively perform both missions simultaneously with significant fuel and cargo loads. Due to critical AAR needs, the US Air Force and Royal Air Force use their KC-10 and Tristar tankers almost exclusively for AAR missions, carrying very little cargo even on 'tow-lines' where said cargo is to support the receivers that are in tow. Most of the time, the US Air Force tasks a C-17 to haul personnel and equipment for a 'fighter drag' and only uses the towing tanker to refuel the fighters. This allows the tanker to support additional AAR missions instead of positioning and repositioning to carry cargo. Also, tankers in a fighter drag are, in most cases, tied to the receivers; and if they divert, the tanker must likely divert as well. This is usually not a problem unless the tanker is also carrying personnel or dangerous goods to support the receivers; if this is the case, the divert options may be limited or more complicated. To be honest, most nations do not have the luxury of a large strategic AT fleet, leaving them no choice but to use their strategic tankers for airlifting support personnel and equipment.

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Will NATO's AT and AAR Needs be Met?

There is no question that the new Tanker Transport aircraft being produced are vastly more capable than the aircraft they are replacing, however, quality and capability do not automatically ensure AT and AAR needs will be met with a sufficient quantity of output. There are three key questions that must be answered to ensure that NATO will have sufficient AT and AAR assets to meet its stated level of ambition. First, what is the AT and AAR requirement needed to meet the level of ambition? Second, will the planned future aircraft inventories be able to meet this requirement? Finally (and most difficult to determine), given the advertised capabilities of these new AT and AAR assets, are nations planning on one aircraft to full fill both needs at the same time; and if so, will this work?

What is NATO's AT/AAR Requirement?

The Alliance has endured rigorous coordination and discussion throughout the NATO Defence Planning Process (NDPP) to ensure sufficient capabilities and quantities of forces are available to meet its level of ambition; namely, to be able to simultaneously conduct two major joint operations and up to six smaller joint operations (one of which will be 'air heavy').[1] The NDPP has determined the number of tankers the Alliance needs, but when exposed to serious scrutiny there is some question as to accuracy of the assessment. If one considers the ISAF mission in Afghanistan a major joint operation and takes the fact that Operation Unified Protector (OUP), an 'air heavy' small joint operation, greatly stretched the Alliance's AAR assets, the question of Alliance capability to support two major joint operations concurrently (not to mention five additional small joint operations) becomes evident.

Attempting to evaluate NATO's AT requirement is even more difficult especially since NATO has yet to quantify the need as it has with AAR. NATO doctrine has held that nations are responsible for their own deployment, sustainment and redeployment. Also, determining the amount of AT assets required is much more complex than determining AAR requirements. It is difficult to estimate the total cargo the Alliance would need to move given the number of nations involved and the diversity of their airlift requirements. Also, cargo weight is not the only limiting factor; the dimension of the cargo to be moved, especially outsized cargo, often complicates load planning. Finally, it is difficult to estimate the amount of cargo to be transported by air versus what will go by surface. By definition, AAR can only be performed by aircraft; whereas transport is multimodal. The balance between air and surface transport largely depends on how quickly the cargo must be delivered.

There is one sensitive subject that has yet to be mentioned when it comes to determining the amount of assets that each nation should provide: should any nation in the Alliance be expected to provide a majority of any given capability? The US currently provides the majority of NATO's AAR and AT (especially outsized) capability. A number of NATO nations have stated a desire for a more balanced approach, but will this actually result in increased procurement from the rest of the Alliance? A study produced for the US Air Force Institute of Technology determined that if Europe procures its planned number of A400Ms, Europe will be able to transport an entire NATO Reaction Force (NRF) up to 4,000 miles in less than 30 days.[2] The problem is that NATO's level of ambition is larger than a single NRF. More analyses of NATO's requirements and capabilities is needed.

NATO's Future AT/AAR Capability

Fortunately, it is a little easier to calculate NATO's future capability than it is to identify the future requirement. One just needs to know what specific AT and AAR assets the nations plan to procure and maintain for the future fleet and the capability of that fleet. On the surface, things look promising for the Alliance; the new aircraft are far more capable than the aircraft they are replacing. See table on previous page for NATO's projected AT (strategic) and AAR fleets for the 2025 time frame.

Double Counting or Counting Double?

Even if it is possible to accurately determine NATO's AT and AAR requirement and pinpoint the capacity of the Alliance's future fleet, there remains the expectation

NATO's Current and Planned AT and AAR Fleets[3]

Nation	Tanker Inventory 2013[1]	Tanker Inventory 2025	Strat AT Inventory 2013	Strat AT Inventory 2025[8]
Belgium	Currently No Tankers	EDA Pillar 4[2] Tanker	Currently No Strat AT	EDA Pillar 4[2] Tanker 7 A400M
Canada	2 CC-150T (A310) 4 CC-130HT	2 CC-150T (A310) 4 CC-130HT[3]	2 CC-150T (A310) 4 CC-177 (C-17)	2 CC-150T (A310) 4 CC-177 (C-17)
France	7 C-160NG W/pods 11 C-135FR 3 KC-135R	10 A400M W/pods[4] 12 A-330MRTT	2 A340 3 A310	50 A400M 12 A-330MRTT 3 A310 2 A340
Germany	4 A310MRTT	4 A310MRTT 10 A400M W/pods	4 A310MRTT 1 A310-304	4 A310MRTT 1 A310-304 40 A400M
Italy	4 KC-767 9 KC-130J	4 KC-767 9 KC-130J	4 KC-767	4 KC-767
Luxembourg	Currently No Tankers	EDA Pillar 4[2] Tanker	Currently No Strat AT	EDA Pillar 4[2] Tanker 1 A400M
Netherlands	2 KDC-10	EDA Pillar 4[2] Tanker	3 DC/KDC-10	EDA Pillar 4[2] Tanker
Spain	2 B-707 5 KC-130	EDA Pillar 4[2] Tanker 9 A400M W/pods	Currently No Strat AT	EDA Pillar 4[2] Tanker 27 A400M
Turkey	7 KC-135R	7 KC-135R	Currently No Strat AT	10 A400M
United Kingdom	2 Voyager KC2 (A330) 5 TriStar K1/KC1	14 Voyager KC2 (A330)	2 Voyager KC2 (A330) 5 TriStar K1/KC1 7 C-17	14 Voyager KC2 (A330) 22 A400M 7 C-17
United States	59 KC-10 411 KC-135 R/T 57 MC-130E/H/P 36 HC-130P/N 15 MC-130J 9 HC-130J 28 KC-130T 46 KC-130J	59 KC-10 232 KC-135 R/T[6] 179 KC-46[5] 37 MC-130J 20 MC-130H 37 HC-130J 74 KC-130J	59 KC-10 95 C-5 213 C-17	59 KC-10 179 KC-46[5] 52 C-5 213 C-17
Multinational	Currently No Tankers	8 EDA Pillar 4[2] Tankers	3 C-17 (SAC/HAW)	3 C-17 (SAC/HAW) 8 EDA Pillar 4[2] Tankers
Total (including US)	**728**	**731+31[7]**	**406**	**724**
Total (excluding US)	**67**	**93+31[7]**	**39**	**221**

1. All numbers in current inventories are taken from the national declaration made during the NATO AARWG and ARSAG conference in April 2013. The only exceptions are US C-130 type tankers where the sources are USAF and NAVAIR.
2. It is assumed a minimum collective procurement of 8 strategic tankers under Pillar 4 of the EDA initiative. The exact number has not been decided yet.
3. CC-130 planned for retirement but replacement not yet selected.
4. The total number of underwing kits represents the total number of A400M tankers available. The additional HDUs do not represent additional tankers.
5. Delivery of the KC-46 programme will be completed in 2028. For the purpose of this document the 2025 timeframe includes all aircraft deliveries.
6. The estimated number of KC-135 still in service during the period 2020-2025 is based on a one for one replacement with KC-46. Official data regarding the retirement schedule of the KC-135 is unavailable.
7. Under the EDA's AAR Initiative (Pillar 3) the purchase of an additional 31 U/W kits and 15 HDUs will convert a further 31 A400M aircraft to the tanker role from the existing fleet.
8. A400M included as a strategic airlifter.

Table 1: NATO's current and planned AT and AAR fleets.[3]

that many of the new aircraft being procured will satisfy both AT and the AAR requirements. But can they? The question is not so much if, on the same mission, an individual A330 or 767 (and A400M to a lesser extent) can deliver a near full load of fuel and cargo or passengers, but if the entire fleet of new more capable aircraft can fully satisfy both requirements concurrently. For example, a nation determines it needs 10 tactical airlifters and 10 tactical tankers to meet its AT and AAR needs. Will the nation need 20 or 10 A400Ms to meet both AT and AAR requirements?

The problem is that even though the aircraft is physically able to perform both AT and AAR missions at the same time, the mission parameters or regulations may not allow these capabilities to be exercised on the same mission. Most wartime AAR missions are in support of fighter caps or strike ingress/egresses and require the tanker to fly to an orbit, remain there until empty and then return to home station. This allows little opportunity for the asset's AT capabilities to be used. Similarly, strategic AT mission routings are seldom conveniently aligned with AAR tracks, thus making it very difficult to combine long AT legs with AAR tasks. Combining passenger missions with AAR missions is even more problematic. It is one thing to extend a cargo mission by hours or fly them into or near hostile airspace to accommodate AAR missions; it is yet another to require the same of a passenger mission.

During peace time, it will be much easier to manage the new tanker transport fleet, satisfying both AAR and AT requirements. Obviously, the term 'peace time' is relative; so for the sake of this discussion, we will consider peace time a period where there is one major joint operation, such as the ISAF mission, in the sustainment phase combined with an air heavy small joint operation similar to OUP or Mali. Under these circumstances, most of the AAR required supports training, fighter deployments or is needed to extend the legs of AT and surveillance/C2 missions. These types of missions are much easier to combine with AT missions, because the amount of fuel required/time on orbit is significantly less or the AT portion of the mission is supporting towed receivers. Similarly, during relatively peaceful times, many AT missions are scheduled for training or less urgent matters. In times of peace, there is increased flexibility to add AAR tasks to the mission mix or shift transportation needs to commercial air or surface providers.

The real question is will this new flexibility and capacity to perform the AAR and AT mission simultaneously hold up if NATO is forced to exercise its full level of ambition in the '2 plus 6' environment? Much of the philosophy behind using these new tanker transports to cover both AT and AAR requirements is predicated on the belief that, during peace time, these platforms will be used primarily for training and AT duties. If large scale war occurs, aircraft tasking will shift to cover the increased AAR requirement. But what happens if the nature of the conflict (distance from NATO's territory, the need for rapid mobility and/or lack of good surface transport options) prevents assets needed for strategic airlift from shifting to the AAR mission? Also, much the Alliance's proposed drogue AAR capability will be realised through the A400M. What happens if the situation calls for increased use of that platform for airdrop, tactical intra-theatre airlift or special operations missions and these assets have reduced availability for AAR? To mitigate this potential shortfall, it is vital that the Alliance develop procedures and efficiencies that make it easier to successfully deconflict all of these missions.

What's Needed?

As the Alliance's defence budgets shrink, it becomes more and more important that the military uses its resources as efficiently as possible without sacrificing effectiveness. Many of the reductions in inventory are predicated on replacement aircraft being more capable and able to perform multiple missions. But if this efficiency and flexibility is not achieved, the planned inventory of AT and AAR assets will not support effective operations at the envisioned maximum level of NATO ambition. Updated doctrine, procedures, and tactics are needed to ensure these assets are able to satisfy the AT and AAR missions simultaneously.

As an example of the desperate need for guidance, NATO does not even have an official term identifying this aircraft type. Airbus has copyrighted the term 'Multi Role Tanker Transport (MRTT)' and Boeing has adopted the term 'Multi Mission Tanker Transport (MMTT)'. For

simplicity, the JAPCC has proposed the term 'tanker transport'. NATO has sound doctrine for AT and AAR operations (ATP-3.3.4 Volume I & II), but if the next generation of tanker transporters is to be effective, there is a need for additional doctrine (ATP-3.3.4 Volume III?) covering the simultaneous use of AT and AAR in the same mission. Nations already have some procedures and regulations that govern the combination of these two missions, but this guidance is lacking with regard to the multinational aspect of today's coalition operations and the sheer scale of what is required of the new tanker transport platforms.

As part of a new volume to ATP-3.3.4, the JAPCC proposes the creation of a matrix detailing the possibilities and limitations applicable to simultaneous multinational AT/AAR missions. Some nations allow the combination of AAR with certain AT missions, while others either fail to address the subject or prohibit such arrangements when a second or third nation is involved. If NATO CAOC AT and AAR planners are to efficiently combine these missions, there needs to be a clear understanding of what AT missions (including passenger, aeromedical evacuation and cargo missions, to include various dangerous goods) each tanker transport nation will allow simultaneously on AAR missions where the load and/or receiver are from different nations. The ultimate goal is to harmonise and reduce the restrictions nations put on these simultaneous multinational AT/AAR missions.

If AT and AAR missions are to successfully integrate, outdated paradigms will need revised or eliminated to make room for new and creative solutions that would have previously been dismissed. Imagine an A400M taking off with an airdrop load and then refuelling the attack aircraft that are enroute to secure/cover the same Drop Zone that A400M is dropping on? Or imagine a KC-767, delivering supplies to build up a forward operating base (FOB) and evacuating critically injured from that same FOB, all while providing fuel on the way in and out to the fighter CAP protecting that FOB? If the full capability and flexibility of the new fleet of tanker transporters is needed, missions like this may soon become a reality. If these ideas come to fruition, the crews flying such missions will need appropriate training to ensure they are fully mission qualified. AT and AAR planners will also have to develop creative ways to combine different mission types together.

Conclusion

It is an exciting time in the NATO Air Mobility community, as shiny new airlifters and tankers enter the inventory. It is important that the glitter of the awesome capabilities these new tanker transports offer does not blind the vigilant eyes of those tasked to ensure our fleets meet the future needs of NATO's level of ambition. This article probably poses more questions than it answers, but we must continue to question our assumptions so that they remain true and supported by valid data and continuously strive to validate our data. We must also continue to push the envelope of the possible and be prepared to develop new ways of operating, increasing efficiency without loss of effectiveness. Much more work is required to ensure our future NATO Air Mobility forces continue the excellent support they have provided to the Alliance in the past. ●

1. June 2006 NATO Defence Ministerial Meeting.
2. May 2013 Major Lee Hages (USAF).
3. JAPCC AAR Consolidation, Autumn 2013.

Major Chad Taylor

is a U.S. Senior Air Force Pilot with 3,500+ flying hours, mostly in the C-130E, H and J. He has completed operational tours in Southeast Asia, Afghanistan, Iraq and the Middle East as an aviator, CAOC Planner and Operations Officer. Major Taylor has extensive experience in mobility operations, inspections and evaluations, exercise conception and control, contingency mobilisation and forward deployment/employment. Major Taylor currently works in the Air Operations Support branch at the Joint Air Power Competence Centre in Kalkar, Germany, where he develops NATO AAR and AT doctrine and fosters interoperability among the Alliance.

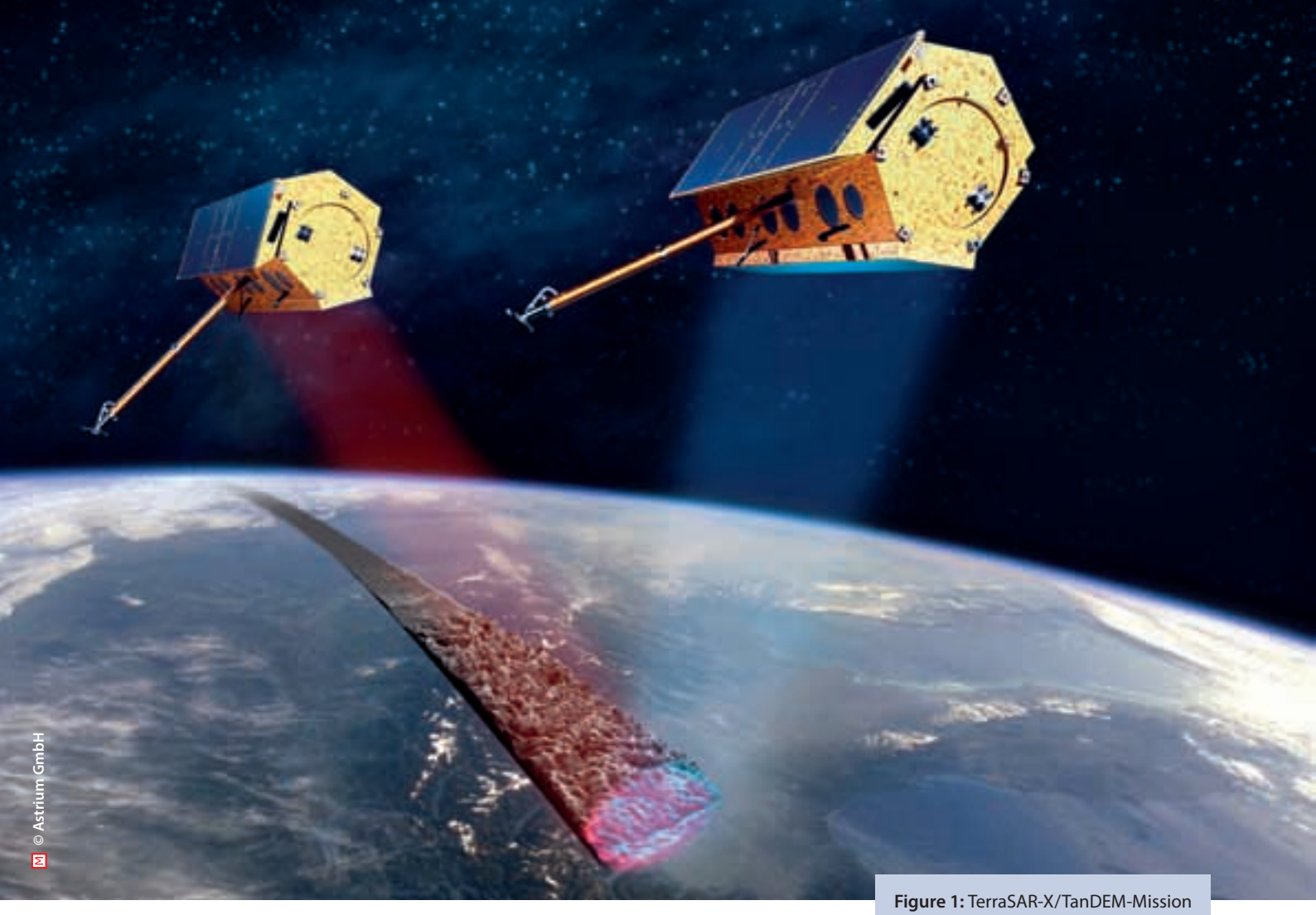

Figure 1: TerraSAR-X/TanDEM-Mission

Innovative Commercial Space Capabilities in Support of NATO's Space Efforts and Theatre Operations

By Lt Col GAF (ret.) Wolfgang Duerr, Vice President
Security & Defence Germany, Astrium

Next-Generation Geo Information Support capabilities, innovative Radar Satellite Technology and Data Transfer capabilities will revolutionise the commercial sector's space support to NATO´s operations.

"NATO as an Alliance enabled by space relies on national and commercial space capabilities to support its missions and operations."
Schriever Wargame 2012 International

Introduction

The strategic advantage that space capabilities provide to NATO-led operations has been described and underlined in a variety of publications, strategy papers, and exercises like the Schriever Wargame 2012 International. The scope of any combined space operation that NATO forces engage in will be driven by civil, military, and commercial players.[1] Space services

provide a set of tools to support and meet mission requirements and commander´s objectives. Commercial space services are already integral across a full spectrum of military operations with a focus on C4ISR and Geo-Information. These services can bolster available space capabilities at the time needed in a respective area of interest, providing a 'diversity of capabilities' and thus potentially reducing vulnerability. The article will focus on some emerging commercial services in Germany which are being driven by innovative next generation radar and laser technology.

