Transforming Joint Air Power
The Journal of the JAPCC

Edition 10

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Editorial

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We encourage comments on the articles in order to promote discussion concerning Air and Space Power inside NATO's Joint Air community. All comments should be sent to articles@japcc.de

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The Journal of the JAPCC,
Roemerstrasse 140, D-47546 Kalkar Germany

To conquer the command of the air means victory; to be beaten in the air means defeat.

General Giulio Douhet, 1921

Whilst I am sure this edition provides something for all those with an interest in Air and Space matters, it unashamedly focuses on the challenge first articulated by Gen Douhet of assuring access to our environment and the perils of failing in that fundamental task.

Indeed, NATO's burgeoning expeditionary posture makes it evermore critical that we can manoeuvre freely in the 3rd dimension. Air & Space provides a vital line of communication for both the movement of materiel and information and, therefore, must be protected if we are to even reach the starting line in fulfilling our goals. But it doesn't end there – countless operations have highlighted the advantages of dominating the Air environment and, as a number of articles in this edition point out, Space is rapidly reaching, if not already at, a similar point.

We are also discovering in contemporary operations that creating a favourable situation in the Air doesn't end with driving competitors from the sky. With that in mind, I am most grateful to a number of authors for looking at this issue through a wider lens; the articles on Air Basing, Air and CIMIC and Air Law all add to what is a most timely dialogue.

I am pleased to reintroduce our "Chiefs' Perspective" series and am grateful to Gen Tömböl for providing his views on the challenges faced by both Hungary and its Air Force. Elsewhere, we have provided a long overdue insight into AAR initiatives, along with a challenge from Maj Gen Schmidt, Commander NAEWF, to look long and hard at how we utilise the new possibilities embedded on that long standing co-operative venture. Following on from this, I commend to you the 'Out of the Box' article, which builds on our last edition and provides genuine food for thought on how we ensure we get the very best from all NATO common ventures in the future.

All these subjects will be on the table at the upcoming JAPCC Annual Conference, 13–15 Oct 09. I hope to see you there!

Garfield Porter
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Transforming Joint Air Power:
The Journal of the JAPCC

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The Journal of the JAPCC

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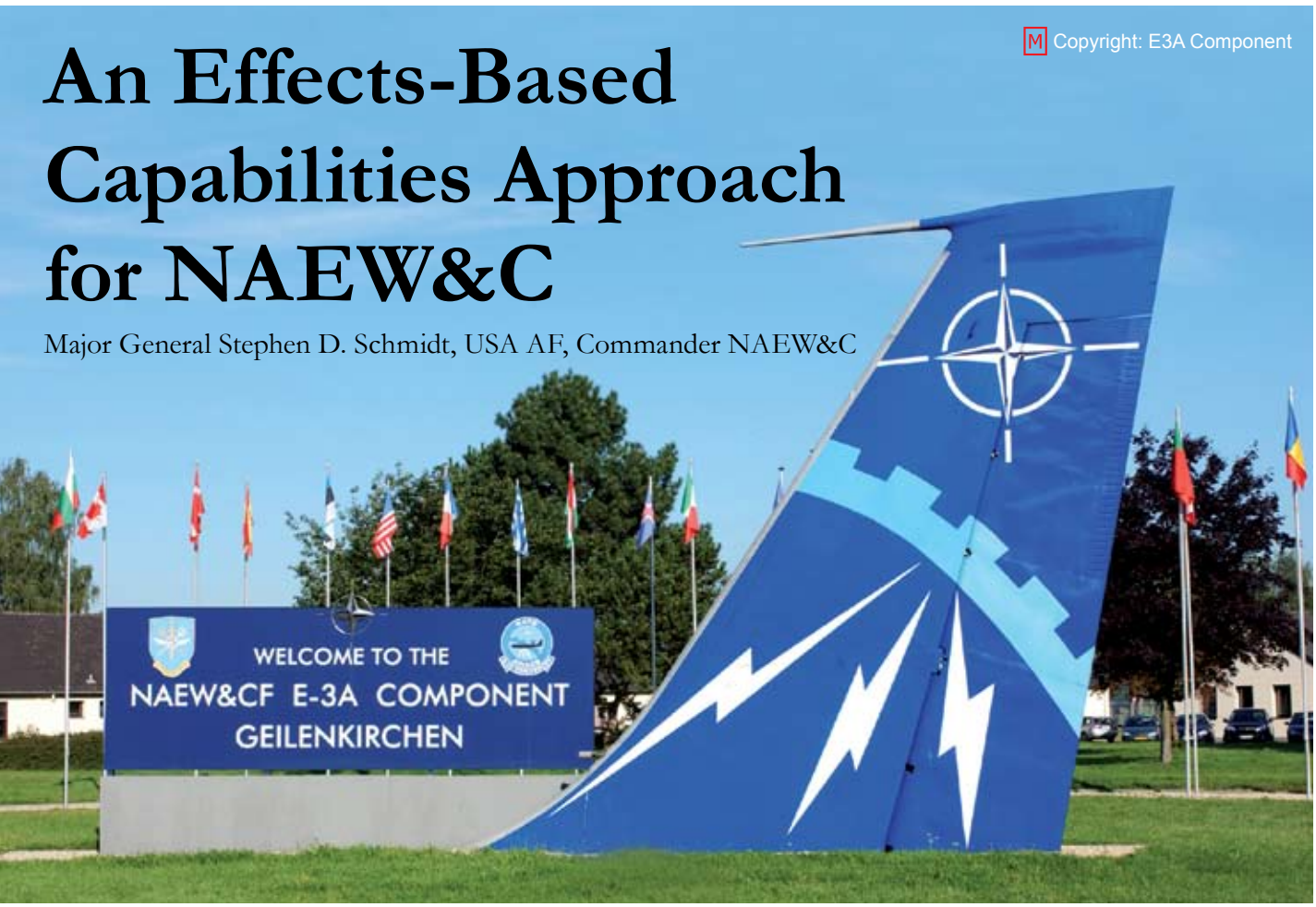
An Effects-Based Capabilities Approach for NAEW&C

Major General Stephen D. Schmidt, USA AF, Commander NAEW&C



Foreword by SACEUR …

… Our NATO AEW Force is the premier air early warning capability in the world. Major General Schmidt is right to focus on its real world applicability in both the maritime and warfare domain. As our NATO AWACS Commander, he is uniquely positioned to discuss these key issues in this issue of the Journal of the JAPCC.

Adm James G. Stavridis

The NATO Alliance recently fielded the most capable Airborne Early Warning (AEW) system in the world. The latest upgrade of E-3A mission systems, designated NATO-Mid Term (NMT), will reach full operational capability in early 2010. This all-digital upgrade lays the foundation for multi-user integration that could provide NMT effects across NATO's emerging networked force. But the Alliance must take a much broader capabilities-based approach to achieve real networked effects. It will require innovation and aggressive analysis on how best to use NMT to fully leverage its networked capabilities in providing optimised Air Battle Management (ABM) and Joint Intelligence, Reconnaissance and Surveillance (JISR).

Developing Capabilities

Equipped with long-range air and maritime surveillance radars, robust communications, multiple tactical data links (TDLs), and key ABM capabilities, NAEW is a formidable force enabler for a wide range of joint operations. The early NAEW surveillance mission in the 1980s has dramatically evolved from Cold War warning and control – using only radar and radios. The mission expanded into integration and execution of Air Tasking Orders (ATOs) in the Balkans during the 1990s. By the time of ALLIED FORCE in 1999, NAEW was at the center of a large, multi-national force executing ATOs and conducting ABM while controlling hundreds of air assets.

Just a few years ago, General Ronald E. Keys, a former USAF Commander of Air Combat Command, succinctly outlined these major AWACS mission changes:

When the E-3 started, it was purely an additive to our capability to conduct air defense. It would go out and point the fighters in the right direction. Now it can do so much more. The E-3 is becoming a gateway. It's not only a command and control aircraft but also a gateway to process information and send it to the larger force.

Today that gateway is a reality with NMT's digital transformation of NAEW's mission and communications systems. NMT's off-the-shelf, open system

architecture gives it a plug-and-play capability much like the software applications used on a desktop. The one major remaining NMT requirement is for NAEW to field the Internet Protocol-based (IP) communications needed to fully link it to other NATO networked platforms and sensors.

Not the 'Son of AWACS'

But NMT is not the 'son of AWACS' … it's a network game changer. Technologically, NMT is capable of performing much wider ABM and even JISR roles like no other AWACS. It's an Alliance enabler that NATO must fully leverage to exploit its comparative digital advantage.

With NMT comes the 'digital backbone' needed to act as a key node for emerging NATO Networked Enabled Capabilities (NNEC). The upgraded NMT main computer already processes IP-based digital information, much like any wireless device. All NMT needs now is connection to NATO's networks so it can more effectively leverage effects-based opportunities. These IP-based communication enhancements are already in the works and, once in place, they will significantly improve NAEW's ability to receive and process imagery for targeting tasks, increase numbers of targets managed, improve the speed of time-sensitive targeting, reduce the risk of error (fratricide), and improve NMT's overall effectiveness in conducting full spectrum ABM. If NATO gets this right, the NE-3A will evolve into a genuine, network-enabled, multi-mission system.

Effects are Not Platform Specific

Paradigms create mindsets that filter data. Using old AWACS paradigms in today's battlefield only creates boundaries that restrict operations. Commanders in ISAF need more command and control, battle management and situational awareness. Every commander needs more ISR. But AWACS is not what commanders ask for in many cases (despite NMT's new capabilities) because AWACS' reputation is still based on its historic radar and radios paradigm.