Precise Global Elevation Information

Precise elevation data is the initial foundation of any accurate geospatial product, particularly when the integration of multi-source data is performed based upon it. The accuracy of the base Digital Elevation Model (DEM) is key to successful mission planning and operation. A new seamless homogeneous high quality standardised elevation model for the Earth´s entire land surface will be available upon 2014. The so-called 'WorldDEM™' will provide global coverage with a unique quality and accuracy of 2 m (relative)/better than 10 m (absolute) in a 12 m x 12 m raster. The accuracy will surpass that of any global satellite based elevation model available today. WorldDEM™ is intended to be the replacement data set for the current SRTM standard (SRTM = Shuttle Radar Topography Mission) and is a quantum-leap in global elevation modelling. The data basis for the WorldDEM™ is being acquired since 2010 by the German radar satellites TerraSAR-X and TanDEM-X which form a unique high-precision radar interferometer in space *(figure 1)*. The two radar sensors acquire absolutely reliable data as they operate independent of cloud and lightning conditions. The key advantage of this satellite-based data acquisition is the generation of a global DEM with no break lines at regional or national borders and no heterogeneities caused by differing measurement procedures or campaigns staggered in time. The mission has been implemented in the frame of a Public Private Partnership between the German Aerospace Centre (DLR) and Astrium. The WorldDEM™ will enhance a wide range of applications, from orthorectification and base topographic mapping to the more specialised geospatial needs of defence, homeland security, intelligence and military engineering interests. It will provide detailed terrain information and hydrology data for surveillance, reconnaissance and mission planning. The 3D nature of the data provides an ideal visualisation tool indispensable for military and intelligence planning and rehearsing of complex missions. Military personnel can rely on accurate information about the natural and built environment including elevation, infrastructure, vegetation and water bodies anywhere on the globe. The data facilitates the assessment and interpretation of landscapes with exceptional detail, supports mobility options planning, inclusive mapping of obstacles that can stop, impede, or divert military movement, and supports the assessment of military engineering projects.

"The WorldSAR will provide end-users (civilian or military) with high resolution SAR data and quick mission response due to access to the entire constellation … WorldSAR constellation is scheduled to be operational upon 2018 …"

Military Aviation, manned and unmanned, is another area where the WorldDEM™ can make a valuable contribution. The highly precise and globally available DEMs combined with airfield information provide improved input data for collision avoidance systems, ground proximity warning and flight management systems. It supports flight path and landing area planning even in remote and difficult to access areas.

"The objective of WorldSAR is to provide NRT remote sensing information on a global scale, based on advanced SAR sensor technology allowing a spatial resolution down to 0.25 m and based on chirp bandwidth extended to 1,200 MHz."

The global availability of the dataset with full homogeneity and seamlessness will enhance international cooperation and cross-border mission planning. Particularly

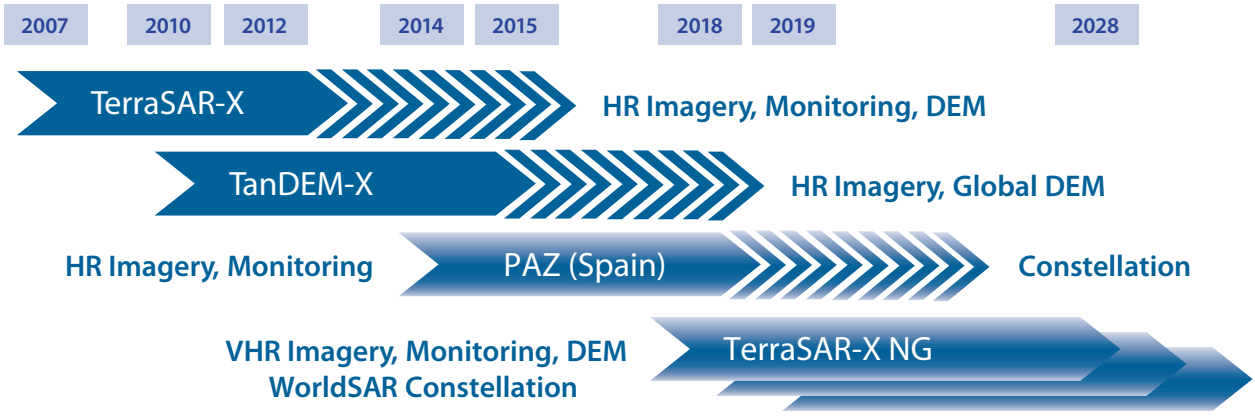

Figure 3: TerraSAR-X-Program Schedule

when the rapid provision of accurate information is of utmost importance, e.g. in case of an emergency situation). The dataset can support the improvement of emergency preparedness measures by supporting e.g. reliable flood modelling to calculate risks and evaluate exposed areas. In a crisis situation rescue teams on the ground can rely on accurate elevation information for the rapid implementation of response measures incl. damage assessment and planning of access and evacuation routes.

"… SpaceDataHighway enables immediate broadband data transfer from LEO satellites and UAS to the ground with an unprecedented data rate of up to 1.8 Gigabits per second, enabling e.g. the transfer of full motion video at full rate with no rate change/choke points."

Astrium Services/Infoterra GmbH holds the exclusive commercial marketing rights for the WorldDEM™ and is responsible for the adaptation of the elevation model to the needs of commercial users worldwide. Astrium will refine the DEM according to customer requirements, e.g. editing of water surfaces or processing to a Digital Terrain Model. There will most probably be a military DEM editing alliance in future initiated by the German BGIO (Bundeswehr Geo Information Office) and with involvement of many NATO nations. More information about the WorldDEM™ and sample data can be found on the respective Infoterra website.

WorldSAR – A Next Generation Very High Resolution X-Band Radar Constellation

TerraSAR-X (TS-X) Services commenced in January 2008, providing a commercial space based radar capability with a spatial resolution down to 1 m and featuring a pixel location accuracy of less than 1 m. TanDEM-X (TD-X), a TS-X rebuilt, was launched in 2010 to fly in close formation with TS-X and to allow for across track interferometry to establish a global level 3 DEM (as described above). Besides that, the TD-X satellite is also used for nominal imagery. Several Ministries of Defense of NATO nations already belong to the user community of TS-X/TD-X services including the U.S. National Geospatial Intelligence Agency (NGA) and the German BGIO.

To comply with increased requirements in data refreshes, especially from the Maritime and Emergency Response Services segments, Astrium Services/Infoterra GmbH has constantly been upgrading TerraSAR´s ground station network access. As a benefit, especially through improved polar station access and processing capabilities, Near Real Time (NRT) delivery requirements can be served since early 2012. The almost identical Spanish-built PAZ satellite will be launched in early 2014 and injected into the TS-X reference orbit. Astrium and Hisdesat (operator of PAZ) will establish a constellation approach with TS-X/TD-X and PAZ aiming to improve revisit and enable new interferometric

services *(figure 2)*. The constellation will secure continuity of TS-X services until the Next Generation of TS-X satellites will be available.

Lessons learned from more than five years of operating space-based commercial Synthetic Aparture Radar (SAR) systems along with the related user community and stakeholder feedback have led to the TS-X Next Generation (NG) based constellation concept called 'WorldSAR'. The objective of WorldSAR is to provide NRT remote sensing information on a global scale, based on advanced SAR sensor technology allowing a spatial resolution down to 0.25 m and based on chirp bandwidth extended to 1,200 MHz. Besides the advanced Very High Resolution modes the TS-X NG satellite will provide heritage modes ensuring data continuity for established applications like continuation of existing data stacks and interferometry. Improved wide swath modes will support large area applications, like open ocean surveillance. WorldSAR is a weather independent high quality SAR satellite constellation with NRT data access supported by a high-speed workflow/processing capability, providing an information latency of 15 minutes or better. The WorldSAR will provide end-users (civilian or military) with high resolution SAR data and quick mission response due to access to the entire constellation.[2] The WorldSAR constellation is scheduled to be operational upon 2018 *(figure 3, p. 38)*, providing a variety of Very High Resolution SAR products in NRT availability as described above to a broad user community including military end-users.

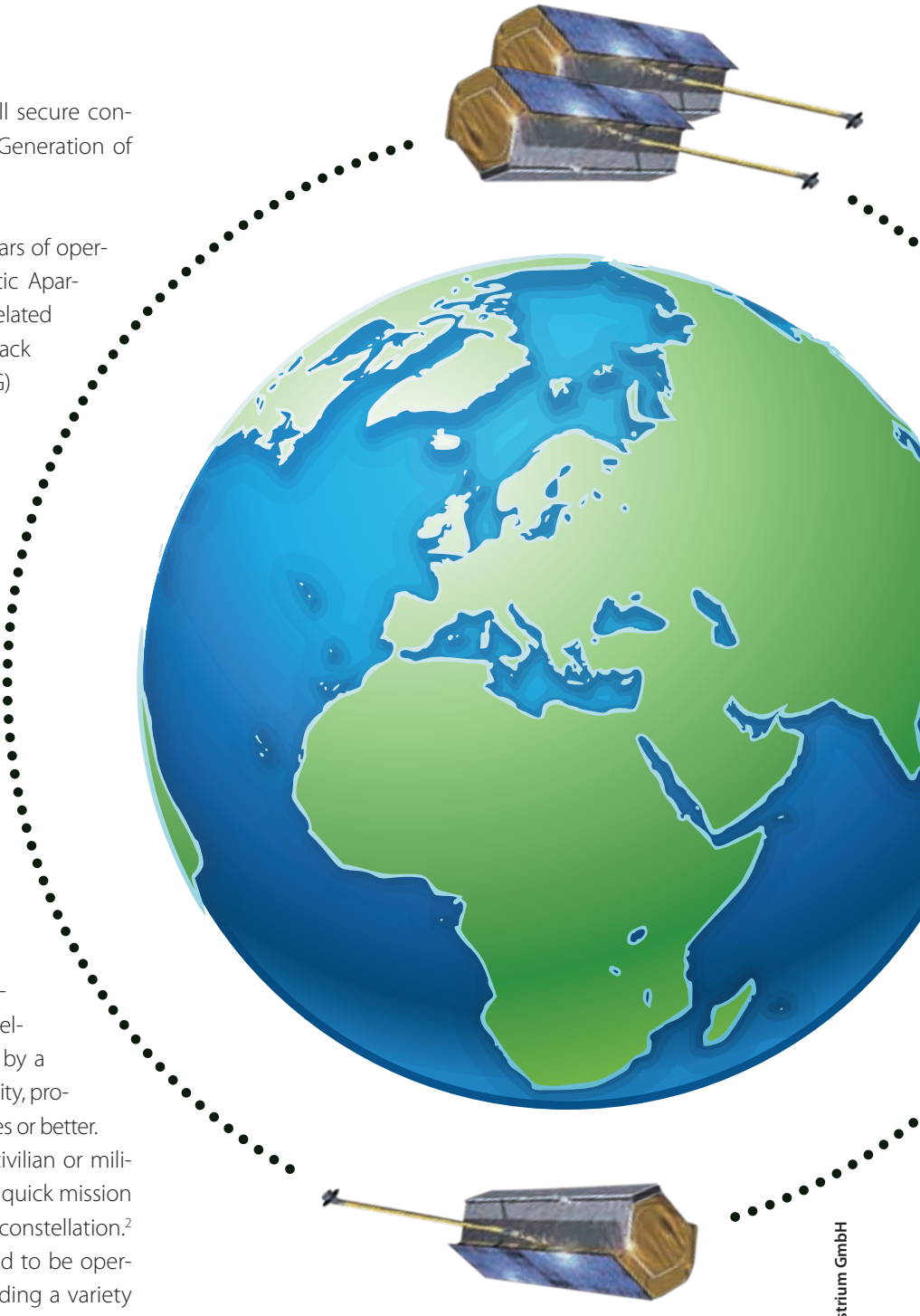

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Figure 2: TerraSAR-X/TanDEM-X -PAZ-Constellation

SpaceDataHighway – Minimising Information Latency

The combination of radar satellite TS-X NG with a bi-directional high-speed data transfer capability will revolutionise the way we monitor and disseminate data. The unprecedented performance options for payload tasking and data download of/from satellites in Low Earth Orbit and/or Unmanned Aerial Systems (UAS) will make data available at the right time at the right place. Together these systems inaugurate the first commercial global NRT ISR Service capable of delivering actionable information in less than 20 minutes.[3]

"The key advantage of this satellite-based data acquisition is the generation of a global DEM with no break lines at regional or national borders and no heterogeneities caused by differing measurement procedures or campaigns staggered in time."

The 'SpaceDataHighway' currently being implemented (projected 2016 FOC) by Astrium Services is a constellation of geostationary satellites which provide two-way broadband data relay services for the above mentioned NRT ISR services *(figure 4)*. It is developed and implemented within the EDRS (European Data Relay System) Public Private Partnership program between the European Space Agency (ESA) and Astrium Services. As prime Astrium builds, owns, operates and co-finances the system´s infrastructure. Astrium also implements the data transmission services to ESA and customers worldwide. ESA is the anchor customer through the Sentinel satellite mission, i.e. the SpaceDataHighway will provide data relay services for the Copernicus/ Global Monitoring for Environment and Security (GMES) satellites, facilitating a rapid downlink of large volumes of imagery.

The SpaceDataHighway enables immediate broadband data transfer from LEO satellites and UAS to the ground with an unprecedented data rate of up to 1.8 Gigabits per second, enabling e.g. the transfer of full motion video at full rate with no rate change/choke points. Due to the state-of-the-art laser communication technology onboard the SpaceDataHighway, the probability of interception is significantly reduced. The system enables forward tasking of platforms in joystick mode resulting in a significantly improved system reactivity and flexibility. Routing the data through the SpaceDataHighway infrastructure also reduces the need for an extensive ground station network. Data from different systems used in an operation, whether it be UAS´s, manned platforms or satellites, can be routed through the same secure and high-performance infrastructure.

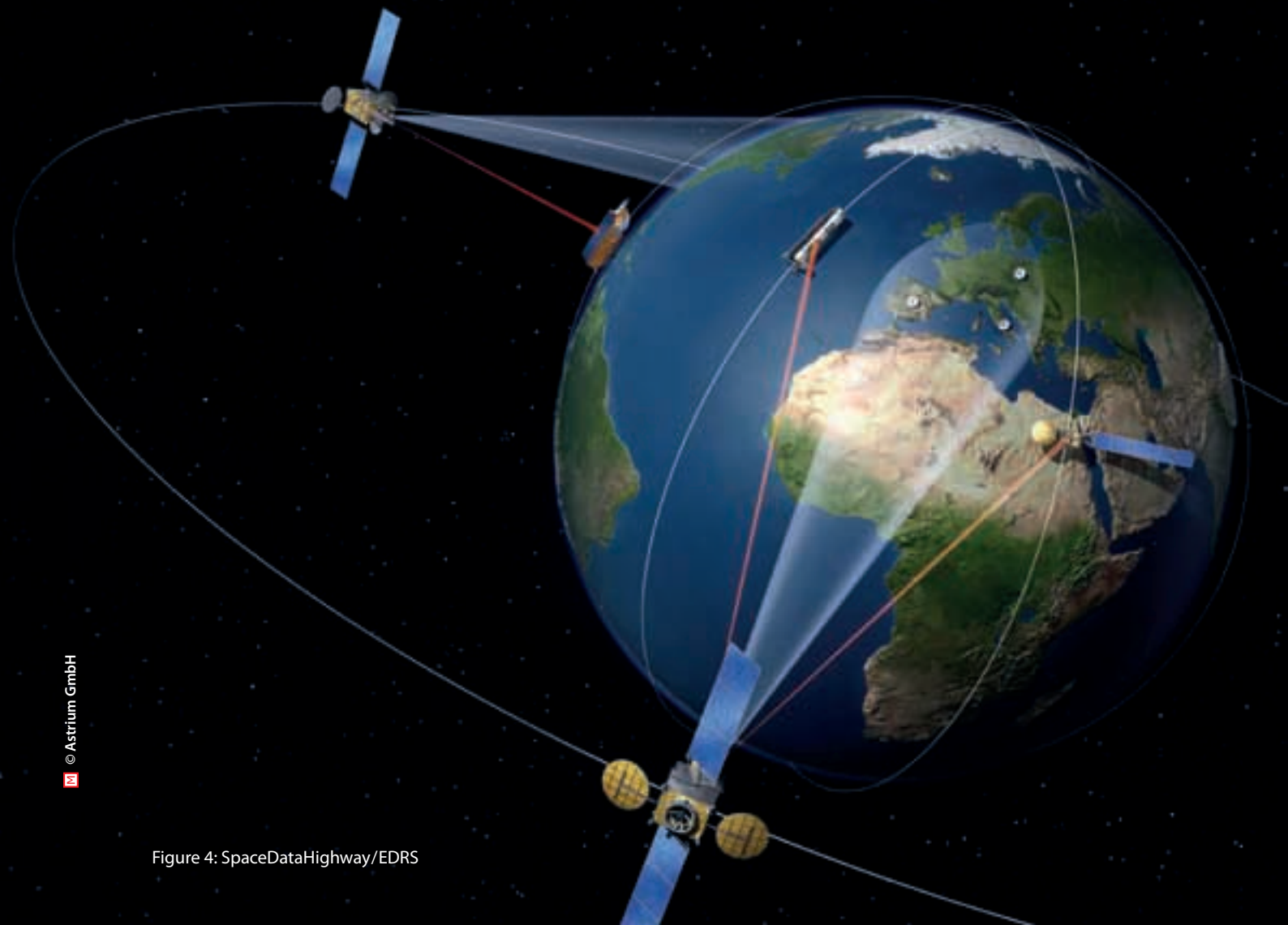

Figure 4: SpaceDataHighway/EDRS

Operations of the SpaceDataHighway commenced with the launch of the first payload on-board a commercial telecommunication satellite at the end of 2014. The system will be enhanced with a second dedicated satellite in 2015 providing an increased field of coverage and system redundancy. Both satellites will form the initial core space infrastructure for service provision and coverage for LEO satellites and UAS flying over Europe, Middle East, Africa, Americas, Asia and the Poles. Plans to enhance the system with future spacecraft are already underway with an ultimate goal of providing complete global coverage and long-term system redundancy.

Conclusion

Recent NATO operations continue to prove the demand for reliable and precise geospatial data for military operations is high. Beside the resolution and revisit time, the determining factor for mission success is the rapid delivery of ISR data to the end user. Upcoming commercial systems and services as described above are very promising and able to complement military capabilities in support of mission requirements and commander´s objectives. Improved data quality and collection capability provided by the next-generation radar satellites will be more beneficial when combined with a space-based data relay system. Furthermore, it allows the tasking of satellites shortly before they enter the imaging area, optimising the satellite programming with the latest target area information and facilitating rapid response to activities on the ground for further investigation.

"Due to the state-of-the-art laser communication technology onboard the SpaceDataHighway, the probability of interception is significantly reduced. The system enables forward tasking of platforms in joystick mode resulting in a significantly improved system reactivity and flexibility."

The dissemination of near-real-time images will be extended and thus potentially available directly to the warfighter. The WorldDEM™ will set the standard for global digital elevation information in the upcoming years and revolutionise geo information services. Cutting-edge next-generation radar and laser communication technology from Germany will provide capabilities facilitated by WorldDEM™, WorldSAR and the SpaceDataHighway, and may support future NATO missions or operations.