In the emerging era of networked operations, NATO cannot continue to solely design capabilities based on Minimum Military Requirements (MMRs) compatible only with one platform or system. Effects are no longer platform or system specific. NATO cannot afford MMRs that generate costly modifications and only work in the back of an AWACS. Instead, NATO needs to take a broader systems approach towards NAEW that looks at what new capabilities are required across the networked force. Commanders require capabilities that produce air, ground, maritime, and networked effects, not just AWACS effects.

An Effects-Based Capabilities Approach

NAEW must be all-net capable; integrated networked effects are only achievable if their contribution is captured, along with other assets, in a holistic approach. A digital system that only works onboard AWACS merely generates another NAEW stovepipe. Such stovepipes sub-optimise NMT's unique and substantial processing capabilities that could better support users across the entire battle space. A true effects-based approach means no more stand alone digital stovepipes.

The mission of NATO AWACS is no longer solely about warning and control. Today, AWACS provides surveillance in a Recognised Air Picture primarily transmitted through TDLs using Link-16. This TDL air picture is only available to a limited number of users, who are in range and capable of receiving point-to-point, encrypted data links. But NMT's state-of-the-art computer mainframe and air picture is compatible and potentially available for use by multiple new dispersed operators through IP-based communication links. With its commercial-off-the-shelf computer processing up to three million lines of software code a minute, NMT has the potential to produce, share and leverage digital capabilities with multiple networked users. Theoretically, anything that runs on a desktop could also run on NMT – all that's needed is to connect NMT with an IP-based network.

> 'By using EBCA in the future, NAEW surveillance and reconnaissance could become a multi-mission, network-centric collection and dissemination platform able to maximise effects across a joint battle space.'

Besides multiple network users being able to exploit NMT's ABM capabilities, NMT's on-board operators will also be able to pull in data from other sensors to provide on-orbit JISR capabilities never before possible on an AWACS. As NATO fields the new Alliance Ground Surveillance Block 40 Global Hawk unmanned aerial systems (UAS), NMT operators with the right satellite bandwidth could perform on-board ISR processing and analysis much like US JSTARS' crewmembers do today. Shared access could also provide relevant digital information to remote networked users, who could then turn it into actionable intelligence.

In broad terms, all new NATO capabilities must produce effects leveraged across its networks. To prevent sub-optimisation, an effects-based capabilities approach (EBCA) is needed to ensure new systems are designed with wide network compatibility from the start. By using EBCA in the future, NAEW surveillance and reconnaissance could become a multi-mission, network-centric collection and dissemination platform able to maximise effects across a joint battle space.

ISAF Support

The employment of NAEW&C in support of ISAF operations was recently approved by the North Atlantic Council. The Force will deploy outside of NATO to support this important international mission as soon as a basing agreement is finalised. With its ability to conduct wide area surveillance, NAEW will significantly contribute to increased air traffic de-confliction and safety in Afghanistan. It will provide a real-time air picture, improved communications and situational awareness, and give ISAF a better ability to react quickly in this very dynamic air environment. NAEW also recently fielded an IP-based messaging system, known as 'chat,' to exchange text and share data for better ISAF C2 integration. The Force will also soon pursue a NATO Friendly Force Information capability using AWACS data links to better detect, track and monitor

NMT will produce, share and leverage digital capabilities with multiple networked users.

friendly forces and reduce the risk of fratricide. NATO needs this key NAEW&C force enabler deployed in support of ISAF as soon as possible.

Emerging Counter-Piracy Role

Although primarily known for its air surveillance, the E-3 also has a long-range maritime surveillance radar that can effectively complement Maritime Patrol Aircraft in counter-piracy (CP) operations. Automatic Identification System (AIS) signals are now internationally required for many ships, so NAEW has also added new receivers to identify and correlate these additional AIS tracks and potentially include them in its maritime recognised surface picture (RSP). Any radar surface track identified that is not also transmitting an AIS signal can thus be investigated as a potential threat. Other unusual behavior, like a ship closing fast on a recognised track could also be immediately reported. The RSP is transmitted simultaneously to NATO and other international forces by Link-16 and Link-11. This real-time ability to transmit data links to maritime ships gives NAEW a high degree of interoperability with CP task forces.

Early identification of potential pirates and quick responses when under duress remain on-going international challenges. One innovative potential way to thwart these assaults was recently demonstrated when a Royal Australian Air Force Wedgetail 737 Airborne Early Warning and Control aircraft demonstrated simultaneous command and control of three ScanEagle surveillance UAS. Using NMT-like software and NATO-standard sensor and air-vehicle commands, the airborne operators were able to conduct search, reconnaissance, point surveillance and targeting. Real-time video imagery of ground targets was also transmitted.[1] Systems such as ScanEagle could provide a persistent, cost-effective, ISR capability for use with NAEW in future CP operations.

NMT was also fielded with five additional operator consoles on-board allowing additional crew members or other system and subject matter experts to fly, augment, and perform new missions and tasks like ScanEagle control for CP missions. The NAEW&C Force has established a NMT Future Capabilities Working Group to pursue these and other promising innovative options in the near-term.

The NAEW&C Force is undergoing a very real transformation with NMT and NNEC that should significantly enhance NATO operational effectiveness. The operational emergence of NMT should dispel old paradigms – like the radar and radios mindset of only using AWACS to identify and defend against enemy aircraft. NAEW will soon have the ability to act as a network enabler providing cross-domain effects, while conducting key battle management and JISR functions. But maximum NMT leverage is only achievable if EBCA is used to fully exploit our future NATO Network-Enabled force. ■

1. Aviation Week & Space Technology/13 April 2009.

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The E-3 also has long-range surveillance radar that can effectively complement CP operations.

NATO AIR POLICING

Mr. Jim Lovell, Head, Air Defence Section, NATO HQ Inv Div
Colonel Thomas H. Lorber, DEU AF,
Chief Air and Missile Defence Section, NATO HQ

History

Without a suitable forum for substantive political dialogue, the Cold War confrontation between NATO and the Warsaw Pact required an overtly robust military posture to preserve the integrity of Alliance territory while also demonstrating collective unity of purpose and the resolve to resist any threat of aggression. NATO Air Policing (AP) made a substantial contribution to this end.

The potential for simultaneous, coordinated incursions into NATO airspace along its entire border required a relatively large number of fighter aircraft at very high readiness, supported by a robust, fixed Air Surveillance and Control System (ASACS) and a dedicated Air Command and Control (Air C2) structure, to provide the necessary AP cover. Although these Quick Reaction Alert (Interceptor) (QRA(I)) aircraft were not intended as the counter to an air attack, the possibility of encountering hostile air action was acknowledged in their Rules of Engagement (ROE). This Cold War posture, however, was unable to guarantee a challenge to every incursion into NATO airspace even with specific airspace control measures put in place, such as Air Defence Identification Zones, to facilitate early identification and interception of intruders.

With the disintegration of the Warsaw Pact and the end of the Cold War, the threat of simultaneous incursions into NATO airspace along a broad front all but disappeared and the rationale for high readiness QRA(I) came into question. Furthermore, the geography of the Alliance changed substantially, first with the reunification of Germany and then with successive enlargements of NATO's membership. In this changed environment, the focus of the Alliance, as expressed in its Strategic Concept, shifted from territorial defence to the wider promotion of security and stability throughout the Euro-Atlantic region. Moreover, in marked contrast with the Cold War period, formal political dialogue has since been established with nearly all of NATO's neighbours through the Alliance's various initiatives under the Outreach programme.

> 'All Allies, regardless of whether they possess the means necessary to provide for the AP of their territory, should benefit from the same standard of AP.'

Policy

This new strategic environment, with no immediate threat to guard against, merited a review of the conduct of the NATO AP mission from both a policy and implementation perspective to make sure the task was conducted as efficiently and effectively as possible. The review acknowledged the many valuable roles outside the normal NATO AP mission that QRA(I) aircraft had performed, such as assisting airmen in distress, contributing to search and rescue operations and intercepting aircraft that were in violation of civil airspace directives, and the need for their continuation.

Two significant events in the early part of this century provided some urgency and shaped the development of the new NATO AP Policy. Firstly, the tragic events of 11 September 2001 reminded us all that threats can

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evolve quickly and unexpectedly and that, notwithstanding national prerogatives on dealing with hijacked aircraft, a military reaction at the outset (and perhaps later) was a necessary element as part of a larger political-military response. Secondly, the accession of new members to the Alliance, some of whom did not possess all the necessary indigenous means to conduct AP activities, required new thinking and paradigms to ensure SACEUR could perform the NATO AP mission successfully.

Any new approach to the NATO AP mission needed to adhere to some basic principles: it was to remain a peacetime task and should be conducted as efficiently and effectively as possible. All Allies should contribute to the mission and no member's security should be disadvantaged compared to any other member. All Allies, regardless of whether they possess the means necessary to provide for the AP of their territory, should benefit from the same standard of AP.

While the principles were straightforward, the policy was written to provide SACEUR with the flexibility to meet the requirements of the NATO AP mission in a rapidly changing security environment with conventional and unconventional risks. Although the operational tempo has subsequently put enormous strain on many national forces, the challenges faced by the NATO AP mission have been met and future developments must continue to satisfy the security needs of all Allies.

Current Implementation

As mentioned, in 2005 the Alliance agreed that all European allies, regardless of whether they possessed the necessary means, should benefit from the same minimum standard of AP. Consequently, SACEUR has since continued to conduct AP on the basis of the agreed

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The attacks of 11 September 2001 shaped new NATO AP policy.

Air congestion and UAVs (because of their non-immediate responsiveness to intercept control) present unique challenges to AP.

policy and principles while taking into account respective national military capabilities.