1. HQ SACT, Executive Summary of the Schriever Wargame 2012 International Report, 2012.
2. S. Gantert, A. Kern, J. Janoth, L. Petersen, J. Herrmann, Infoterra GmbH, 'The future of X-Band SAR', Friedrichshafen, Germany 2013.
3. A. Hegyi, Astrium Services, 'SpaceDataHighway – Re-Defining Satellite Data Transfer', 2013.

Lieutenant Colonel (ret.) Wolfgang Duerr

is the Vice President Security & Defence Germany at EADS Astrium and a graduate electrical engineer. He retired from the GAF in 2008 and is still an Officer of the Reserve Corps. In his military career, he had several operational and staff assignments in the Fighter Control/Air Battle Management and C4ISR branch, served as the ADC of the Commanding General GAF Command South/Cdr CAOC 4, took over command of the Tactical Air Control Squadron 111, and served as the responsible General Staff Officer for Space Operations and Information/Knowledge Management at the GAF Development Centre/Air Power Center. He is a distinguished graduate of the Air University/ACSC, awarded with the 'Brigadier General Robbie Risner International Officers Leadership Award' and received a Master Degree of Military Operational Art and Science. He is a graduate of the German Federal Academy for Security Policy, Seminar for Security Policy (SP12). (wolfgang.duerr@astrium.eads.net)

Joint Air & Space Power Conference

Air Power Post-Afghanistan

By Colonel Francesco Turrisi, ITA AF, Lieutenant Colonel Richard Hartung, DEU AF, Lieutenant Colonel José García, ESP AF, Lieutenant Colonel Francesco Persichetti, ITA Army, Lieutenant Colonel Heiko Hermanns, DEU AF (JAPCC Authors)

Introduction

The JAPCC's annual conference is fast approaching and JAPCC Staff is eagerly looking forward to the start of the event. We have high expectations that we hope will yield thought-provoking and interesting dialogue. The air power principles of pre-2001 have evolved with recent operational events. The key challenge will be identifying the developments which must lead to significant and relevant transformation, vice marking the incidental needs unique to the conflict in Afghanistan. Inaccurate analysis will increase the likelihood that air forces of the future will suffer from having inappropriate equipment, ineffective organisations and flawed doctrine and Tactics, Techniques and Procedures. Adding to the complexity, will be a framework of great political and economic uncertainty.

The topics for this year's conference include:

- NATO's Air Strategy After Afghanistan – a proposal for NATO's future Air Vision after Afghanistan;
- Unmanned Technology: Key to Success or Limiting Factor;
- Air Power: Independent Action and Independent Effect;
- Education and Training Post Afghanistan: The Dawn of Real Joint Efforts?

Providing advice on the future role of Air and Space Power in NATO might have serious impacts far beyond the military community. We have a clear understanding that our responsibility is to facilitate discussion across the entire NATO community to include sponsoring countries, academia and industry. In order to lay the groundwork for the upcoming discussions, we have produced this '*Conference Introduction*' that seeks to provide some interesting points of view regarding the proposed topics. We do not intend to answer the many questions that might be raised at this year conference but instead strive to induce thought about the challenges that may be faced in the future. The four chapters presented here do not reflect the JAPCC's official positions but are the personal opinions of JAPCC Subject Matter Experts. ●

NATO's Air Strategy After Afghanistan

A Proposal for NATO's Future Air Vision After Afghanistan

The end of the Cold War brought an increase in NATO's reliance on Air Power as NATO and the Alliance nations have repeatedly turned to Air Power as their first, and in some cases only, military response option.

Heavy and long term land operations are neither financially feasible nor politically sustainable. Thus, the need for responsive and flexible Air Forces and Naval Air services remains valid. NATO must retain and improve its Air and Space Power capabilities if it is to successfully meet future challenges. Thus, the change required to retain Air and Space Power superiority must primarily come from policy and strategy, not from acquisition of increasing sophisticated and costly technology.

In an effort to cut military budgets, NATO nations risk reduction of not just the number of assets but their Air Power capabilities too. From the end of the Cold War, this reduction has continued at a pace giving cause for concern. The near-term cessation of combat operations in Afghanistan, in combination with the on-going financial cuts, makes certain that investment in future Air and Space Power (A&S) capabilities will be subjected to close scrutiny and will most likely be further reduced.

Compared to land warfare, however, airpower is still the cheaper solution. As a result of continued operations in Afghanistan, NATO nations have often tailored their air assets to support COIN operations reducing strategic capabilities. How can NATO and its member nations meet anticipated future Air Power requirements?

There is a temptation during times of austerity for nations to become introspective and focus exclusively on national priorities at the expense of multi-national co-operation. What other difficulties exist in realising A&S transformation and how can we overcome them? Is present NATO policy and structure (NDPP, SMART Defence, command structure etc.) enough to face future challenges? Maybe we are still stuck in 'old thinking' mode, and it might be reasonable to shift efforts by adapting requirements to newly developing threats and strategy.

Times Have Changed. Have We?

Conflicts, wars, and warfare of the 2000s had a political character such that the matching violence was of an irregular kind. The dominant strategic narrative for airpower has reflected the paradigm of state on state, regular-combat-style warfare. The World's major air forces have been shaped overwhelmingly to meet the needs attendant upon regular forms of warfare. From time to time air forces have been obliged to address the challenges of irregular war, but the expertise and much of the equipment tailored to those particular tasks have tended to be fleeting capabilities and competencies. So talking about 'irregular' or 'hybrid' war may raise the question: Do we still develop, buy, and use the right weapon systems? The relative significance of the air contribution to the joint fight certainly has shifted from one war to the next over the last decade.

From a political perspective, ethical and/or economic reasons, the public is less willing to accept operations that require friendly troops on the ground. In that respect, A&S Power may be seen as the preferable means to solve future challenges. Boots on the ground, resulting in military casualties, nowadays is unacceptable. Airpower however, guarantees minimal loss of friendly troops.

National vs. NATO Interests

In times of economic constraint, nations will give priority first to their own national interest then to the alliance interest. Article 5 scenarios are generally accepted without regard to legitimacy. Not all nations will join a 'coalition of the willing', if theatres of war, warring factions and political/ethnical/religious aims are not widely accepted. We have to face the fact that southern countries will be interested more in the Mediterranean challenges with little focus on the 'pacific arena'; eastern counties are concerned about their relationship with former USSR nations; northern Europe nations have different approach on foreign policy (expeditionary versus non-expeditionary); the US have already moved their attention to Asia; how will all this affect future airpower policies? The 2011 Libyan war provides a likely blueprint for many future NATO operations. During the conflict, the US took on a limited, supporting role for the first time, leaving its European allies in a leadership role. Primarily under French and British command, NATO forces were indispensable in helping the Libyan rebels to topple Muammar Gaddafi. NATO's European members realised that the essential bargain underlying their alliance with the US had changed. Ideally national interests should match Alliance interests.

"There is a temptation during times of austerity for nations to become introspective and focus exclusively on national priorities at the expense of multi-national co-operation."

Air Power's Relavance

Airpower does not solely mean dropping bombs and engaging hostile fighter aircraft. It is universally, ubiquitously and strategically useful. There is an air narrative integral to every conflict. Rather foolish doubts with respect to airpower's strategic value in the past have tended to obscure the more significant reality of airpower's true pervasiveness. Coming back to Afghanistan, airpower provides an air bridge for mobility both to and within the country, provides and supports all C4ISTAR functions, delivers essential medevac services, and both manned and unmanned platforms provide agile precise fire power. Lessons Learned from Afghanistan are surely relevant for future asymmetric conflicts but they are not the sole paradigm.

If we still are convinced that air power is the primary tool for today's warfare, we have to use our valuable assets and invaluable competencies in the smartest way. We are sure that reducing numbers will be acceptable, loosing core competencies is not! In implementing new solutions for air power, the challenge is now to get the most out of our investments. Will improved range and speed play a central role in a successful Air Force strategy? Will the integration of air, space and cyber capabilities across domains become the key enabler for the coming decades? Will we be able to sustain our competencies and advantage?

Unmanned Technology

Key to Success or Limiting Factor?

Introduction

From the beginning of history, every society has sought to attain military supremacy over their potential rivals. It has always been recognised that military power was needed to protect territories and interests from competitors or to otherwise enlarge dominions. In many instances, this supremacy was attained by using all available national capabilities, including its pool of scientific knowledge, industrial capacity and natural resources. The focus on military development was considered the highest priority within the national policy when a real or potential threat, risk or enemy became evident. In these cases, all efforts in a country or nation are used and focused in this direction.

"The advantage of operating military unmanned vehicles from a control centre located outside of the operational area has just recently become a reality."

This battle to attain military supremacy over other potentially enemies has become a genuine race. Nations currently seek to develop better weapons and capabilities faster than their competitors. In all these new inventions, a common denominator is present: science and technology. Military forces appreciate having a technological advantage over their opponents because this unbalanced situation gives them freedom of action in most military scenarios. Conversely, this advantage is not absolute or unlimited and normally depends on the given situation or scenario. Military history is full of anecdotes where a technological advantage was insufficient in assuring success in a campaign or scenario.

Dependence on Technology

Technology surrounds us, not only in the military environment but also in most facets of our lives. We undoubtedly realise that all these technical advantages produce not only benefits but also dependencies or over-reliance on them. This is because people adapt their lives quickly to the services and convenience provided by technical advances. It is almost impossible to imagine a world without cars, cellular phones or computers.

This is an elementary example to explain the ease with which humans become dependent on technology. There are many other examples in the military environment such as military C^2 systems, communications, computers, mission planning, etc. Are modern armed forces also real or potential victims of dependency on capabilities attained through the use of new technological developments? If so, must we then forego these technological advantages? Or perhaps, is a certain balance possible? And how is this balance determined?

Because it would be difficult and counter-intuitive to surrender these advantages, the over-reliance on technology could be a potential source of vulnerability and as such, must be recognised and mitigated. Therefore, applying this hypothesis to existing NATO

concepts, are NATO and NATO member countries aware of this concern? Are the most fragile and key elements in NATO's technological nodes identified and suitably protected? Where are the weakest links in the chain? Are C^2 systems in NATO adequately protected against cyber-attacks?

Since space assets such as satellites are not part of NATO's inventory, but rather managed by individual countries and in many cases by commercial companies, how can NATO protect its C^2 network? What if these satellites must be switched off for commercial or strategic reasons? How will this reduction in available capability be mitigated?

On the other hand, another issue to consider is the price of technology. Undoubtedly, technology is becoming increasingly more expensive. Vast sums of money must be spent in R&D to maintain existing capabilities, which fewer countries are able to afford. Because of this, the differences in technology between countries could generate interoperability issues and consequently become a limiting factor for NATO.

Unmanned Aircraft Technology

Unmanned military assets like UAS or UCAS have been considered a highlight of military technology in the last few years. Understanding the term 'unmanned' to mean remotely operated, these vehicles are only truly unmanned when they are operating in an autonomous or pre-planned operating mode. The advantage of operating military unmanned vehicles from a control centre located outside of the operational area has just recently become a reality. Other advantages, such as reduced risk for aircrew, longer endurance, and increased pay loads capabilities, can be realised through the use of unmanned aircraft technology.

These capabilities instantaneously dazzled many analysts that rushed to predict that in a couple of decades all the military aircraft would be unmanned. Unfortunately, reality is smashing these optimistic predictions. But, where were the errors made? Were they unaware of the limitations and weaknesses of unmanned vehicles, blinded only by the advantages of these new systems? Some of the main weaknesses of these vehicles such as the reduction in aircrew situational awareness (SA) in some instances or limited flexibility in certain scenarios, limited defensive capabilities in complex threat environments and the dependence on satellites links to control the system may not have been considered in these predictions. This is another example of being overly enthusiastic based on the mirage of technology. The problem will be exacerbated when traditional capabilities are neglected and discarded in favour of the significant advantages these new technologies may provide.

Looking at the controversy between unmanned versus remotely operated/vehicles,[1] it is necessary to clarify the terms 'autonomous' versus 'automated'. Current UAS/UCAS/UAV's are remotely operated, because these vehicles almost always have a human controlling the actions of the vehicle. Only when an autonomous mode is activated (usually as a result of some type of malfunction), are these vehicles considered unmanned. On the other hand, should an 'autonomous' mode be considered merely as another mode of operation in which UAS/UCAS/UAV's work in accordance with a pre-planned pattern? Since it is incapable of determining a proper course of action within a given threat scenario without human interaction, is it just a less flexible mode of operation?

UAS are currently considered a good complement to manned aircraft in missions where UAS strengths are

maximised and their weakness are mitigated or resolved. Additionally, although the use of UAS has grown exponentially during last few years, it is believed an even greater use of UAS will continue in the future. Unmanned vehicles are currently under development that are faster and better protected than current models. They will have better and more sophisticated sensors with robust communications systems that will improve connectivity between the operator, the UAV and the customer. This will drastically improve operator situation awareness and flexibility. In other words, it is absolutely imperative to remove or reduce the figurative distance between the operator and the vehicle to the maximum extent possible.

Another issue to be considered is the existing debate regarding the moral and ethical implications of 'killing at a distance'. Many opinions and questions have been put forth related to the responsibilities of these types of operations, to include the issues of collateral damage produced by unmanned machine and the limited risk to the operators. If decision makers and planners see them as a way to eliminate the risk of military forces, does it make a military option seems more attractive? To whom does the responsibility fall when operating UAS in an autonomous mode? Is it a way to save lives on both sides of a conflict? Is it ethically acceptable to prosecute a war in which only the opposing forces are killed?

It is certain that UAS will be increasingly included in future military operations as they continue to evolve. Since military planners will rely increasingly on the capabilities this technology provides, will they fall into the traps mentioned above? Will they be victims of the illusion of new technologies? Could these technologies go from being 'the key to success' to a factor in future defeat? ●

1. JAPCC Flyer, Edition 9. Machines do not think! The contradiction with autonomous systems. By DEU Army Maj Andre Haider.

Air Power

Independent Action and Independent Effect

Independent Air Power has been an enduring theme of military aviation since man first took to the skies. It underpinned the establishment of air forces and led some airmen to adopt particularly firm views on the 'correct' use of air power. But this debate has clouded the real issue and made an examination of the proper independent application of air power a challenging topic. Afghanistan saw a predominantly auxiliary application of air power, but is that the enduring model for the future? In what ways can air power be integrated with diplomatic and political action to bring about crisis resolution without the need for extensive surface deployments? Can air power act in a wider containment role without the establishment of extensive deployed infrastructure?[1]

The widely recognised definition of Air Power is the one coined by the British MOD. Air Power is described as "the capacity and ability to project national or alliance power from air and space to influence the behaviour of people or the course of events".

With the Chicago Summit Declaration (20–21 May 2012), the Heads of state of NATO have agreed that: *through the UN-mandated Operation Unified Protector (OUP), and with the support of the League of Arab States, our Alliance played a crucial role in protecting the civilian population in Libya and in helping save thousands of lives (…).* It is always difficult to measure the success of a military operation; often only history will disclose the truth. What is incontestable is that, for the Alliance, Air Power in Lybia has been playing solo and it has influenced both the behaviour of people and the course of events.

Changing Balance

When we refer to air power, we don't mean single service, the army and navy took part to the endeavour, through different even sophisticated declination of air power but still air power.

What was really revolutionary in the Operation Unified Protector was from a political and military perspective the absence of coalition's 'boots on the ground' or at least that the air phase was not preparing any allied land activity.

In [2]the edition number 8 of our journal, only three years prior Operation Unified Protector, we wrote that *in irregular warfare it was crucial to have an effective air land integration with small and often isolated Land units, who use mission command to conduct HUMINT-led operations and interface with local population. A mantra of centralised control decentralised execution will result in unmatched Joint, Air and Land command and control constructs, which leave Air as a responsive tactical level activity rather than shaping activity at all levels.*

Were we short sighted at the time? Or just trying to adapt, rewrite a doctrine shaped for symmetric warfare to the new fragmented scenarios. In a time of rapid changes, history ran faster than ideas and Air Power during this period was either the main or the sole tool employed by the alliance.

Governments are no longer eager to send land troops to overseas operations if the vital interests of the nations are not directly threatened. Land/joint operations demand a different level of investment both moral and economical; operations are more demanding in economic and moral terms. Public opinion is not tolerating the personnel losses witnessed in the last decades; Deploying and redeploying of land units is a demanding complex activity. Our illustrious 'colleague' and celebrated poet Antoine de Saint Exupery quoted in his celebrated novella the Little Prince: *"You become responsible, forever, for what you have tamed",* taming in this case can't be interpreted as *changing the course of events, changing the behaviour of people.*

Is air power too strong, too decisive and at the same time too volatile? Is it ethical to change the course of events without our presence on the ground?

Air Power in Isolation

Shall Air Power in isolation be considered the preferred option for the military interventions of the Alliance or only a necessary component of a joint set up? Our heads of state, again in the Chicago declaration affirm again:

Our successful operation in Libya showed once more that the Alliance can quickly and effectively conduct complex operations in support of the broader international community. We have also learned a number of important lessons which we are incorporating into our plans and policies …

In a perfect world there would be no conflict, but if we have to fight, we (the military) like to have all the pieces on our chessboard; kings, queens, rooks, bishops, knights and pawns, all moving along the traditional patterns. NATO doctrine and its capstone documents AJP 01 *Allied Joint Doctrine* and AJP 3.3 *Joint Air & Space Doctrine,* of which the JAPCC is the proud custodian, are a triumph of the joint mind-set incorporating the lessons learned of the recent joint experiences in the Balkans, Iraq, Afghanistan and the heritage of the of The Cold War era well reflected by the Latin adage *"Si vis pacem, para bellum"* (if you want peace, prepare for war).

Soldiers don't like to have all the pieces on the chessboard because they are nice to have; every piece performs a specific role complementary and synergetic, every piece has his own talents and responsibilities. Even still, Air Power has been employed in almost perfect isolation and it performed well or at least accomplished the mission. In this fast moving world, Politics doesn't wait on doctrine upgrades to give tasks to the military and 'what to do' comes before the 'how to do' and despite vacuums in the doctrine, our men did it.

"When we refer to air power, we don't mean single service, the army and navy took part to the endeavour, through different even sophisticated declination of air power but still air power."

It is probable that NATO may face a variety of crises in the future: "Ethnic, political and religious rivalries, territorial disputes, disputes over vital resources, inadequate or failed efforts at reform, the abuse of human rights and the dissolution of states could lead to local and regional instability. The resulting tensions could create a wide spectrum of consequences, ranging from the need to provide humanitarian assistance to armed conflict."[3] It is foreseeable as well that politics will be reluctant to employ ground troops. Will the OUP model become a paradigm for new operations? Shall we incorporate its lesson learned in the relevant doctrine? Wouldn't it be appropriate to provide our crews and commands a coherent set of rules and guidance in case of employ of air power in isolation? Shall we review the targeting process? Why, during OUP, despite the small numbers, was it deemed so important to carry on shipboard operations with attack helicopters? Was it testing a capability? Was it the research of a psychological effect? ●

1. JAPCC Conference Flyer.
2. Group Captain John Alexander 'Air power in Countering Irregular Warfare'.
3. AJP 01 Allied Joint Operations.

Education and Training (E&T) Post-Afghanistan

Is this the Dawn of Real Joint Efforts?

Many Airmen believe that recent air operations like those supporting ISAF or Operation Unified Protector set the stage for future challenges NATO airpower may face. However, it is just as likely that the mission environments NATO must find its way through in the near future will be shaped by more complex, unpredictable and different factors than in most recent NATO engagements. Hence, preparation for future operations will become more challenging. As a result, NATO's current E&T system constantly adapts to different types of missions to ensure that the Alliance is prepared to battle these future challenges.