The requirements and responsibilities for the NATO AP peacetime mission are specified in various documents and address the guiding principles and essential elements, i.e. ASACS, an Air C2 structure and appropriate Air Defence assets, including interceptors, and the ROE.

A well-orchestrated and coordinated AP regime requires that air vehicles are detected, tracked, identified and intercepted, as necessary, and at any given time.

Most Allies possess sufficient organic capabilities and assets to support the NATO AP mission; however, there are some that do not have all the essential elements. Noting the shortfall and recognising the commitment to equality of security for all Allies, NATO developed options to meet that commitment. Pursuant to North Atlantic Council (NAC) guidance and direction, the NATO Military Authorities implemented arrangements to ensure the minimum standard of AP, as defined collectively, was also provided for Nations lacking some organic capabilities.

> '… interoperability and information exchange is important for all stakeholders, including the military, to ensure that airspace is secure and safe for all air traffic …'

The arrangements implemented vary depending on the National capacities and on the circumstances of the particular Nation(s). In some instances, ASACS and the Air C2 structure are sufficient and the requirement for augmentation is interceptor aircraft to provide a QRA(I) capability. In other cases, assistance may include the provision of supplemental radar data as necessary. When interceptor aircraft assets are required, they can be provided either by deploying aircraft from other Allies on a voluntary rotational basis or by bi-lateral arrangements with neighbouring NATO Nation(s). A key aspect and advantage of this latter solution is that it can be implemented without deployment of equipment and/or aircraft. A prerequisite for this approach is well established coordination between the Nations involved; in particular, arrangements for information and data exchange, for command and control responsibilities and procedures for border crossing authority need to be defined. SACEUR plays a leading role by supporting and assisting Nations to coordinate all the relevant issues.

Challenges

NATO AP and its implementation is not a static mission and will face a variety of wide-ranging and interrelated challenges in the future. The growth of civil aviation traffic is an immediate concern and one

where civil developments have the potential of outpacing the military's ability to keep up. An airspace that is increasingly populated has necessitated the development of means and mechanisms to increase capacity; in turn, this has seen the implementation of new standards, procedures and technologies, and led to structural developments in the Air Traffic Management (ATM) and Communication Navigation Surveillance (CNS) domains, e.g. Single European Sky ATM Research (SESAR). Access to this already crowded airspace will inevitably be dependent on compliance with these new standards and procedures. Therefore, an effective interoperability and information exchange is important for all stakeholders, including the military, to ensure that airspace is secure and safe for all air traffic, and that any violations or infringements are quickly detected and the appropriate response taken.

NATO AWACS are often utilised to monitor airspace not covered by radar.

Another area of concern is that there is a significant portion of the airspace, which is not covered adequately by active ground based (radar) sensors. To compensate for this shortfall, in some instances aerial sensor platforms like NATO AWACS are utilised. As AWACS assets are limited in number, this should not be seen as an enduring solution and the Alliance may need to look to advances in sensor technology to provide solutions to the 'air surveillance' challenge.

Unmanned Aerial Systems (UAS) also present a unique challenge as they are not immediately responsive to intercept control, but require communication with the controlling 'pilots' who could be anywhere. Moreover, UAS are being used increasingly in operations and their potential presence in airspace proximate to civil airspace poses special challenges for ATM/ATC and potentially the AP mission.

In sum, the future offers challenges, as well as opportunities to NATO's AP mission. A proactive approach combining analytical work, procedural change and political pragmatism will most likely be necessary to ensure that one of NATO's genuine success stories continues to meet the Alliance's AP needs both today and in the future. ■

New Horizons: Improving Space Integration for NATO Air Operations

Lieutenant General Friedrich W. Ploeger, DEU AF, Executive Director, JAPCC
Lieutenant Colonel Thomas G. Single, USA AF, JAPCC

Military leaders, planners, operators and intelligence analysts continue to emphasise the importance of Space and its value to military operations. While many still believe that Space is just an extension of the air medium, advocates have begun to turn the tide on this common misunderstanding, empowering leaders and staff alike to expect more. Our existing Air and Space doctrine explains that Space power can be the great enabler that allows Air, Land and Maritime forces to synchronise their contributions to a campaign requiring a joint (or coalition) approach.[1] Our NATO doctrine goes on to explain that the Joint Force Commander (JFC) may elect to delegate the detailed responsibility for coordinating and requesting Space support to a force component commander, and that it will often be the air component that is given this responsibility.[2] As Commander of a NATO Combined Air Operations Centre (CAOC) and Executive Director of the JAPCC, I have concerns that we are not doing all that we can to integrate Space into operations, and that we may not be as prepared as we should be in NATO's Air C2 structure to take the lead on Space on behalf of a JFC. The Alliance needs to take a more active role on educating our soldiers, sailors and airmen to understand the capacity and capabilities Space assets have to offer as they serve on the various operational staffs.