Professional Mastering

Any soldier, especially at the leadership level, must have the competencies and skills that enable them to thoroughly plan and execute operations utilising timely decision-making in order to successfully handle these challenges. All too often, todays military leaders, particularly those that have been, or perceive themselves as having been "on the winning side of the recent wars", maintain the status quo, organising, training and equipping their personnel with the same direction that led to success in the previous conflict. Their opponents, usually fundamentalists, rather than out and out warfighters; fuelled by ideology and driven by an inner belief to succeed, often think creatively about the next conflict.

For a long time nations structured and trained their military forces to conduct war on a battlefield with comparable forces. Today most military forces are still conventionally configured and structured while the structure of battle and the enemy has significantly changed. Raised and trained to think in such terms, nowadays politicians and military professionals alike, face difficulties when asked how to apply military force effectively. Western societies are becoming more and more a legitimate target for a variety of fundamentalist organisations, using both conventional and unconventional means. In such circumstances, fighting for hard and absolute objectives of an interstate war turns toward more flexible objectives. State actors, mainly multinational groupings, typically find themselves in confrontation or conflict with non-state parties which are highly effective at finding new uses for old weapons. Furthermore, continuous media presence on the front lines ensures constant worldwide exposure, which has the potential to influence operational decision making.

Recent operations provide incontrovertible evidence at all levels of command that commanders are required to act outside the traditional military patterns. Such deep interaction has been outside the normal military convention and thus received less attention in military E&T, especially from an Air Power perspective. All military forces and especially air forces recruit

highly talented individuals to maintain force capacities, readiness and leadership. All their 'learning' is done through formalised E&T programmes, which are often conducted in a structured and constrained manner, without opportunity or intent for individual or collective reflection. Also within the corresponding civilian public services, only a few train for the identified way to operate under the new paradigm of modern conflicts. Efforts conducted on community level to encourage real 'jointness' are still limited to a very small scale. In highly qualified career paths dealing with a very high level of technical and psychological complexity like in air forces, E&T is mainly seen as a cost factor that requires an amortisation to become cost effective. Hence in the early years of their careers service personnel become technically and tactically proficient which will pay off over the rest of their careers, but their ability and willingness to analyse, evaluate, and create while becoming able to comprehend and to understand why things are done the way they are done, is blunted. Intense and expensive individual training is concentrated in the early period after entering the military service. While on Mid-level or senior level the ability to think 'jointly' at all levels is getting more and more important, training opportunities (e.g. staff or war colleges) are seldom available to a wider audience.[1]

Decisions Makers Role in Joint Doctrine

It is essential for military commanders to understand the connections between political objectives and the actions of military forces to support those objectives. E&T must play a vital role in qualifying not only the commanders but also political and military decision makers to cope with such conflicts and confrontations.

The new NATO Command Structure and the decisions taken by the political leadership of the Alliance in the 2010 Lisbon and 2012 Chicago Summit mandated changes which NATO is currently transforming into action. This, in combination with the significant change of the ISAF mission, drives changes in the way NATO and its members prepare and generate military forces. Even if those changes are generally recognisable, very often mind-sets and reaction schemes remain unchanged. As they pretend to be less affected by geographic and socio-political settings than the land forces in the NATO Air and Maritime environment fewer changes to the former training and exercise regimes occur. Both services often limit exercises to evaluation of combat readiness and capabilities, assessing the performance of tactical units within their specific tasks. In such circumstances it is a logical consequence that passing the test gets more attention than conducting collective training with a focus on jointness. Never the less the new positions of the HQ AIRCOM and HQ MARCOM in the NATO Command Structure (NCS) require significant changes in their mind-sets towards Education, Training and Exercises. Regardless which NATO nation one may look at, their air and naval forces train and prepare in similar ways. This principal commonality shared, not exclusively but especially, among NATO air forces creates many difficulties for them when integrating with ground forces. It became evident in missions like Bosnia, ISAF or OUP that the issues of insufficient inter-service cooperation and different service perspectives have not been adequately addressed in the extant training regimes. Even further it is a fact that small or large military successes have been achieved in operations like KFOR, ISAF or OUP, but due to the absence of a clearly defined political end state, no lasting success on the strategic level was achieved. As long as military and political leadership do not learn and train together to

understand each other and their demands, this hardship will remain. Just like the single services will continue to fail in achieving real 'jointness'.

The perspectives of ground, maritime and air services on threats and how to contain them by application of force are significantly different. Consequently this difference is also recognisable with regards to training and exercises. At the same time the characteristics and natures of threats towards NATO, nations, or any other (western) alliance or coalition keep changing, expanding, and gaining higher levels of complexity. It is acknowledged that there is still a need for a full-scale defence capability and hence a need to train and prepare for it, but its structure and culture will change. The characteristics of threats delivered from space, cyberspace or by unmanned weapons like UAV aim to influence the will or the objectives of target populations, governments and institutions. They describe the scene for future major NATO or national defence operations. Manipulation of decision-making and information gaining or analyses processes by targeting information management and knowledge development processes, will become the main objectives for any opponent. For NATO, territory defence on NATO ground will either become a matter of inner security (usually handled by regular police or other civilian forces rather than the military) or be limited to local incidents from precisely targeted attacks by heavy or long-range weapons like artillery, ballistic missiles or airframes.

Future of E&T

There is a lack of understanding of the needs of other services at the strategic and operational level, while most education, training and exercises rarely exceed tactical level issues. E&T are essential pillars in which the Alliance must trust. Financial constraints put frequency of training at risk and may deny leaders valuable experience needed in the field. Hence innovation in the development of training programs and opportunities in the military and civilian domain will be essential. Peace keeping or peace enforcing missions and support of humanitarian assistance on the ground with support from the air and from sea may remain the main scenarios to which NATO, ad-hoc coalitions or nations will need to utilise their forces. At the same time the stability and functional infrastructure, which is the backbone of our economic and social wellbeing, needs to be defended against new challenges and threats along the lines of cyber-attacks or sabotage to various lines of communication.

Is following the tendency of current leadership to train personnel just in order to fill billets in peacetime or crises organisational establishments, while focusing towards increased technical or tactical proficiency and readiness evaluation suitable to match those challenges described above? What kind of training and education would apt such demanding scenarios and at what cost? In the current world financial climate it can often be politically difficult to justify military expenditure and Education, Training and Exercises are an easy target for cost-cutting measures – made all the easier because the results of such savings will not be seen for a number of years. Without Exercises and Training to inform the debate, how can the Alliance form and develop the necessary networks to support future capability? In which ways will ideas be exchanged and thinking be challenged towards common understanding and effectiveness? Is NATO's 'smart defence approach' more about smart preparation for missions rather than about smart execution of them? ●

1. Nolte, William M., Rethinking War and Intelligence, in: Mc Ivor, Anthony, (editor), Rethinking the principles of war. Annapolis, Maryland: Naval Institute Press, 2007, Pages 434–436.

The Advent of the 'Armed Drones'

Imperatives for the NATO Alliance

By Dr. Mark R. Jacobson, Senior Transatlantic Fellow, German Marshall Fund of the United States

As NATO looks beyond its current deployment to Afghanistan and prepares for the 2014 Summit, it would do well to begin both informal and formal discussions over what role armed drones may play in Alliance operations. With drone warfare playing an increasingly important part of modern warfare, their use begs the question: to what extent, with what protocols, and with what sort of transparency will we use these weapons?

The 'drone' is rapidly on the path to becoming ubiquitous in modern warfare, just as manned aircraft did during the first half of the twentieth century. The use of these remotely piloted vehicles (RPVs) for both surveillance and attack has provided a challenging set of issues for military strategists, as well as civilian security and defence planners. In particular, the employment of the armed drone, like other revolutionary weapons – crossbows, machine guns, submarines, and nuclear weapons – has led to fierce doctrinal, ethical, and legal debates surrounding their use.

NATO's Current Position

As an organisation, NATO has avoided diving into these deliberations, instead preferring to allow discussions to take place at a national level. While this is certainly understandable, it does not mean that the

Alliance can reasonably expect to avoid the matter beyond the immediate future. With worldwide spending on drones likely to double over the next ten years, the political and operational challenges may only get more complex. Indeed, if formal and focused discussions to address the issues surrounding armed drones does not take place soon, then it is likely that NATO will have to address these issues in the midst of contingency operations – which could lead to expedient solutions at the expense of strategic solutions for the longer term.

Even if the Alliance does not seek a NATO-flagged 'armed drone' capability, it will need to engage in the debate and consider the appropriate role of such weapons in armed conflict and other contingencies, and, consequently, how drones can or cannot be integrated into Alliance operations. It will not be sufficient to say that national assets will be used within national channels to support operations. Debates in the United States, Germany, and the United Kingdom suggest that there are significant differences of opinion on the acquisition and use of armed drones that could lead, directly or indirectly, to barriers to overall NATO planning and operations. Ironically, one might think that a long-standing European aversion to casualties might drive governments to procure more of these weapons in the hopes of putting fewer military personnel in harm's way. This has not necessarily been the case, though, as was seen recently when German Minister of Defence Thomas de Maizière argued that armed drones were necessary to provide force protection to deployed German forces – but failed to convince critics in the German Bundestag and the public.

What is more concerning are comments from some European civilians who have argued that drones are 'unfair' because they put 'our soldiers' in relative safety but the enemy is at risk – misplaced modern chivalry could represent an insurmountable gap between public perception and military requirements. Similarly, the Alliance will have to discuss the international legal ramifications of the use of armed drones – no matter how sensitive the issue – in order to identify irreconcilable differences and hopefully areas where there can be greater consensus.

Advantages vs. Disadvantages

Clearly, armed drones offer a unique military capability insofar as they significantly reduce the risk to military personnel, can provide a way to hit targets inaccessible by conventional aircraft and, for the most part, cost less than manned aircraft. Likewise, technological advances will continue to increase the loiter time on these platforms, which can shorten the 'sensor-to-shooter' timeline. Coupled with advances in stealth technology, the day is soon approaching when the 'armed drone' may indeed be a revolutionary platform – allowing for unprecedented survivability and striking capacity all in one package.

There is in some quarters an almost religious reverence for the drone and its capabilities, much in the same way that air power enthusiasts embraced the airplane, especially strategic bombers. Indeed, the promise of the bomber – according to futurists such as H.G. Wells and Jan S. Bloch, as well as the airpower theorists such as Douhet, Mitchell, and Trenchard, included the ability to strike targets with virtual impunity. These thinkers contended that air power could bypass the chaos of the battlefield, and potentially win wars without a commitment of ground forces. In the most basic terms, attacks on vital industrial or population centres could bring states to their knees in a short period of time. Even with the experience of military action over the past hundred years, an experience that demonstrated that airpower alone cannot win wars, there are some who remain convinced that airpower alone can win wars, especially given today's drone technology.

Critics believe there is a danger that any inherent advantages in using armed drones may hide the true costs of using force and provide a 'feel good panacea' that makes drones seem like a cure-all. This can lead to the use of drones as a substitute for a comprehensive strategy. After all, drones don't do governance and drones don't enhance the rule-of-law. Some even argue that the decreased risk to pilots in drone operations may make wars *more likely* and that because weapons reduce the risk to flight crews, who operate the platforms from afar, states may be encouraged to use military force where previously they were un-

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willing to assume the risk. Unfortunately, not only are there potential problems with *how* these weapons are used, but drones have an image problem in any situation that may be difficult to overcome.

What is clear is that drone attacks are increasingly unpopular around the world and have shaped opinions about U.S. foreign policy. But this does not mean that *every* use of armed drones needs be contentious. In fact, their use in Afghanistan, Libya, or planning for their use in future contingencies should be, or could be largely uncontroversial. The problem is that the use of drones is largely coloured by the United States reliance on these weapons, particularly when employed outside of internationally recognised zones of armed conflict such as in Yemen, Somalia, and Pakistan. In short, many believe the use of drones to be synonymous with covert action. Most critiques do not distinguish between military operations such as those conducted by the Alliance and less transparent national operations. Fortunately, the Obama Administration is already beginning to address this challenge in the United States through a deliberate shift of control of many missions from back to the Department of Defense from the intelligence community.

NATO's Next Steps

While NATO does not, as an Alliance, have to determine whether Ministries of Defence or intelligence services lead drone operations, it will have to consider what manner of operations will require the Alliance to use surveillance and weaponised drones. The use of drones to support ground troops, or in limited air-to-ground strikes – such as in an Afghanistan or Libya – may be least controversial, as the operations are most similar to the close air support currently provided by manned aircraft. From an ethical, legal, and strategic standpoint, however, the use of armed drones for counter-terrorism operations without having boots on the ground will prove much more contentious. These kinds of missions will not have the sort of international sanction needed by the North Atlantic Council (Kosovo of course being an exception) and of course the Alliance is not positioned to conduct covert operations. It is not realistic to suppose that NATO can do *everything* its member nations require to preserve their security. As such, perhaps counter-terrorism, especially with regards to independent armed drone operations, will best remain outside NATO's purview.

NATO should also consider more formal structures and guidelines with regards to addressing the issue of civilian casualties in operations involving the use of armed drones. NATO has of course already dealt with this tragic issue in military operations but, as noted before, there are additional difficulties when operations or civilian casualty incidents involve the use of drones. While drones are arguably some of the most precise weapons used in conflict, it is getting harder to distinguish between civilians and combatants on


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the battlefield. Further, insurgents deliberately blur these increasingly imprecise lines. Thus, any real or perceived decrease in the ability of the military to assess 'ground truth' suggests less granularity in the accuracy of targeting information. While from a technical standpoint, drone operations could provide even better situational awareness at times; but, the reality is that drones are often used in distant or remote locations where objective post-strike assessment is difficult. Today, there is little agreement between the U.S. government, think-tanks, and NGOs over the civilian casualty rate and this has exacerbated public, especially European, discontent with some aspects of 'armed drone' use. There are steps, however, that NATO can, and in fact should take to help alleviate this problem for its own future operations.

First, NATO must make a public commitment to transparency and civilian safety in their drone policy. Indeed, if there is a single lesson for NATO to identify from the initial experiences of the U.S. and the use of drones – it is that transparency works. Transparency has helped NATO to gain credibility and outflank Taliban propaganda in Afghanistan. There is no reason that this should not be the case for potential drone operations in the same way it has worked for other military operations. Indeed, from an objective standpoint NATO has done admirably over the last several years to reduce civilian casualties in Afghanistan and by many accounts did extraordinarily well in Libya. Unfortunately the transparency seen on this issue in Afghanistan was not replicated in Libya, and thus, will set the precedent for future operations. Transparency on the impacts of kinetic operations should be viewed as an absolute imperative for success at both the operational and strategic level. After all – the failure to convince the host nation, NATO, and international audiences that reducing civilian casualties is a priority, can lead to a lack of sustained political support and thus potential mission failure. To this end, NATO should consider not only the establishment of a permanent unit at Headquarters to address the political and strategic aspects of civilian casualty mitigation, as well as permanent structures within Allied Command Operations and deployed headquarters.

Next, NATO's challenges will not just be in terms of the offensive use of armed drones. As the number of nations acquiring armed drones increases, so will the likelihood that NATO will have to plan to face these weapons on the battlefield. While anti-drone technologies need not be any more sophisticated than current anti-air systems, there is little doubt that potential NATO adversaries are seeking ways to leverage the

technological characteristics of the platforms to avoid or potentially 'swamp' a defensive network with swarms of small armed drones. Indeed, if one is to look back at the Second World War to identify 'lessons' on the use of airpower, the seminal event was not the air war over Germany or Japan, but likely the Battle of Britain, which demonstrated that a networked defensive system of radars, anti-aircraft artillery, and fighter aircraft could provide a significant obstacle to an offensive strategic bombing campaign. Likewise, the introduction of backpack-portable drones and the proliferation of lightweight small diameter bombs creates a lethal combination that is technologically and financially available to scores of nations. While the current strategic environment for NATO nations does not justify the need for massive expenditures on defense-in-depth against potential airpower threats, the Alliance may wish to reconsider the development of a next-generation of deployable short-range air defence systems designed to address small, stealthy drones armed with stand-off weapons.

Finally, the rapid evolution of drone technology will create new challenges for the Alliance even as the initial questions remain unsolved. While we are not yet at the point where autonomous aircraft fly missions without human beings in the loop, the technology for partially or fully automated defensive and offensive systems does exist, as seen in the Israeli Iron Dome anti-missile system and other similar programs. It would not take too much of a leap to use similar technology, or more advanced artificial intelligence systems, to allow an armed drone or a swarm of these airframes to operate without human intervention during part or all of its mission. While automating the terminal phase of an operation might not be much different from how a Joint Direct Attack Munition (JDAM) or a cruise missile works, allowing such a system to loiter and select its own targets might pose more complex ethical and legal challenges. Who would be responsible if a drone selected the wrong target? Similarly, where should nations, as a matter of law or policy, require human beings to remain in the loop? It will not be good enough to simply eschew the problem and "ban the killer robots" but nor is it appropriate to either employ these weapons without limitations, nor to wait until the problem presents itself to discuss the issue.

Conclusion

While developing Alliance consensus can be a painstaking and lengthy process, one of the strengths of the NATO Alliance is indeed the shared sense of values amongst its members. The need to maintain an effective capability and to operate according to the laws of war – and within the confines of international practice and custom – is an imperative the Alliance cannot easily discard. There must also be recognition that the way we wage war is ever-changing. Indeed, as drone technology progresses at a rapid pace, there will be some degree of discomfort over where, how, and under what authorities nations take military action. In the end, however, these debates will maintain the political strength of the Alliance and ensure its relevancy well into the 21st Century. ●

Dr. Mark R. Jacobson

is a Senior Transatlantic Fellow at the German Marshall Fund of the United States and the former Deputy NATO Senior Civilian Representative in Afghanistan. He has served in a number of positions at the Department of Defense and was a professional staff member at the U.S. Senate Committee on Armed Services. A Senior Adviser for the Truman National Security Project. He holds a Ph.D. in Military History from The Ohio State University and has served for almost 20 years as a military reservist.

New Technologies

Fire, Wheel, Steam Engine and … Nanotechnology

By Lieutenant Colonel José García, ESP AF, JAPCC

Introduction

"A number of significant technology-related trends – including the development of laser weapons, electronic warfare and technologies that impede access to space – appear poised to have major global effects that will impact on NATO military planning and operations."
NATO Strategic Concept 2010

Since its inception over one hundred years ago, aviation has always been at the leading edge of technology. For a long time, technological solutions and developments derived from the field of aviation have been used by industries. Aviation has been considered a real originator of research and development for a great number of technological advances. But this situation seems to have changed somewhat. Today, new technological developments from other branches of research and development are just as likely to be applied to the field of aviation. For this reason, it is important for air power theorists to be aware of current and future innovations expected to come from industry. This will help to improve the capabilities of existing weapon systems, and thus determine the best way to face both traditional and new threats. New trends in technologies such as nanotechnology, aeroelasticity, laser applications in communications or new synthetic fuels are going to be a familiar part of our lives in the near future. The aim of this article is to highlight the technological advances in the emerging field of nanotechnology and forecast how it could improve the future potential of air power capabilities by leveraging the new capabilities this technological advance may provide.