Today's Space

Today, we face some daunting challenges. Most of our nations are confronting reductions in forces and resources, greatly increased operational tempo and the need to adapt to rapidly advancing information technology. Furthermore, our hardware continues to age and operations become increasingly more complex and demanding. We continue to try and transform the Alliance to meet our new role of supporting expeditionary operations, while providing for the common defence of the Alliance. On a positive note, lean times often spur innovation and force us to make the most out of the resources we have available. Space is an area ripe for such innovation.

Space systems provide the vital links that enable expeditionary operations. Massive amounts of critical information are provided from, and transit through, Space. This includes command and control, intelligence and other data from the tactical to strategic. The connectivity provided by Space systems is crucial to decision making, planning and operations. In fact, the majority of air operations are dependent upon Space capabilities. Moreover, two of our primary missions, Air

Policing and supporting ISAF[3] operations could further benefit from Space. Unfortunately, greater Space contributions are limited due to the lack of education, training and awareness by leaders, planners and operators throughout our Alliance.

The diagram overleaf (Figure 1) shows a few of the many capabilities that Space brings to the fight. Space technology has advanced to the point where 'Space is for everyone.' All of our Nations (as well as our adversaries) have access to Space capabilities, but we cannot take them for granted.

Space Integration

As we strive for decision superiority, the need for global and tactical situational awareness will continue to increase. Furthermore, persistent ISR (including UAS), precise engagement, flexibility and network-enabled capabilities demand use of Space-based services. This dependency has also created vulnerabilities. The Space security environment has changed in recent years and it is no longer a sanctuary. Space is a contested environment and we must consider how we can guarantee freedom of action and assured access to the Space domain. NATO addressing Space power is not just a good idea, it is necessary and vitally important. Space capabilities are available to us today, which can help us use our resources more effectively. The JAPCC would argue that we have been providing 'adequate,' rather than optimal, Space support. There are several steps that we should take to improve how we utilise Space to support air operations.

Our leaders, planners, operators and intelligence analysts need to understand how to integrate and employ Space capabilities to generate desired effects across the Joint battlespace. The Airman plans, controls and executes effects through the CAOC. Unfortunately, these key nodes do not have the Space expertise that is needed. The majority of CAOC personnel are inadequately trained regarding the entire spectrum of Space capability, including how to request Space capabilities. With regard to Space, it is important to note that NATO is today where the US military forces were 10 years ago. There is much that we can learn from the experience the US gained as Space was integrated into its Air Operations Center (AOCs). A USAF Air University study conducted in 2000 identified a requirement for better integration of Space into the AOCs to achieve rapid dominance on the battlefield.[4] The JAPCC identified the same issue in its 'NATO Space Operations Assessment,' published in January 2009.[5] Both studies highlighted the need to address 5 interrelated elements: education and training, doctrine and policy, personnel, equipment, and C2 (Figure 2 overleaf).

We need a deliberate and holistic approach to better integrate Space. We don't want to 'do' Space just for the sake of doing it, we want to improve the way we do business and generate better effects in the most cost effective manner. This must start with education and training. Our personnel, from the most junior Airman to the senior Flag Officers, need to receive training and basic education on Space if we expect them to make better informed decisions. While the NATO School offers the 'Space Operational Planning Course,' this does not meet our requirements and is not supported as well as it could be. We need to urgently review our Space education programme and develop it to better meet our needs. Furthermore, the Space-savvy NATO nations need to be willing to support this effort by providing the qualified manpower to help implement any emerging programme and develop additional forums to expand the Alliance's Space expertise.

Additionally, we must make the effort to develop sound policies and doctrine to address Space operations. In the past, this has been a very sensitive topic as the Space nations were somewhat unwilling to divulge capabilities for fear of proprietary conflicts and national security matters. However, the paradigm is slowly changing and these nations are becoming more apt to openly discuss Space topics. Several Nations have or are developing Space policy, strategy and doctrine. Furthermore, the European Union also reached consensus on a Space policy in 2007. It is time for NATO to take a similar stance.

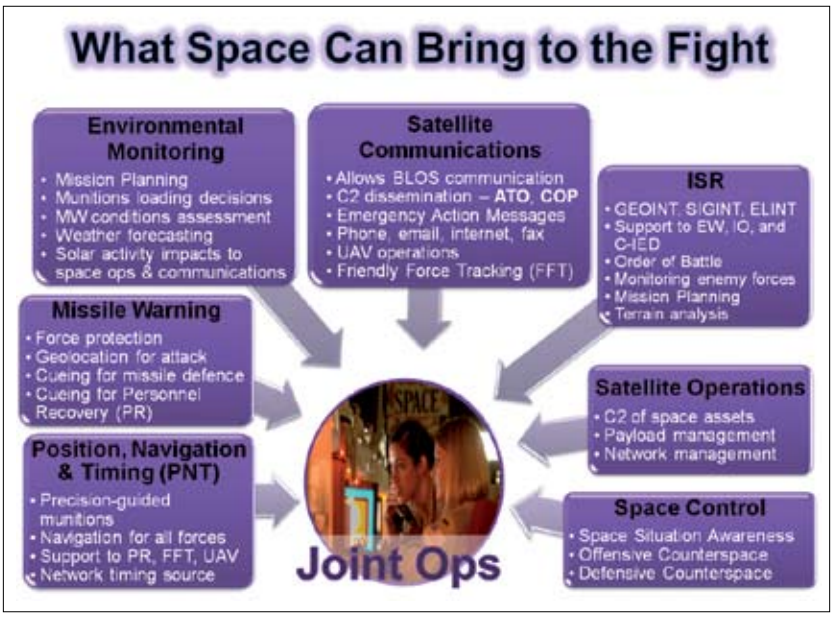


Figure 1: Space Capabilities.

Proper planning and executing Space power requires Space specialists to not only be assigned to our operational commands, but also to be employed as Space planners and not assigned to other tasks. The current HQ PE structures do not contain enough Space billets, so commanders will need to ensure the people they have are employed appropriately. The JAPCC estimates that to properly integrate Space into our planning efforts the ACO PE would need 30 new Space positions.[6] Moreover, as we look to improve Air Land Integration (ALI), our Air Liaison Elements, with the other components, should be augmented during operations and exercises with Space specialists. Although we are currently understaffed in terms of Space planners, we may be well served to offer these specialists as exchange and liaison officers on a more permanent basis in the future to ensure our component counterparts are empowered with the full range of space options.

Along with training, doctrine and personnel, the Alliance will need to invest in additional hardware to ensure Commanders are able to effectively employ the full range of Space capabilities. In particular, the CAOCs need to be outfitted with a standard suite of tools to provide Space Situational Awareness. Systems are available through commercial resources that could enable us to monitor the operational and link status of our satellites, develop an enemy order of battle and provide numerous products to the warfighters both in HQs and on the front line.

> '… the Alliance as a whole has very little appreciation for what these assets could offer the fight.'

Finally, we must address NATO's shortcoming in C2. Space assets have provided those Nations with robust space capabilities, the ability to communicate, coordinate and command across the global battlespace. While many NATO Nations have access to military and/or commercial Space capabilities, the Alliance as a whole has very little appreciation for what these assets could offer the fight. As we develop the Alliance's Space expertise and capability, we must strive to integrate these capabilities and events into wargames, exercises and training events. Through training and exercises, we can mature and improve our ability to C2 by properly employing our Space capabilities. Furthermore, through better integration we can familiarise our staffers, planners and commanders with the full range of opportunities and shortcomings that Space offers.

New Horizons

If NATO HQs and CAOCs were better trained and educated to properly leverage the full realm of existing Space capabilities and assets available across the Alliance, we could both reduce redundancy and maximise limited budgets. For example, the Joint Space Operations Center (JSpOC) in the United States could be used to support NATO CAOCs, much as they currently support the US AOCs located throughout the globe. Obviously, NATO would need to define and establish such support relationships.

We must strive to provide at least one Space planner in each of our HQs and CAOCs to establish links with National Space communities. This reachback support would greatly enhance the delivery of Air and Space power and provide access to a broader selection of capabilities

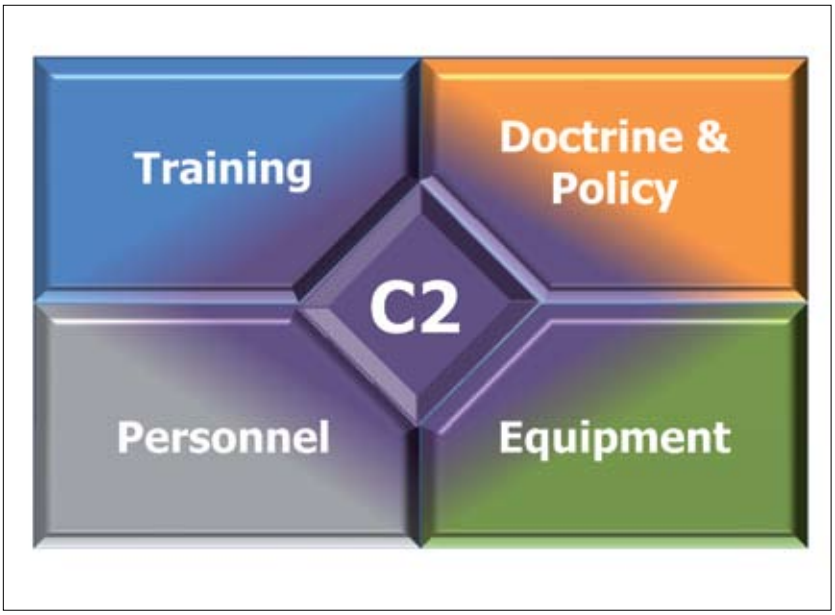


Figure 2: Interrelated elements required to improve Space Operations.

than NATO currently accesses. By introducing more Space planners to the staffs, we will not only empower our commanders' decision making processes, but will similarly increase our intelligence analysts and planners' understanding of Space. These staff officers must understand the full spectrum of Space operations to develop comprehensive courses of action, plans, targets and options. We need to increase the information exchange on Space threats and capabilities. We have access to Space expertise in the Alliance (or in the civilian Space community, such as the European Space Agency) and it is time that we reach out to those resources and begin the dialogue.