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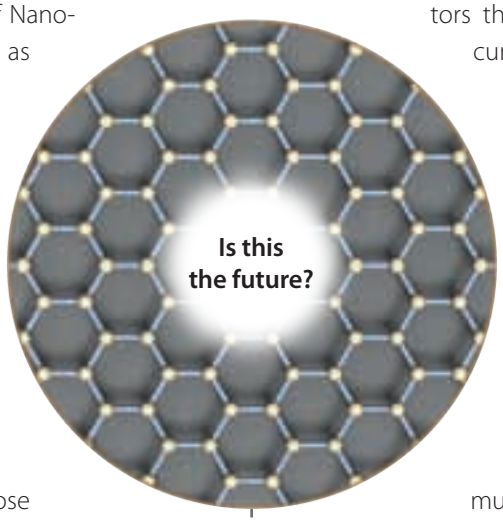
Nanotechnology

"Nanotechnology is an area which has highly promising prospects for turning fundamental research into successful innovations. Not only to boost the competitiveness of our industry but also to create new products that will make positive changes in the lives of our citizens, be it in medicine, environment, electronics or any other field."
European Commissioner for Science & Research, Janez Potočnik

Nanotechnology is a branch of engineering concerned with manipulating materials on an atomic or molecular scale. The Institute of Nanotechnology in the U.K. defines it as "science and technology where dimensions and tolerances in the range of 0.1 nanometer (nm) to 100 nm play a critical role". The first and most important advantage of manipulating material at the atomic/molecular level is the ability to obtain new physical features and behaviours of common materials with the possibility of obtaining new micro-machines based on those new features and behaviours. The possibilities for this burgeoning area of science are infinite and some theorists call this area of study "the industrial revolution of the 21st Century".



Graphene

One of the most important examples of this phenomenon is Graphene[1]. It is a hexagonal honeycomb made entirely of a regular carbon structure material, one atom thick. The features of this new material are extraordinary. It is much stronger than steel but also much lighter. It is more electrically and thermally conductive than other conductive metals like copper. It is very flexible and almost transparent. It could be said that it is a film of diamond. A new wide horizon of possibilities and applications has opened, some of these include slim screens[2], solar cells, batteries[3], bulletproof vests, graphene muscles and electronic transistors that are much more efficient than current silicon transistors[4]. There are numerous possibilities that can be applied to the aeronautical field. The weight of aircraft components could be reduced as stronger, ultra-light fuselage components made of graphene are used as the foundation of a new generation of aircraft. Also, due to graphene's optoelectronic properties, the entire fuselage could work like a full multisensory antenna[5]. The use of graphene is also being considered as a fuel additive as it could yield more efficiency, reduce environmental pollution and greenhouse gas emissions, while improving the aircraft endurance and payloads[6].

Nanotubes

A nanotube is a tube with a nanometer scale structure, made mainly of rolled graphene[7]. In this form, the graphene acquires new features and improves existing ones. Nanotubes have extraordinary optical, thermal, chemical, mechanical and electrical properties[8] and are currently being used to advance several scientific fields such as medicine, biology, chemistry, and technology. The key properties of carbon nanotubes are the ability to behave as a metal or a semiconductor[9], and be modified by a nearby magnetic field. They also have unique optoelectronic[10] and field emission properties[11]. Carbon nanotubes are stable at high temperatures and have very high thermo-conductivity in one axis, but acts as a thermal insulator in the other axis. This property, along with its strength, flexibility and lightness, makes nanotubes a good shield or armour against kinetic threats (body armour, light-weight armour for vulnerable aircraft structures, etc.), and electromagnetic and acoustic[12] threats. Carbon nanotubes' absorption capability makes them highly valuable as a Radar Absorbing Material (RAM) improving the 'stealth' capability of combat aircraft[13]. Aircraft wiring as it currently exists is close to its structural limitations. Construction of carbon nanotubes cables could result in more efficient and conductive wires than copper with better current density[14] and corrosion resistance. They are much lighter and work in a wider range of temperatures with less cooling requirements. This could be a very important step forward in all technological fields but especially in the field of aeronautics[15].

By using concentric multiwall nanotubes, it is possible to craft rotational nano-bearings with extremely low friction between telescopic nanotubes. Working as an actuator, nanotubes could facilitate the production of nano-machines and nano-robots, and even normal-sized machines. This rotational molecular system could be considered the smallest engine ever made. Since there is almost no friction between different nanotube walls, lubricants are unnecessary and nano-machine components will not wear out. Additionally, if an internal nanotube, inside a multi-walled one, slides out of its normal position, it tends to return back to its original position, working like a natural permanent telescopic spring. These characteristics of carbon nanotubes make them useful in enhancing the lubrication in gasoline engines, reducing friction by up to 40% and hence the wear of the components while improving efficiency and decreasing fuel consumption[16]. Because carbon nanotubes have better conductive properties than common materials, improvements in processing speed and memory capacity could facilitate further electronic miniaturisation than is currently possible with existing technology.

Limitations

Similar to other technological developments throughout history, nanotechnology could be a double edged sword. Unfortunately, there are many unsolved questions regarding the use of, and exposure to, nanotubes. What are the environmental or health negative effects? What will be the interaction between nanomaterial and the human body? And finally, who is going to regulate the use of it?

The European Commission presented 'Nanosciences and Nanotechnologies: an action plan for Europe 2005–2009'[17]. Many ethical, legal and societal aspects of this issue are addressed in this document. The study emphasised that all developments and applications derived from nanotechnology must be closely monitored with the highest level of health protection. It also underscored the need to ensure that technological advances are supported by parallel investigations about possible related risks and hazards[18].

Nanotechnology and Military Applications – Science Fiction?

Nanotechnology and its application to aviation can be placed into two main categories, improvement of aerodynamic performance and improvement of weapons and sensors capabilities. Reducing weight by using lighter materials in combination with more efficient fuels and engines is one way to improve aircraft payload while increasing endurance. Using new RAM materials, paints and designs will make aircraft more 'stealthy'. Through the employment of nanotechnology, future aircraft could have the following features:

· New aircraft designs with certain 'morph-able' capacities in some portion of its wings or fuselage. These could replace flaps, slats or winglets, or could change the profile of the wings depending of the flight conditions.

· With the fuselage or wings made, covered or even painted with carbon nanotubes, it is possible to make the aircraft more 'stealthy' against radars and even invisible to electro-optical systems in low visibility conditions or night, thanks to the absorption capabilities or the lack of electromagnetic refraction and reflection of these materials.

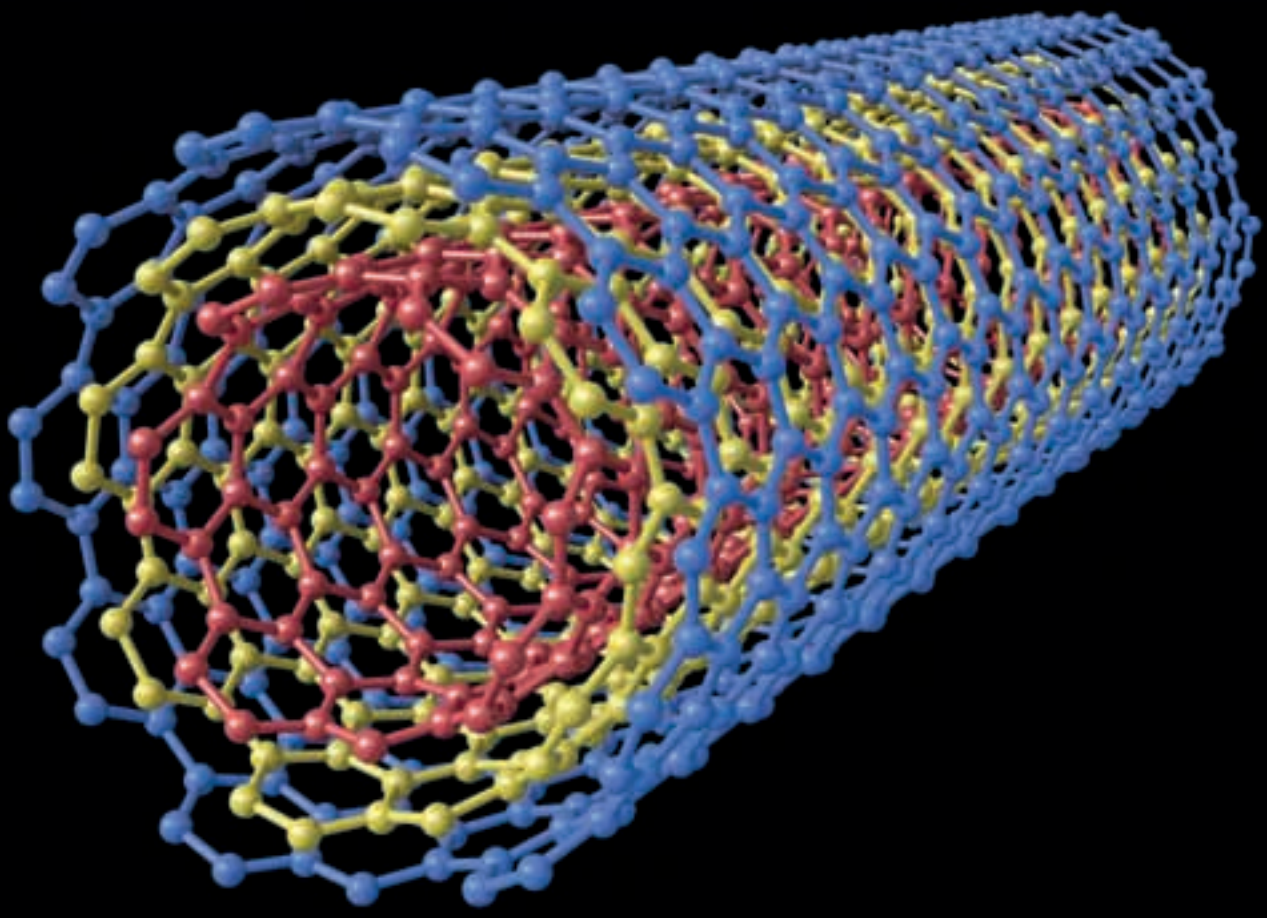
· By using carbon nanotubes and graphene along the fuselage or wings, aircraft could become a continuous sensor or early warning system. The opto-electronic properties of nanotubes make them an excellent receiver of external signals, not only electronic ones but detecting gases coming from missiles, submarines, aircraft, etc., or even as a biological/chemical warning alert device.

· In weaponeering, sensors could be used as seekers in the guidance of missiles or precision bombs against electronic transmitter or exhaust gases.

· As internal sensors[19], carbon nanotubes could be distributed along sensitive aircraft parts such as hot zones in the engines, turbines, afterburner, etc., or into areas of extreme force like landing gear or wings roots, measuring temperatures, pressure or strain.

· Due to their strength and flexibility, carbon nanotubes and graphene might be used as armour or shielding for vulnerable zones in the aircraft. Even the canopy could be made with this transparent material. Hydrophobic properties of graphene give windshield and canopies better performance in the rain, even without wipers.

· By applying nanotechnology in electronic components, it is possible to increase the processing speed and memory capacity of existing silicon transistors, reducing the size and weight of electronic



Multiwall nanotubes could facilitate the production of nano-machines and nano-robots even normal sized machines. This rotational molecules system could be considered the smallest engine ever made!

components. This means more space available, more useable payload and faster processing capability for aircraft computer systems. There are companies developing very slim and flexible displays made of graphene, which facilitates the construction of electronic control panels in aircraft where electronic circuits, transistors and other elements are included all on the same panel.

- Because of graphene's fireproof characteristics, certain sensitive parts of this hypothetical future aircraft will be protected against fire with carbon nanotube shields or it could be used as a fire extinguisher powder in the case of on-board fires.
- Future aircraft could employ new lighter batteries with greatly improved electrical storage capacity. Also, if hydrogen becomes a source of fuel, carbon nanotubes can provide good hydrogen storage capability, solving one of the most difficult challenges in the use of hydrogen as a fuel.

"The features of this new material are extraordinary. It is much stronger than steel but also much lighter. It is more electrically and thermally conductive than other conductive metals like copper."

All of the applications mentioned above in the hypothetical design of a future aircraft that uses the capabilities of nanotechnology are equally valid for other areas with military interest such as medicine, passive defence, force protection, C2 systems, energy storage, production of drinking water or water decontamination in air bases or into first aid kits, etc. The advance of science and future progress in the development of nanotechnology holds the key to bringing us all closer to these enormous benefits. ●

1. This material was discovered by Andre Geim and Kostya Novoselov in 2004. They received the Nobel Prize in Physic in 2010.
2. Samsung in collaboration with Sungkyunkwa University is making rolled and flexible touching screens with invisible electronic connections.
3. Vorbeck, a materials producer company, is developing new graphene batteries with more storing capability and less recharge time than the lithium batteries.
4. In 2010, IBM has made a graphene transistor with a processing speed 25 times higher than a siliceous one.
5. Nanotubes applications as chemical sensor or thermo battery are possible because its electrical conductance changes when it is exposed to gases, and nanotubes produce electricity when heat is applied.
6. US researchers study fuel additives made of tiny particles of graphene. These particles make fuels ignite and burn faster.
7. The diameter/length ratio is very high, diameter is a nano-scale and the length could be about centimetres.
8. Nanotubes properties depend on the kind of nanotube, length and diameter, and defects of them.
9. It depends of the ratio between 'Hamada' indexes. This index shows the way that the nanotubes have been rolled.
10. Optoelectronic is the field of the science and technology that studies and fabricates devices to convert electrical signals into light, and the reverse.
11. Field emission, or cold emission, is the capacity of some material to leave electrons when an electric field is applied.
12. Due to its structure in net and its electrical conductivity, the electromagnetic radiations or acoustic waves are diverted and disseminated along the shield's surface avoiding it reaches the target.
13. Lockheed Martin uses nanotechnology in its 'Juno' spacecraft and F-35 'Joint Strike Fighter' in areas like Multifunctional Materials and Manufacturing, Sensors and electronic (carbon nanotube-based memory, chemical/biological sensors and nano copper), Energy Solutions (high performance energy storage devices) and Integrated Computational Material (electronic devices, nao informatics modelling). Source: Lockheed Martin webpage.
14. 'Current Density' is the ratio between the quantity of electricity per unit of cross section, and it is related to the lack of energy due to the resistance and the heat produced.
15. Article 'Iodine doped carbon nanotube cables exceeding specific electrical conductivity of metals' by Department of Mechanical Engineering and Materials Science, Rice University, Houston, United States.
16. 'Friction and Wear of Materials' by Ernest Rabinowicz.
17. "Second Implementation Report 2007–2009. This outlines the key developments during 2007–2009 in each policy area of the Action Plan, identifies current challenges, and draws conclusions relevant to the future European nanotechnology policy."
18. In 2008, the European Commission released a 'Code of Conduct for responsible nanosciences and nanotechnologies research', which provides guidelines favouring a responsible and open approach, it will be regularly monitored, and updated every two years.
19. Informe de Vigilancia Tecnológica: 'current and future applications of carbon nanotubes' by Maria J. Rivas Martínez, José R. Ganzer and María L. Cosme Huertas.

Lieutenant Colonel José García

is a fighter pilot of the Spanish Air Force assigned to the JAPCC (Combat Air Branch). With 4.300 flight hours, he is an experienced Air Operations and Pilots Formation Officer. His previous assignments include the 14th Fighter Wing, the Spanish Air Force Academy and the Spanish Air Force Combat Command.

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Gen. Philip Breedlove (USAFE and Air Force Africa Commander at that time) speaks with Brig. Gen. Alain Pereira (Senegal Air Chief) during a group discussion at the Regional Air Chief Conference in Dakar Senegal, 29 Aug 2012.

African Relations

NATO's Reach for Stability

By Colonel António A. Santos, PRT AF, JAPCC

"… beyond our [Alliance] frontiers there is uncertainty and insecurity, … my first and enduring priority will be to ensure that NATO remains vigilant and prepared to meet the challenges and threats of the future."
General Philip Mark Breedlove, USAF, SACEUR, 13 May 2013

Introduction

Europe is part of an area of influence where conflict between neighbours arises from aspects of ethnic, religious and border disputes. However, there are some more relevant factors that feed into this conflict. In fact, in the wake of the end of the Cold War and the advent of the globalisation phenomenon, the world has seen the emergence of new and complex problems which put national sovereignty and security at risk.

Political and economic developments eventually fostered a remarkable change of position in the world order. Indeed, the re-characterisation of the strategic threats has led nations to rethink their defence policies; leading them to be more involved outside their physical boundaries. This new attitude was in the name of safeguarding security and territorial integrity and the promotion of peace, through a strategic-political approach, adjusted to a greater international scale.

Relationship as Part of the Stability

The creation of NATO was part of a broader effort by Western nations to serve various strategic purposes. Deterring Soviet expansionism was one of the most important purposes for NATO's creation and it characterised and defined the NATO body. After the Cold War, NATO member states felt it necessary to enlarge their Alliance by creating a new 'pan-European security architecture'[1].

The Euro-Atlantic Partnership Council[2], established in 1997, set the Allies together with their Central European, Eastern European, and Central Asian neighbours for joint consultations and cooperation. These Partners saw a "relationship with NATO as fundamental to their own aspirations for stability, democracy, and European integration". This cooperation enlarged the stability arc, but it is important to take into account some other areas which might affect stability and security. One should be aware that radial stability drives the central security in any given area. As such, stability and support of humanitarian crises are important to Africa, but should also be of concern to NATO.

Building Air Transport Capabilities in Africa

During the Military Airlift SMI Conference, in Amsterdam, Colonel Birane Diop from the Senegalese Air Force (Armée de l'Air Sénégalaise) gave a presentation on the need for the Africa countries to start cooperating in strategic air transport. His remarks were clear, stating that "Africa should have cooperation for strategic airlift capabilities". Africa is constantly dependent on international partners for airlift, and this does not serve its nations well. Most African nations don't have the capacity to manage medium to large scale humanitarian crises. Despite some African nations having an abundance of natural resources, they still face many challenges: health, food, discrimination, etc.

Some African nations are trying to engage a plan to go forward with the idea of a coordinated African airlift capability. They agree that it is time to start more participation and cooperation amongst African countries to improve their capabilities. During the Regional Air Chief Conference in Dakar, Senegal, August 2012, Nigerian Air Marshall M.D. Umar, Chief of the Nigerian Air Force, stated, "Participation and cooperation (amongst African countries) is key to the improvement of our capabilities, our personnel readiness and the multiple challenges and security challenges in the region". The aim of this conference was to a start discussion about possible initiatives concerning regional partnerships, because they need to find "African solutions to African challenges". "Strategic airlift remains a critical supporting capability that should be achieved, maintained and improved. A systematic use of pooled and shared (strategic airlift) assets would reduce duplication, overhead and medium and long-term capabilities", said Ghana Air Force Wing Commander, Nana Adu-Gyamfi[3].

Cooperation Forces a Significant Mind-Set Change

Sharing capabilities will result in major cultural shifts within nations. NATO has been dealing with this issue for many years, and many NATO member nations have experienced the difficulty of multinational deployments and redeployments. In Africa, this concept shouldn't be any different; in fact, some of its countries are already willing to step forward with this big change, which is a good starting point.

The Alliance built the Partnership for Peace (PfP) programme, which allowed non-NATO countries to share information with NATO and modernise their armed forces in line with modern democratic standards. As such, there is a role that NATO can play to do more to help those African countries that are willing to cooperate in a more robust way.

Cooperation already extends to the south of Europe, where the Alliance founded the Mediterranean Dialogue. NATO's Mediterranean Dialogue was initiated in 1994 and involves seven non-NATO countries of the Mediterranean region: Algeria, Egypt, Israel, Jordan, Mauritania, Morocco and Tunisia. The Dialogue reflects the Alliance's view that security in Europe is closely linked to security and stability in the Mediterranean. It

is an integral part of NATO's adaptation to the post-Cold War security environment, as well as an important component of the Alliance's policy of outreach and cooperation. The Mediterranean Dialogue's objectives in principal are to: "contribute to regional security and stability; to achieve better mutual understanding; and to dispel any misconceptions about NATO among Dialogue countries". However, it is not enough to focus on stability in this region alone. We should not glance towards Africa with the 'tyranny of distance' and ignore its many problems both old and new. The growing problems south of the Mediterranean are becoming an increasing risk to NATO's security. To counter this emerging problem, NATO should promote an enlargement dialogue to include more countries and not just maintain the 'status quo'.

Concerns in Africa

The media shows a variety of significant issues regarding the African continent. Some of the problems affecting this region include: the poor economic situation; proliferation of extremism, challenges to democratisation, terrorism, piracy, etc. All the instability and the dominance of outlaw groups in large areas of the continent, could be the utmost reason for considerably more work between African nations and NATO. An increased and more effective cooperation and relationship that NATO, as an alliance, could have with African countries is definitely required. In this aspect, the African Union (AU) should be the conduit for cooperation between NATO and its African member nations and the AU should set the requirements for cooperation and should be the entity leading any African Partnership.

At the NATO Summit in Lisbon 2010, several priorities were identified, which included fighting terrorism and piracy. At this high level event, member states agreed that the Alliance should continue with an open way to increase cooperation with other nations, and stated that "we agreed to further enhance our existing partnerships and to develop new ones with interested countries and organisations".

NATO already provides assistance to AU missions, but, this can be a deeper engagement by providing capacity-building support within different areas of operations. Considering some nations are willing to cooperate in the air transport environment, NATO could promote this spirit of cooperation fostering the opportunity for African nations to start building an air transport fleet and have their own air transport capacity.

Instability or conflict beyond NATO borders can directly threaten Alliance security, by fostering extremism, terrorism, and transnational illegal activities such as trafficking in arms, narcotics and people. At the request of the AU, the Alliance could promote a comprehensive defence strategy by giving training assistance and promoting standardisation in a cooperative environment. This would be an appreciated act of assistance for a continent facing the challenges of the aforementioned threats. As an example, the Gulf of Guinea Commission is trying to find mechanisms through their nations to have a force to protect the area against piracy, which is affecting not only their security, but all other nations crossing the Gulf of Guinea. Because this problem has wide-ranging negative impact, any possible solution to the problem

should involve both nations in that AOR and the international community that relies on trade routes that transit this area.

Developing Cooperation, the Way Ahead

NATO is already providing, at the AU's request, training opportunities and capacity building support to the AU's long term peacekeeping capabilities, in particular the African Standby Force. However, this is not enough. NATO should also support the AU's desire to develop Air Transport capabilities for the support of their daily humanitarian and military needs to provide to the maximum extent possible, a secured and stabled situation in Africa. The Alliance and the AU are developing a 'very positive' relationship, according to

the Head of the Peace Support Operations Division (PSOD) of the AU, Mr Sivuyile Thandikhaya Bam, but nevertheless the AU desires to build up and expand collaboration in others areas.

"The Mediterranean Dialogue's objectives in principal are to: "contribute to regional security and stability; to achieve better mutual understanding; and to dispel any misconceptions about NATO among Dialogue countries"."

As such, NATO can give not only support to ground troops but effective air training support and advice for AU forces to reach an operational standard able to face humanitarian crises across African Continent by moving personnel and cargo throughout the 'tyranny of distance'. If interested nations were given the chance to have improved support, they would gain valuable hands-on experience and be better equipped and trained to handle their transport challenges.

Future challenges are not only facing the Africa Continent but also facing NATO. In the past twenty years, global economic power has shifted to the Pacific Rim and the United States has started to shift its military focus toward this region. Consequently, NATO military power in Europe will be diminished, opening the door for questions about the continued strength of the North Atlantic Alliance. NATO cannot be allowed to become irrelevant nor can it risk reduction of its current level of security; in that vein, politicians should consider expanding their focus outside their current field of vision.

Conclusion

If NATO paid more attention to Africa, it could lead to a greater understanding and help build greater security and economic stability in the area. This is achievable, if one considers that the area can give to the member states a simultaneously place for trade and competitive resources.

There is a place for NATO to work more extensively with African countries. Indeed, this can be done by enlarging AU airlift training. NATO may use their expertise to help those nations build an important capability for the entire region, and at the same time bring Africa into the fold as part of NATO's stability. The sharing of expertise and knowledge should not be only kept within the Alliance, but spread outside of NATO in regions that play important roles in securing NATO's stability.

"Now NATO has a new mission: extending peace through the strategic projection of security"[4], this should be extended also to Africa, in a comprehensive and collaborative way.

1. http://www.nato.int/history/nato-history.html
2. http://www.nato.int/cps/en/natolive/51288.htm
3. http://www.usafe.af.mil/news/story.asp?id=123316228
4. http://www.nato.int/history/nato-history.html

Colonel António Santos

joined the Portuguese Air Force in September 1984, and graduated from the Portuguese Air Force Academy, in 1989. After his graduation he was posted to a fighter squadron where he flew the A-7P Corsair. With 7 years of flight experience he became an Instructor Pilot and Flight Safety Officer for the A-jet training squadron. After three years as an instructor, he was selected for Air Staff College. At the conclusion of Air Staff College, Col Santos became qualified in the C-130 (General and Tactical Airlift), where he became a Squadron Leader. Col António Santos also served as a Section member for Exercise & Training at CAOC 10, Lisbon, for one year, before transferring to the Joint Air Power Competence Centre (JAPCC) in Kalkar, Germany as a Subject Matter Expert in Air Transport.

Developing Future Force Protection Capability (Part 1)

Where Might We Be Going and Where Should We Be Going?

By Group Captain Jez Parkinson, GBR AF, JAPCC

Introduction

This 2-part article focussed on Force Protection (FP) will discuss some of the issues surrounding where NATO FP *might* be going and explore where perhaps it *should* be going? In this first instalment, the author will try to outline the realities of FP today, discuss NATO's doctrinal approach, introduce current challenges and suggest why lessons identified need to be captured. The second piece, which will be published in the JAPCC's Spring 2014 edition, will analyse the work done by students attending the NATO School Oberammergau (NSO) Force Protection Course with a view to identifying what they have concluded will be NATO's likely future FP challenges, based on potential NATO Reaction Force (NRF) mission scenarios.

Purpose

The purpose of this work is to *try* and combine NATO's current doctrinal approach to FP and lessons learned from recent operations with the views of students on the FP Course. The hope is that this will lead to the identification of a *Minimum Military Requirement (MMR)* for FP based on some likely future scenarios. By utilising work from the FP Course, it should be possible to derive a truly multinational view that is representative of all components, provided by a spread of ranks and experience and from a broad spectrum of career fields. If a *MMR* for FP can be defined, this could subsequently be used in an attempt to persuade the nations to commit FP resources ahead of any deployment so that we can be confident from the outset that at least the

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basic, mission-enabling, FP requirements, are in place. Readers are encouraged to contribute to the discussion with their own views and experiences.

Understanding NATO Force Protection

It is perhaps necessary to explain what the author believes constitutes FP in its NATO context. In the Cold War era, in simple terms, the Maritime Component fought at sea and the Land Component deployed into the field. Both used their ability to manoeuvre and the tactics integral to delivering their specific missions to provide protection for their own force elements. The Air Component by contrast did not have this option and had to fight from immovable, well known and highly visible pieces of real estate. Therefore, in order to deliver its mission, the Air Component had to be able to defend the airfields from which it would fight and when necessary, continue to fight from these airfields despite any adversaries best efforts to stop them. It is this basic concept of the consideration of FP as a separate, discreet function that NATO has taken forward as the core of its FP doctrine for the defence of fixed installations irrespective of whether the installation is a headquarters, port, logistics facility or airfield.

It is *fully* accepted that NATO FP doctrine *should* be more than the defence of fixed installations however; in reality beyond the FP of fixed installation other doctrines will likely take precedence. Alternatively, the activity being conducted will be on a scale where national not NATO doctrine can be more easily applied. Recent operations have demonstrated that the nations have a desire to gain the benefits from the economies of scale provided by operating many assets from a single location. These locations quickly become self-perpetuating and with most if not all partners operating from them quickly become tempting targets for an enemy; they are of strategic importance to both any would-be attacker and the defender.

International Security Assistance Force – Expansion to Redeployment

As the International Security Assistance Force (ISAF) expanded from 2005 onwards, a number of large, NATO common funded installations were created and various nations carried out either FP Estimates or Vulnerability Assessments in order to understand what resources would be required to protect these facilities. Unfortunately, these initial assessments have never been fully resourced through the NATO Force Generation process. What is more, as the facilities have continued to expand *(self-perpetuate),* revisions of the initial estimates have been ignored meaning that installations that are now many times larger than they were in 2005 are still being protected by force levels that were inadequate at the outset.

Looking at the current situation in Afghanistan, it needs to be emphasised that to date, we have been extremely lucky that the Insurgency has either not been able to identify weaknesses in NATO's FP posture or, for whatever reason, have been either unwilling or unable to successfully exploit those weaknesses. As the Provisional Irish Republican Army put it after their minimal success with the Brighton Bomb of 12 October 1984:

"Today we were unlucky, but remember we only have to be lucky once. You will have to be lucky always." This quote has been changed, modified and re-stated numerous times over subsequent years and is regularly used in post-9/11 discussions. Regardless of its origins, it is a quote that still contains a certain level of truth today.

With the move from ISAF to Operation RESOLUTE SUPPORT, the bases which will be the focus of this transition must remain secure. The large NATO bases will be at the centre of redeployment and retrograde activity, not to mention Demilitarisation, Dismantling and Disposal (D3). As this work gathers pace, our installations must remain protected if we are to transition from one operation to the other and concurrently withdraw the bulk of our forces and their equipment in good order. The challenge is that nations seem more unwilling than ever to provide or continue to provide resources for FP in order to deliver this protection through transition and beyond.

The Theory

The NATO doctrinal approach to FP relies on an accurate and detailed assessment of the threat, what


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elements of the force are critical to mission success and where our vulnerabilities lie. This process must be continuous as threats change, often rapidly, over time and as such, FP must have dedicated intelligence support. This intelligence support must have a detailed understanding of the local environment as well as a broader understanding of the threat theatre-wide. Only once the threat, mission critical capabilities and our own vulnerabilities are understood can we then define the FP capabilities required to counter the threat and protect the force.

Of course, there has to be a reality-check in the system. Not all those capabilities required will either be available or available in sufficient quantities so, commanders will need to undertake an element of Risk Management. The key point here and where we are extremely weak, is having identified the risks[1], we then fail to identify the risk owner. It is suggested that it is all too easy in *any* Alliance to say that *"the nations own the risk"* because it is they who are failing to provide the resource. However, are we doing enough to articulate the risks and the consequences of the enemy *'being lucky'*?

So what of the capabilities required? These will be situation dependent but, the start point needs to assume a harsh operating environment, little HN support, austere or bare basing options and a complex threat ranging from something akin to force-on-force (an air threat?) through to asymmetric. Doctrine recognise this and presents the commander and planner with what amounts to a 'shopping list' of capabilities where, based on an assessment of the operating environment, those capabilities deemed as necessary are requested through the Force Generation process.

In a complex environment with a considerable range of capabilities to be coordinated, synchronised and in some cases actively de-conflicted, there is without doubt a need for a cadre of specialists. These specialists will need to have some level of training in a number of different FP functions and be a specialist in at least one. Also, they must have gained experience throughout their careers in the delivery, at various levels, of the different FP capabilities as described in doctrine. These specialists will be needed to plan, command, deliver and train the FP capability of the future.

Image and Understanding

NATO has three primary challenges with regard to the provision of FP on operations. Firstly, because of a lack of understanding of how FP is provided, it is all too often seen in capitals and headquarters as little more than a static guarding task and as such is not perceived as contributing to the actual delivery of the mission. Secondly, there is a general lack of understanding of just how complex and resource intensive the securing of the large installations can be particularly in environments with high, multi-dimensional threats. Finally, it seems evident that whilst nations may appreciate the need for effective FP, few are willing to provide the necessary assets from their often politically-capped resource contributions.

Even if some threats are not present at the outset, there is a likelihood that they could materialise over time as an adversary evolves or the presence of NATO forces attracts threats from outside the theatre of operations in the shape of 'foreign fighters'. Both these scenarios will change the nature of the threat and necessitate the development of the FP posture. In this type of scenario, the initial FP posture has to be sufficiently robust to manage the emerging threat(s) and the nations have to be willing to either see resources already deployed redirected from the primary mission to FP tasks or, provide additional resources to reinforce and/or enhance FP. The FP posture has to be dynamic and ideally, based on sound intelligence, develop ahead of any threat.

The Reality

FP capabilities required will vary considerably but from work to date, looking at future requirements, there is already a noticeable trend towards assuming that *"the Host Nation (HN) will provide …"* either the complete FP requirement or considerable element of it, particularly the 'outside the wire' portion. This is a very dangerous assumption to make and the simple retort is that if we adopt a frame of mind where the solution is that FP is effectively someone else's problem, we run the risk of being found lacking at some point in the future when that *'someone else'* cannot be identified.

It is an often voiced view that the NATO approach to FP is too *'air-centric'* but it is within the Air Component where the predominance of FP expertise still sits as a result of some nations having invested over many years in developing FP expertise in order to enable the Air Mission. However, this core of expertise is at risk as nations look to reduce defence expenditure and focus on what they perceive to be core capabilities (the author would of course argue that FP **is** a core capability).

"If FP does not contribute to the mission, its absence or failure will most certainly contribute to its failure."

What is clear is that nations are looking individually at their own needs and based on the current ISAF experience, some already view FP as *non-core* activity and more worryingly, someone else's responsibility to provide. It is suggested that we are not that far away from being unable to generate FP expertise to plan and coordinate FP efforts together with the nations being unwilling to provide the necessary resources simply because they view FP as not contributing to the mission. If FP does not contribute to the mission, its absence or failure will most certainly contribute to its failure. The lack of FP could severely hamper Operations and Logistics activities. Force Protection is a prerequisite for the conduct of Operations and Logistics therefore, FP is in all respects, a Force Enabler.

A long standing *'bone of contention'* is the domination of the area around any installation. This Tactical Area of Responsibility (TAOR) (in Air known as a Ground Defence Area), is a vital part of establishing effective defence of any installation. The TAOR should extend well beyond the perimeter of the facility, in order to prevent direct and indirect attacks being targeted against the facility, its personnel and any asset operating from that facility (be that aircraft, shipping or ground forces). Furthermore, the immediate linkage between countering/mitigating adversary action in the TAOR and the delivery of operations from any facility requires that the TAOR and base FP forces operating in the TAOR are under the Command and Control (C^2) of the individual responsible for delivering operations from the base.

It would be fair to say, that at least some of the current debate surrounding the provision of FP is being compounded by inter-component friction. The last sentence of the paragraph above, particularly in cases where the facility is *'owned and operated'* by a component other than Land usually forms the crux of any debate over the provision of FP for NATO fixed installations. Unfortunately, recent Joint operations have been Land-centric and Land has grown used to being the supported contingent. The fact is that as resources grow ever scarcer, we all need to be better at thinking and working Joint and be able to switch seamlessly from being supported to supporting.

Perhaps a sensitive issue but one which necessarily must be mentioned is that delivering FP, particularly outside the wire, is dangerous. The dichotomy particularly when applied to Air *(and perhaps in the future, Maritime?)* is that whilst nations might be willing to provide an air contribution, they will only do so if that contribution can operate from a safe and secure base location. However, taking the risks necessary to deliver that safe and secure base is not something they are politically or militarily prepared to do; again, it is *'someone else's'* problem.

So What?

Today's reality is that we are not correctly resourcing FP at a critical time; this article has offered a brief explanation as to why this might be. However, the truth is that we have so far been lucky. We need to acknowledge that in many cases FP will be a separate, discreet function that must be intelligence-led and is planned, controlled and delivered by personnel who understand its intricacies. The capabilities required to deliver FP effect will come from across the components and will be specific to the task in hand. Critically though, resources vital to the FP effort should not be able tow be re-prioritised to other tasks by anyone other than Joint Commander as it is only at this level where there will be the necessary understanding of the potential strategic impact of any failure in FP. Our adversary only has to be lucky once.

"Even if some threats are not present at the outset, there is a likelihood that they could materialise over time as an adversary evolves or the presence of NATO forces attracts threats from outside the theatre of operations in the shape of 'foreign fighters'."

The next part of this article will attempt to identify a MMR for FP against a set of NRF mission scenarios. If an MMR *can* be identified then perhaps nations can be persuaded to commit these capabilities ahead of time so that when the need to deploy the NRF arises, we can rest assured that at least it will have the minimum necessary level of FP. ●

1. Either internally or via external assistance visits.

Group Captain Jez Parkinson

joined the RAF in 1986 as a RAF Regiment Officer. He is currently serving at the Joint Air Power Competence Centre (JAPCC) at Kalkar in Germany in his third NATO appointment where he is employed as a Special Advisor to the Directorate. He has a broad background in Force Protection (FP) and has completed operational tours in the Middle East, the Balkans and Northern Ireland being awarded the NATO Meritorious Service Medal for his last deployment as the Deputy Commander of Kandahar Airfield responsible for FP. Amongst his many projects and responsibilities related to FP, he is the Officer with Principle Responsibility for the NATO FP Course, the author of both NATO FP Policy and NATO Doctrine for the Force Protection of Air Operations.

F-35, The Backbone of Next Generation NATO Operations

By the JAPCC Editorial Board

After years of turbulence, the F-35 together with other developments such as UAV's will redefine the application of Air Power for North Atlantic Treaty Organization (NATO) members. The program has progressed to such an extent that the fielding forces are preparing for operational capability. In June 2013, the United States Marine Corps and Air Force declared their intention to field early Initial Operational Capability with Block 2B software in 2015 and 2016 respectively. In support of the decision, General Amos, The Commandant of The Marine Corps, stated that it "will provide an airplane that will deliver more weapons, be more capable, be stealthier, have more capabilities, more information assurance, more information dominance, than anything we're flying today in the United States Marine Corps".

A History of the Program

To understand the F-35 as it exists today, it's valuable to examine the origins of the program. In the early 1990's, the United States Department of Defense launched a tri-service combat aircraft recapitalisation program called the Joint Strike Fighter (JSF). The intent of the program was to leverage recent major investments by the U.S. in technology, introduce true service interoperability and achieve economies of commonality and scale as legacy combat aircraft fleets were to be replaced. The ongoing U.S. National Security strategy to require coalition based operations had also revealed significant capability gaps between the equipment utilised by U.S. and allied air forces.

Component Commanders were impacted by these shortfalls and a decision was made to allow participation by selected allied nations in the development and procurement of the JSF. Seven additional NATO countries (U.K., Netherlands, Italy, Canada, Denmark, Norway, and Turkey) and key NATO partner Australia were asked by the U.S. to join the program following the contract award in October of 2001. These relationships were codified in formal bi-lateral Government to Government agreements for the initial stage.

The joint capability and industrial tenets established by the F-35 Program are a precursor to the Smart Defence Initiative embraced by the Alliance in 2012. From their public position on the topic, NATO has stated that "… the other Allies must reduce the gap with the U.S. by equipping themselves with capabilities that are deemed to be critical, deployable and sustainable, and must demonstrate political determination to achieve that goal. There must be equitable sharing of the defence burden. Smart defence is NATO's response to this." The world financial crisis since 2008 serves to reinforce the value, efficiency, and priority of the F-35 Program in executing this NATO initiative to confront crisis management in the immediate future.

The F-35 will allow other NATO Allies to close the current capability gap with the U.S. Based on the revolutionary introduction of stealth on the F-117 and the subsequent validation of its effectiveness in operations, the U.S. adopted a fighter procurement philosophy that is limited to stealth aircraft. The F-22 was the first platform to be developed under this precept and established the characteristics of a 5th generation aircraft: advanced stealth, integrated sensor fusion, network centric operations, fighter performance, and advanced sustainment. The F-35 capitalises on this investment, utilising many of the technologies created for the F-22 while improving upon them with a decade worth of lessons learned and advances in computing power. Unique structural design characteristics were optimised across three variants to allow the F-35 to operate from land bases, austere environments, and carriers. These design features enable the F-35 to meet requirements not found on any other fighter:

Go deep into a double digit Surface to Air Missile (SAM) threat environment to destroy moving and mobile targets through the weather while outnumbered by advanced fighters equipped with advanced air-to-air weapons. Perform the mission from any base and at a lower cost than legacy programs.

To achieve these goals, the F-35 program pursued a more highly integrated NATO industrial base to maximise the capabilities of the Alliance. The international design and manufacturing aspects of the program, however, diverge from traditional offset mentalities, which are in comparison inefficient, costly, and historically limited to only those airplanes being purchased by that specific nation. The F-35 program introduced a new economic model based on 'competitive best value' where industrial concerns in each of the partner countries were allowed to compete and win work on F-35. As long as competitive cost and quality standards are maintained, the industries of the partner nations are allowed to supply parts for each aircraft produced. Significant outreach work was done by the US industry team supported by the various US agencies to help align the world class capabilities of the NATO industrial base with JSF opportunities. All eight partner countries produced parts flown on the first test airplane and continue to produce components today.

Current Program Status

With the test fleet now surpassing 5,000 total flights, confidence in the maturity of the program is intensifying as the typical technical problems faced by a developmental program of this size have been resolved as they have arisen. While risk remains in the program, it is expected that emerging issues will continue to be solved as their predecessors were.

Significant numbers of aircraft have been produced as well. To date, 235 tails have either been delivered or are on order. The first partner country, the United Kingdom, is operating three training jets at Eglin Air Base. The second partner country, the Netherlands, has two aircraft flying that will be used for Operational Test & Evaluation. The common training facilities, established first at Eglin AFB and coming online at Luke

AFB in 2013, embody the principles of NATO's Connected Forces Initiative, providing "overarching collective training so that Allies can come together and be ready for any eventuality" and "better use of technology [as] a key means to facilitate the ability of Allied and partner forces to work together". By 2018, 416 F-35s are projected to be delivered to NATO countries with an estimated 49 aircraft operating in Europe.

Backbone of Next Generation NATO Operations

Eight of the nine F-35 partner nations are members of NATO and the aircraft will be the backbone of future air operations. The F-35 will provide capabilities throughout NATO that are currently uniquely held by the U.S. In Operations Allied Force, Enduring Freedom, Iraqi Freedom, and Operation Odyssey Dawn, the denied access missions were conducted by the U.S. stealth platforms F-117 and B-2. With the F-35, the ability to penetrate advanced enemy Integrated Air Defense Systems (IADS) will be extended to this core function of NATO.

The coalition force has additionally relied on the EA-18G Growlers of the United States Navy to provide Electronic Attack (EA) against the SAM systems. With the F-35, high gain EA missions can be executed by multiple nations with their indigenous capability. The possession of advanced stealth and EA by a large number of NATO countries will significantly increase the effectiveness of a coalition across a wide range of crisis management operations.

Unlike its 5th generation brethren, the F-22, the F-35 was designed from the outset to bring these capabilities while also being interoperable across a coalition of air power. Two networks are core to this operability: the Link-16 and the new Multi-Function Advanced Datalink (MADL). These data links will allow the F-35 to communicate with all current and future NATO assets. The Link-16 connection is currently utilised by the existing platforms fielded by NATO and will allow F-35 to integrate seamlessly into the coalition force structure. MADL will complement the current networks with NATO's first high bandwidth, low probability of detect and intercept connection. The fundamental design features of MADL will enable all NATO F-35s in a deployed coalition to communicate within an Anti-Access/Area Denial (A2AD) environment.

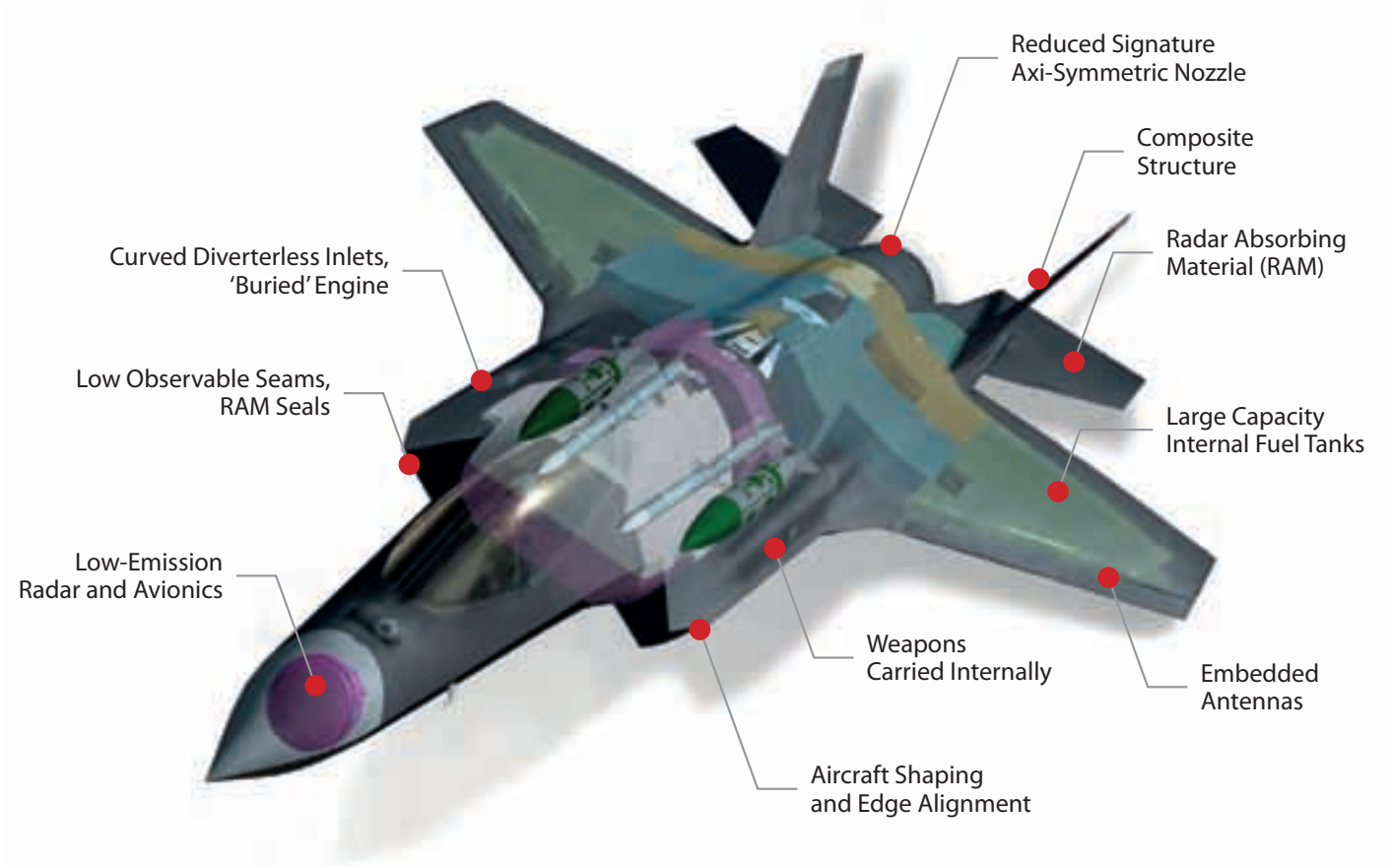
NATO operations in a permissive environment such as Afghanistan will see benefits as well from the addition of the F-35. With its impressive sensor suite, net centric design, and ability to carry more than 18,000 lbs of payload when loaded externally, the F-35 can be thought of as a 5th generation Strike Eagle: the advanced avionics of an F-22 combined with the range payload that nearly matches that of an F-15E. This allows the F-35 to shape a crisis throughout the conflict, beginning with the removal of the enemy IADS and continuing until the final day of sorties.

The Increasing Extant and Emerging Threat

Without the context of the current threat environment, it can be difficult to understand the necessity of the capabilities of the F-35. Reviewing Operation Unified Protector may be the best way to understand how the F-35 will change the way NATO confronts future challenges. In support of the rebels against Gaddafi's regime, NATO established a no-fly zone over the contested region and dramatically shifted the outcome of the nation. With only the application of airpower, NATO was able to manage the crisis without deploying large numbers of ground forces.

This relatively limited conflict required a force of greater than 160 tactical aircraft from thirteen coalition countries. The threat posed by the Libyan forces was predominantly equipment procured prior to the fall of the Berlin Wall: legacy SA-2, SA-3, SA-5, and SA-6 single digit SAM systems complimented by aging Mirage F1s, Mig-21s, and MiG-23s. The minimal threat posed by the regime in Libya will likely be encountered by NATO forces significantly less often in the future and replaced with advanced systems.

In both quantity and quality, highly advanced eastern threat systems have proliferated significantly in the world market. Today's SAM systems are built on digital,



networked sensors that can track hundreds of targets simultaneously. The engagement zone has been extended to distances exceeding 125 miles while attacking multiple targets simultaneously. Navalised versions of these same SAMs further extend the threat zone beyond the coast.

In the world fighter market, advanced 4th generation fighters are the minimal capability pursued by militaries and have become a commodity. Fighters containing electronically scanned radars, long range active missiles, infrared search and track sensors, and sophisticated jamming systems are now commonplace throughout the world. The resulting effectiveness of these threat fighters places NATO forces at parity.

The combination of advanced surface and air threats pose a real challenge to the ability of NATO's forces to provide sufficient conventional deterrence. The threat environment will continue to become more complex and advanced as Russia and China prepare to export multiple 5th Generation platforms products on the world market. When stealth air frames become the standard capability of the air forces of the world, the threat posed by foreign militaries will shift drastically upward.

The Next Crisis Management Scenario

Syria is a prime example of what NATO forces might face in the future. Political concerns aside, the defence capability of the established Syrian government dwarfs that of Libya in both quantity and quality. The Syrian airforce has 2.5 times the number of fighters that were seen in Libya, among them advanced MiG-29 fighters. These fighters have to defend a country that is 1/10th the size of Libya. In addition, other parties may decide to support Syria with additional aircraft to further strengthen their air force.

The Syrian fighters are supplemented by a robust, dense SAM network. Compared to Libya, the Syrian IADS has more than 4 times the number of missile launchers and a missile density almost fifty times greater than the previous operation. Recent purchases of tactical double digit SAMs have reinforced their defensive posture. The potential transfer of strategic double digit SAMs would further fortify this posture.

The aggregation of the number of threat systems and their innate quality complicates the ability of any coalition of (NATO) forces to establish a no-fly zone and deter the regime. It would likely require double

the number of assets deployed against Libya with no guarantee of success. This facet of the conflict has reduced the effectiveness of the political pressures. As advanced threat systems proliferate, conflicts in a high threat environment will likely become the rule instead of the exception.

The Longterm Modernisation of Crisis Management

The F-35 is not just set to reinvent airpower for NATO, it's positioned to have a strong presence in the force for at least the next thirty years. Designed with power and cooling capacity that far exceeds the aircraft that it will be replacing, the F-35 will continue to provide significant opportunities for capability growth throughout its life cycle. This capacity combined with the open architecture of the F-35 will enable rapid integration of future avionics and increases in computing power. Simultaneously, the lethality of the F-35 will be improved. An existing effort to increase the carriage of AIM-120s to six in the internal bay will allow the F-35 to further extend its dominance in air-air engagements. Longer term, the development of 5th generation weapons such as Cuda will create an unmatched combination of air vehicle and air-air missile. Originally unveiled at the Air Force Technology Expo in 2012, the medium range hit-to-kill missile will expand the beyond visual range engagement zone while more than doubling the internal capacity of the F-35. It is expected that kinematic weapons of today will give way to the directed energy (DE) weapons of tomorrow, first as a defensive mechanism before potentially growing into an offensive weapon. Again, the power and cooling capacity of the F-35 could enable this transition.

Conclusion

To enable NATO's essential purpose of safeguarding freedom, the members of the Alliance need to maintain a credible conventional deterrence capability. Currently, this capability is eroding due to the proliferation of advanced threats and is under increased pressure from the financial crisis. The procurement of F-35 will help to safeguard this aspect for NATO and ensure the viability of diplomatic efforts as the first measure to prevent future conflicts. Once established as the backbone of NATO airpower, the growth capabilities of the F-35 will ensure that this capability will not erode for years to come. ●

The JAPCC Editorial Board would like to thank various authors, who all contributed with their insight and expertise.

"The relevant challenge for us today is no longer the total level of defense spending by allies, but how these limited (and dwindling) resources are allocated and for what priorities." – U.S. Defense Secretary Robert M. Gates

Interoperability Through Innovation

By Commander Tim 'Fitz' Fitzpatrick, U.S. Navy, JAPCC

As the war in Afghanistan comes to its pre-planned conclusion after 13 years, nations will be faced with decisions that will shape the future of warfare. The probable reduction of defence spending over the next decade will undoubtedly affect force structures, emerging weapons systems and combat readiness. International resolve to work together, build capacity and educate leaders will be tested. Efficient and effective Air-Land integration and application of Joint Fires offer opportunities to achieve the greatest combat effectiveness while minimising risk to future NATO missions. Leaders must continue building upon existing relationships to strengthen partnerships while maintaining the resident knowledge and core competencies acquired over the last decade.

Today, NATO is striving to do more by pooling and sharing Member States' military capabilities. They are doing this by exploiting civilian-military synergies, taking advantage of economies of scale, avoiding duplication of efforts and encouraging specialisation. Pooling and sharing is designed to enhance the defence capabilities of Member States, individually and as a whole. Pooling and sharing military capabilities can be a sensitive exercise, but nations have recognised that it is better to have excellent collective capabilities than unsustainable or unattainable national ones.[1]

However, there is a tendency to focus only on the tangible pooling and sharing of physical hardware. Most importantly, NATO should look at the most valuable military asset of all – people and their ability to innovate and communicate.

Innovation

Imagine a world where aviators can fly with unlimited access to range space, without concern for the cost of

fuel or ordnance … can plan without concern for availability of red air or support strikers … can launch without concern for weather … and can operate without concern for maintenance issues and without concern for the possibility of a mishap. Does this sound too good to be true? Let me re-introduce you to the world of Modelling and Simulation (M&S).

The advancement of M&S is nothing short of phenomenal and is not just limited to aviation. NATO Forward Air Controllers (FACs) and Joint Terminal Attack Controllers (JTACs) can use M&S to train in virtual terrain with unlimited Close Air Support (CAS) assets. Warships can train in virtual oceans to practice navigation drills and war at sea exercises. Almost any training event across the Air, Sea and Land domains can be nearly replicated, augmented and/or enhanced by M&S.

Many would argue that M&S provides not only better training opportunities, more frequently, than live events it is also far more cost effective. Simulators offer an outstanding tool to introduce and refine processes and repetitive tasks especially when assets, ranges, logistics or funding is simply not available or too expensive. That being said, it must be acknowledged that simulators cannot replace the psychological and physiological factors associated with live flying or manoeuvring through the mud … yet. Aircrew and controllers must have the requisite hours in the air or on the ground to build confidence, experience and required skills to be credible leaders – there is no argument there. However, individual communities need to determine the proper balance between performing live events and training which can be augmented and/or replaced by the virtual world. The Joint Fire Support Executive Steering Committee has, for example, accredited simulators that *can* replace Type I, II & III CAS live controls to include day/night and laser target designation. However, nations need to have a solid understanding of the M&S architecture to fully take advantage of the available benefits.

Architecture

There was always the kid down the block who had the latest and greatest in video gaming systems. Today's frontrunners include the Nintendo Wii, Sony Playstation 3 and Microsoft Xbox 360 systems; I know because my 9 year old son will ask for his requisite allotment of gaming time on a daily basis. Imagine the anguish and frustration if I gave him an Xbox 360 game for his Nintendo Wii gaming system – pretty obvious right? The virtual game (the data architecture) needs to match; otherwise he doesn't get to play. Such is also the case with the M&S architecture as it applies to Distributed Mission Operations (DMO).

Some examples of available M&S architectures include:

Distributed Interactive Simulation is an IEEE standard for conducting real-time platform-level wargaming across multiple host computers and is used worldwide.

High-level Architecture is a general purpose architecture for distributed computer simulation systems. Using High-level Architecture (HLA), computer simulations can interact (that is, to communicate data, and to synchronise actions) with other computer simulations regardless of the computing platforms.

Test and Training Enabling Architecture is designed to promote integrated testing and simulation-based acquisition through the use of a large-scale, distributed, real-time synthetic environment, which integrates testing, training, simulation, and high-performance computing technologies, distributed across many facilities, using a common architecture.

Understanding the type of architecture required *and that* other potential partners *have* is vital in accomplishing successful DMO. Simulators must have the capability to link with other simulators around the world to "train like they fight". With different architectures, inter-service and international engagement is more challenging and may even be cost or time prohibitive depending on the desired participants. Gateway systems are available to permit communication between dissimilar architectures (at additional cost) in order to link simulators together with the assistance of Distributed Mission Operations Centres (DMOC). However, depending on the system purchased, compatibility may be also an issue. It is also imperative that the presented virtual world (graphics), geo-reference grids and clocks are synonymous to enable system integration. Differences in classification levels will also be an ongoing challenge.

Testing and training activities are increasingly composed of Live, Virtual, and Constructive (LVC) distributed simulations and applications. 'LVC' refers to the combination of three types of distributed simulations and applications into a single distributed system:

· Live – real, physical assets, including soldiers, aircraft, tanks, ships, and weapon systems.
· Virtual – simulators of physical assets that provide real-world operator interfaces and humans in the loop, such as aircraft simulators, tank simulators, etc.
· Constructive – pure simulations either controlled by human beings (called 'semiautomated forces'), or run entirely without human intervention (called 'closed simulations').

It is feasible today to link virtual aircraft with other virtual aircraft around the world. It is also possible to link live aircraft with virtual aircraft and a Joint Terminal Attack Controller (JTAC) operating in a virtual ground environment with virtual or live aircraft. *Virtual Flag*, for example, is a real-time tactical-to-operational level event using air, land, space, cyber and maritime distributed scenarios to integrate LVC simulations and train warfighters in robust combat scenarios. Joint and coalition combat platforms are integrated from DMOC-based and worldwide-distributed operational sites. Virtual Flag is a quarterly joint DMO exercise integrating more than 600 joint warfighters sponsored by Commander, Air Combat Command in the United States.[2]

Help Desk

It is imperative that services (and nations) understand the baseline interoperability requirements and preferred standards. Fortunately there is help out there. Organisations such as the European Training and Simulation Association and the National Training and Simulation Association in the United States enable its members to learn, engage and interact with respective training, M&S communities. Another relevant organisation is the Simulation Interoperability Standards Organization, whose mission is to "develop, manage, maintain and promulgate user-driven Modelling and Simulation (M&S) standards that improve the technical quality and cost efficiency of M&S implementations across the world-wide community." There are two annual events that highlight the latest in technology and Innovation in the field of M&S. The Inter-service/Industry Training, Simulation and Education Conference held annually in Orlando, Florida and ITEC planned in Cologne, Germany in 2014. Both forums connect representatives from the military, industry

and academia and allow them to share knowledge regarding international training, education and simulation sectors.

Established organisations that have a training focus with M&S like the Air Battlespace Training Centre (ABTC) at RAF Waddington, England are an excellent source of knowledge. The ABTC has "active links with similar organisations overseas and maintains a prominent role in synthetic training research activity."

Interoperability Opportunities

It is critical in the years ahead that services do not abandon what it means to operate jointly. On a larger scale we must not abandon coalition and international military engagement. Termination of combat operations in Afghanistan enables nations to redistribute the talents and expertise of their personnel to schoolhouses and training centres while focusing on future technologies. National Joint Air Land Organizations (JALO) or Air Ground Operation Schools (AGOS) exist in many countries to teach Tactics, Techniques and Procedures (TTPs) and to qualify operators. M&S offers a tremendous opportunity to create an enduring framework of international partners working together to exercise and develop both tactical and operational capabilities. *The simulators procured today will affect the ability to train and integrate with other nations in the future.*

"With M&S there is a lot of value with little risk only limited by our ability and willingness to work together."

We also have an opportunity within the new NATO Command Structure (NCS) and through NATO Centres Of Excellence (COEs) to support the intelligent and effective use of M&S within NATO.

"Centres Of Excellence are nationally or multi-nationally funded institutions that train and educate leaders and specialists from NATO member and partner countries, assist in doctrine development, identify lessons learned, improve interoperability and test and validate concepts through experimentation. They offer recognised expertise and experience that benefits the Alliance and supports the transformation of NATO, while avoiding duplication of assets, resources and capabilities already present within the NATO command structure."[3]

NATO has an accredited air focused COE with the Joint Air Power Competence Centre (JAPCC) in Kalkar, Germany and an accredited maritime focused COE with the Combined Joint Operations from the Sea, in Norfolk, USA. There is even a NATO M&S COE located in Rome, Italy. However, a multinational COE currently does not exist in support of land focused requirements. Today, individual national AGOS and JALO struggle to meet staff manpower and training requirements as they duplicate effort on similar programs around the world as signatories of the exact same NATO Standardization Agreements and Joint Memorandums of Agreements that guide their Education and Training programs.

An International Joint Fires Centre Of Excellence (JFCOE) supporting land focused requirements, would enhance Joint Fires focused M&S activity and engagement. A recommendation – unlike current COEs which operate outside of the NCS, would be to operate the conceptual JFCOE *within* the NCS in order to gain and maintain the pulse of current operations and community challenges. To operate within the NCS would require NATO to relook its Training Directive specific to JTAC training, but it is worth the time and investment to capitalise on synergies between services and nations.

An opportunity exists to fuse the Warrior Preparation Centre, United States Air Forces in Europe (USAFE) AGOS and FAC Capabilities Section all collocated in and around Ramstein, Germany. A multi-national JFCOE would have a collective responsibility for overseeing Education and Training programs of FACs, JTACs, Joint Fires Observers and Forward Air Controllers Airborne (FAC(A)s). The proposed JFCOE could bring Joint Fires employment and development experts at the international level together and foster collaborative efforts to evaluate and train the warfighter. Up to date TTPs and best practices could also be passed expeditiously to the warfighter to be later

captured in Standardization Agreements & Memorandums of Understanding. The JFCOE could also be a central hub for the coordination and awareness of national and international Joint Fires operational and tactical exercises, something that does not exist anywhere today. Of current significance, the USAFE AGOS intends to transition its schoolhouse to a multinational organisation that shares a combined vision that will better support regional training requirements and is currently offering instructor FAC/JTAC Voluntary National Contribution billets.[4] The USAFE AGOS would then be staffed similar to other Memorandum of Understanding based organisations like the Tactical Leadership Programme out of Albacete, Spain or EuroNATO Joint Jet Pilot Training Program out of Sheppard Air Force Base in Texas, the world's only multi-nationally manned and managed flying training program chartered to produce combat pilots for NATO.

Conclusion

Commitment at the operational and tactical level accompanied with determination to work through traditional barriers to international cooperation such as language and access will improve our collective readiness in a tangible way. With M&S there is a lot of value with little risk only limited by our ability and willingness to work together. M&S is important across NATO but can be vital to the Joint Fires community. The NATO Joint Fires community also needs a JFCOE to advocate a unified and standardised position in order to facilitate required standardisation and interoperability. ●

1. 'Enhancing Defense Capabilities', eufocus, May 2012.
2. http://www.505ccw.acc.af.mil/shared/media/document/AFD-130611-014.pdf
3. http://www.nato.int/cps/en/natolive/topics_68372.htm
4. USAFE-AFAFRICAICC, Request for NATO Support of the USAFE Air Ground Operations School (AGOS), 28 May 2013.

Commander Tim 'Fitz' Fitzpatrick

is currently assigned to the Combat Air Branch at the Joint Air Power Competence Centre in Kalkar, Germany as the Maritime, Carrier Ops and FAC(A) Subject Matter Expert. Commander Fitzpatrick is an F-14 Tomcat Naval Flight Officer and a 21 year veteran of the United States Navy, having flown over 2500 hours and 80 combat missions. Commander Fitzpatrick is a graduate of the US Naval Fighter Weapons School (TopGun) and served as a Strike Fighter Weapons Tactics Instructor, Forward Air Controller Airborne Instructor and Carrier Airwing Strike Lead for US Naval Air Forces, Atlantic Fleet.
Email: Fitzpatrick@japcc.org

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JAPCC Hosts Tactics, Techniques and Procedures Workshop

At the request of Allied Command Transformation (ACT), the JAPCC hosted the Joint ISR Tactics, Techniques and Procedures (TTPs) workshop in April. Eleven nations were represented, including staff Officers from HQ ISAF in Kabul. The overall goal of the workshop was to develop NATO Joint ISR proposals based on the knowledge and experience of representatives from Allied Command Operations (ACO), ACT and nations, as well as from the Multi-sensor Aerospace-ground Joint ISR Interoperability Coalition (MAJIIC) multinational project. The proposals were then to be recorded in a draft Joint ISR related procedures document. This document provides commanders, planners and intelligence staffs, and Joint ISR system operators with TTPs concentrating on Joint ISR processes that provide support to commander's Situational Awareness (SA), in addition to supporting the full complement of operations. The primary focus of this TTP document will be the Joint ISR core activities that support all phases of the intelligence cycle: direct, collect, process, and disseminate that includes ground, maritime and aerospace ISR. It also considers the contributions by sensors or agencies that collect the aforementioned data and information products, and the processing and dissemination of the resulting Joint ISR products. In order to fine-tune the TTP development process, the workshop participants reviewed and integrated the Joint ISR lessons learned from the recent operations in Afghanistan and Libya. The team also investigated the concepts related to the integration of C^2 and Joint ISR processes. In parallel, the workshop reviewed the current NATO Joint ISR Doctrine as it relates to emerging Network Enabled Capabilities. ●

"… to fine-tune the TTP development process, the workshop participants reviewed and integrated the Joint ISR lessons learned from the recent operations in Afghanistan and Libya."

JAPCC Hosts the NATO Air Operations Working Group (AOWG)

Over the period 16–17 April 13, the JAPCC hosted the AOWG. The JAPCC has held the Chairmanship of this Working Group which sits under the Military Committee Air Standardisation Board (MCASB), for a number of years. For the last 3-years the Chairman's appointment has been filled by the JAPCC Liaison Officer to Allied Command Transformation (ACT), Col Konrad Waßmann, DEU AF, but this latest meeting was the first to be chaired by Air Cdre Tom de Bok, NLD AF, the JAPCC's Assistant Director of Transformation (ADT).

The MCASB as a delegated tasking authority is a decision-making body that meets 4-times per year to provide guidance and review results of its Working Groups. While Working Groups are open to Partnership for Peace (PfP) countries, the MCASB itself is limited to NATO nations (Belgium represents Luxembourg and Iceland does not participate). Most MCASB representatives are members of their National Military Representation to NATO in Brussels.

The AOWG is established to improve interoperability among war-fighters to engage in tactical air operations and thereby achieve total force capability using common doctrine and procedures. The Working Group includes Command and Control, Counter Air Operations, Air Interdiction and Close Air Support, Air Support to Maritime Operations, Supporting Air Operations and Airspace Control Management. As a parent Working Group, the AOWG is also charged with improving the effectiveness of NATO forces by developing standardisation agreements and addressing interoperability with respect to Joint Identification, Air Information Exchange Requirements and Unmanned Aerial Vehicles.

Thirty delegates attended the meeting, representing 13 NATO Nations (CAN, CZE, DNK, FRA, DEU, GRC, ITA, NLD, ROU, ESP TUR, GBR and USA); 3 NATO Commands/COEs (SHAPE, MARCOM and JAPCC), and 2 Partner Nations (CHE and NZL). The 13 NATO nations represented at the 36th meeting of the AOWG represented an increase of 4 nations from the 35th meeting last year; this increase of attendance is encouraging. After a formal request to attend, it was pleasing to see a representative from Allied Command Operations in attendance. A proper level of participation by the nations and from NATO bodies is critical to maintaining the work of the AOWG. The AOWG's ability to be responsive to the war fighter's needs by seeking to capture the appropriate lessons from current operations and develop them so that they mature into effective and useable doctrine is the Working Group's Main Effort for the future.

At this latest meeting of the AOWG, it was agreed that as the Working Group moves forward it would meet every six months each April and each October. Establishing a six-month battle rhythm (vice only meeting annually) will enable Air Doctrine Development to be more responsive to the needs of the war-fighter and overcome challenges much more quickly. It was also agreed that the meeting and its agenda would no longer reflect separate syndicates for doctrine and terminology and in the future these topics will be addressed in series via a full plenary of attendees.


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The Joint Capabilities Group Unmanned Aircraft Systems Operational Syndicate (JCGUAS OS) and the Senior Air Information Exchange Requirements Panel (SAIERP) were each scheduled to meet prior to the 36th meeting of the AOWG. Unfortunately, due to national funding issues, both of these meetings were postponed. The entire portfolio of the AOWG is reliant upon the active participation of national Subject Matter Experts (SMEs). In this regard, the JAPCC would seek to encourage nations to look favourably when considering funding requests to allow the participation of SMEs in either the AOWG itself or its subordinate working bodies; only by having this participation can current and future challenges be effectively addressed.

The AOWG covered a multitude of issues over 15 agenda items and a full Record of Decisions can be accessed on the NATO Standardization Agency (NSA) Website which itself can be accessed via the Internet (www.nsa.nato.int).

In delivering robust Chairmanship and actively participating with SMEs as necessary, the JAPCC's goal is the production of documents that are practical, usable and coherent with what we as an Alliance stand for. The JAPCC will remain vigilant to insure that the Doctrine and other procedures developed by the AOWG are implementable at the national level; always bearing in mind that the work that is done by the Working Group is to support the war-fighter during a mission.

The JAPCC will again host the next AOWG which will take place in Kalkar 29–30 October 13 and nations and NATO bodies are actively encouraged to participate.

Joint Optic Windmill – Air and Missile Defence Exercise

From May 27th till June 7th 2013, the Royal Netherlands Air Force (RNLAF) organised the Air and Missile Defence (AMD) exercise Joint Optic Windmill (JPOW)/ Joint Project Alliance (JPOA) 13. The exercise was conducted at the Lt Gen Best Barracks (formerly known as Airbase De Peel) in The Netherlands and from several dispersed locations such as Ramstein (DEU), Holzdorf (DEU), Biscarosse (FRA) and El Paso (USA). The RNLAF has been organising this unique exercise for over a decade now, together with its international partners. JPOW was organised for the first time in 1996 by the RNLAF based on the Missile Defence experiences gained during their deployments to Turkey and Israel in 1991. JPOW provides all the participants the opportunity to develop, exercise and train in a layered architecture. One of the outcomes of previous JPOWs was the prototype of the Ballistic Missile Defence Operation Centre (BMDOC), which today is leading the Standing NATO BMD organisation and commanding Active Fence Units in Turkey. The real-time commitments of the American, German and Dutch Patriot Units and the involvement of NATO and the Extended Air Defence Task Force (EADTF) in Operation Active Fence in Turkey unfortunately forced the RNLAF to adjust the level of ambition and goals for this year's edition. Despite the challenges the 2013 edition was a great success. For the past several years the JAPCC has supported JPOW/JPOA. This year the JAPCC contributed four persons to the exercise including the JAPCC Assistant Director, Air Commodore Tom de Bok, filling the role of Exercise Director. ●

Steadfast Jazz, The NRF Certification of JFC Brunssum

The JAPCC recently had the opportunity to support the Joint Warfare Centre (JWC) Observation and Training (O&T) teams in Brunssum, Netherlands and Ramstein, Germany during the planning phase of Exercise Steadfast Jazz (SFJZ), which ran from 9 May to 23 May 2013.

The Steadfast series of exercises are the NATO Reaction Force (NRF) certification exercises for NATO HQs. SFJZ consists of both a planning and an execution phase. The planning for SFJZ is performed at several levels. Three levels of planning are required within the planning phase: Strategic planning takes place at SHAPE's Comprehensive Crisis and Operations Management Centre (CCOMC), operational planning is conducted at Joint Force Command Brunssum (JFCBS) and tactical planning is organised at the component level. JFCBS formed an Operational Level Planning Group (OLPG) in line with the Comprehensive Operations Planning Directive V2 (draft). Just like planning, exercise execution will also be conducted at all levels in an effort to exercise the smooth joint operation of NATO HQs. The execution phase will take place over the course of several weeks in November 2013 utilising several deployed and fixed locations with the expectation that JFCBS will deploy its HQ to Riga, Lithuania.

JFCBS will act as the Joint Task Force Command in case the NRF is activated in 2014. Besides JFCBS, HQ AIRCOM (Ramstein) with their Joint Force Air Component (JFAC), Italian Maritime Command (ITMARFOR Taranto), French Land Command (LCC Lille) and NATO Special Forces Command (SHAPE-NATO SOC) are all under review for certification. The certification process itself is conducted by the SHAPE J7 division employing augmented manpower support, while at the same time the JWC will assist units with an O&T team which will include embedded JAPCC personnel. Finally, all HQ Commanders will be supported by senior mentors, comprised primarily of retired general officers possessing the relevant experience required.

Planning is an essential and integral part of any operation and therefore a critical phase toward becoming certified for NRF. For that reason, Air, Land, Maritime and SOF Operations Planning Groups (AOPG, OLPG,

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MOPG, SOPG) were formed at the component level. During the OLPG sessions, JFCBS prepared itself as thoroughly as possible for the execution phase of the exercise in November 2013. Besides internal planning for operational issues, intense coordination was performed between the OLPG members, OLPG leadership and the Liaison Officers that were sent to JFCBS by the components. This close cooperation gave each respective level the opportunity to develop a unified Operation Plan (OPLAN) in which all aspects of the future operation will be covered. This OPLAN becomes the overall document on which the execution phase of SFJZ will be based. Every component will consequently develop a Supporting Plan (SUPLAN) based on the OPLAN which provides more detail to component unique operations.

The planning phase revealed some very interesting observations. Some were interesting, because of the SKOLKAN scenario that is used, posing unique challenges based on the lack of experience within the Training Audience (and all NATO for that matter) pursuant to a NATO Article 5 situation. Other observations were related to the complex matter called the Operational Planning Process (OPP) and the fact that NATO in general lacks experienced planners at all levels. Again it was obvious that there is high value in the planning effort for these large scale exercises, even though they are mostly computer based in the execution phase. It is important to note, these planning groups show a very steep learning curve for all actively participating HQ personnel. Unfortunately, due to the relatively short tours of personnel in NATO HQs and the very few opportunities available to focus on planning activities, the level and quality of planning experience never reaches its full potential. Therefore, it is likely to remain a big challenge to find highly trained HQ personnel readily available to plan an operation if needed (quickly).

Exercises like the Steadfast series are unique events to train HQs at all levels of operational planning based on comprehensive collaboration efforts. Real world lessons learned during Operation Enduring Freedom (OUP), the observations seen during SFJZ and the focus of JAPCC on Education and Training of the NATO JFAC ensure the JAPCC remains focussed on providing its expertise and its assistance to NATO HQs in their planning and operations execution efforts. To further this effort, the JAPCC looks forward to sending members of its staff to the execution phase of SFJZ to be part of the JWC O&T team with a focus on both the joint level and the AIRCOM JFAC level. ●

Journal Survey

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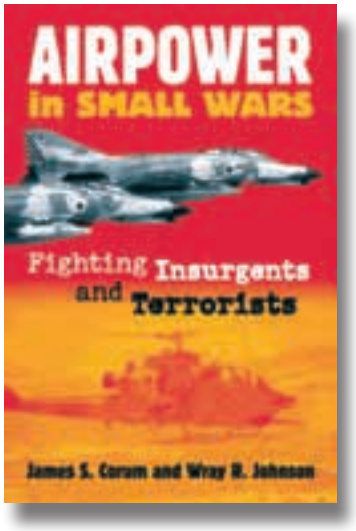
‘Airpower in Small Wars’



By James S. Corum, Wray R. Johnson
University Press of Kansas, 2003
Reviewed by:
Col Bernard M. Willi, USA AF, JAPCC

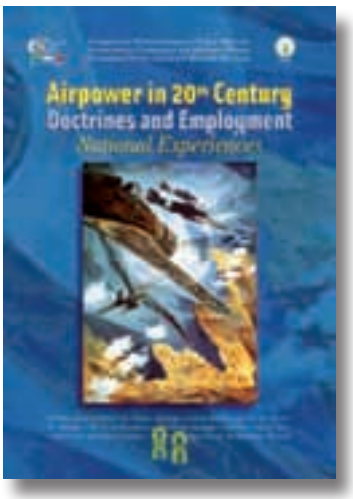
Given there is so little written on the topic of airpower and its use in counter-insurgency, ‘Airpower in Small Wars’ is an important book for military theorists who may not be familiar with the contributions that airpower can have on a national counter-insurgency strategy. The book uses a chronologic perspective from the birth of military aviation to the most recent small scale conflicts. It analyses the impact airpower has had on selected small wars from the point of view of both the insurgents and the ruling power. Although this is a book about airpower, the authors James Corum and Wray Johnson provide enough basic background on the conflict being discussed to set the foundation for the dialogue of airpower’s influence on that particular war. This made the book a very interesting read as well as a good source of general information on what many may consider obscure 20th Century insurgencies. For me, one of the highlights of the book was the section entitled ‘Intervention in the Middle East’. In it, the impact of the modern day media’s depiction of the effects of airpower as indiscriminate and disproportionate was discussed and how this negative portrayal can diminish airpower as effectively as a robust enemy air defence system. Some may argue that the authors’ political biases colour some sections of this book but as a whole I found the book to be not only informative but very thought-provoking as well.

‘Airpower in 20th Century – Doctrines and Employment, National Experiences’

Airpower in 20th Century, Doctrine and Employment, National Experiences, comprises 19 articles articulating the use of the Airpower during the course of the last century. Representatives from both the Military and Academia researched doctrine, capacities, technologies and the operational environment relating to the employment of the Air Power without falling into the trap of documenting history from the perspective of the winners.

This volume encapsulates, for example, the experiences of the Royal Netherlands Air Force tracing their historical progress from a modest colonial air power to a modern, flexible and expeditionary service. In stark contrast to this stands *U.S. Air Force Doctrine: The Search for Decisive Effect*, which identifies the doctrine adopted, and analyses the reasons for its use, by the U.S. Air Force during armed interventions from 1917 until the present. The British contribution reassesses the political and economic impact on airpower in the period immediately prior to World War II and the influence of the Italian Air Power strategist General Douhet on Royal Air Force thinking of the time. The article does make clear that the RAF has, throughout history and to varying degrees, influenced many air forces, including the Italian Air Force.

This collection varies in the scope and depth of its material ranging from the general perspective on Air Power doctrine to more specific military campaigns with a particular significance and detail. Written in different languages it serves not only as a useful historical reference but contains a wealth of diverse ideas to stimulate current thought and debate in an uncertain future.



Commissioned by ICMH, 2011
Reviewed by:
CMS Gaetano Pasqua, ITA AF, JAPCC

THE VALUE OF UNITING AS A GLOBAL TEAM TO DELIVER NATO'S NEW JOINT ISR CAPABILITY.

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