In a US paper from 1999, 'Integrating Space into an Air Expeditionary Force,' one of the conclusions was that the Director of Space Forces (DS4) is 'the most efficient method of providing the JFC with a single point of contact for Space support.'[7] Most certainly our senior leaders need sound advice on Space issues and clearly we need Space planners, but does NATO need a DS4 in our CAOCs like the US does in their AOCs? AJP 3.3 is currently under revision and includes the concepts of DS4 and Space Coordination Authority – permanently embedding the role of Space into NATO's doctrine. However, we need to look at how we want to integrate Space into our operations, and begin the debate on how to best accomplish this task.

'Space is a force multiplier that provides the JFC with the situational awareness and ability to C2 a three-dimensional battlespace …'

As NATO expands its Space horizons, perhaps the Alliance needs to begin a discussion on developing an organic Space capability as we have done with Airborne C2 (NAEW) and ISR (AGS). One possibility is the use of constellations of small satellites. The article on this topic in Edition 9 of the JAPCC Journal offers a brief introduction to many affordable options to provide capabilities that previous operational commanders could only dream of – the ability to task Space-based ISR assets. Clearly, this is an area 'ripe' for development and, notably, the Operationally Responsive Space (ORS) office in the US has made significant progress in this area. Increased NATO dialogue with the ORS office could prove fruitful for our operational commanders.

Finally, as we look to better integrate Space into our decision making processes, we may need to evaluate the prospect of developing a NATO Space Operations Coordination Centre to bring together the various National Space capabilities. Initially, we could leverage support from the US JSpOC, but we need to move towards a permanent multi-national solution to take advantage of the entire spectrum of Space capabilities.

No student of modern day warfare could conceive a NATO air campaign without a JFACC and an AOC to orchestrate the JFC's air assets. So why does the same not hold true for NATO Space operations today? Space is a force multiplier that provides the JFC with the situational awareness and ability to C2 a three-dimensional battlespace across both the globe and the spectrum of conflict. As we continue to modernise our fleets and C4ISR capabilities, our assets and air operations become increasingly dependent upon those Space systems. It is now time to begin developing a 'Space culture' in NATO, if we are to prevail in the contemporary operating environment and the future. ■

1. Allied Joint Publication (AJP) 3.3 Joint Air & Space Operations Doctrine, May 2002
2. AJP 3.3
3. The NATO led International Security Assistance Force in Afghanistan
4. 'Rapid Dominance, Integrating Space Into Today's Air Operation Center.' Maj Mark Harter, Wright Flyer Paper, Air University, April 2000.
5. The 'NATO Space Operations Assessment (Jan 09)' can be downloaded at www.japcc.org.
6. See the 'NATO Space Operations Assessment' Annex J.
7. 'Integrating Space into an Air Expeditionary Force', Major Thomas Doyne, USAF. Air Command and Staff College Paper, April 1999.

Next Generation Tankers:

Standardising Future AAR Needs

Major William Clements USA AF, JAPCC

No single innovation of recent times has contributed more to airpower flexibility than the aerial tanker …

Major General Perry B. Griffith[1]

As NATO watches the next generation of tankers come online, the need for improved interoperability becomes more important, especially in order to sustain operations in Afghanistan and Iraq with a multi-national force. The development of the A-400M for France, Germany and Spain; the Boeing 767 for Italy and Japan; the A330 for the UK and Australia; and the recapitalisation of the KC-135 fleet in the US has raised many questions concerning the future of Air-to-Air Refuelling (AAR) in NATO and across the globe. How will NATO standardise AAR procedures for aircrew from different Nations, while refuelling as an integrated NATO tanker force? How do we ensure complete inclusion of all NATO and non-NATO nations in a future international clearance process[2] during peacetime operations? We must answer these questions, as we build a global tanker force that maximises every Nation's AAR capabilities through interoperability.

Necessity for Interoperability

Improved interoperability amongst all Nations with AAR capabilities is a necessity if we are to fully realise the potential of a global tanker force for expeditionary operations. Many Nations are developing new AAR capabilities and will employ these assets in ISAF and future conflicts. The following AAR projects have been either developed or delivered to realise this goal.

Copyright: Presse- und Informationsbüro der Luftwaffe

ATP-56 (B) – Standardised AAR

The first steps to improve interoperability were initiated through the rewrite of Allied Tactical Publication (ATP) – 56 (B)[3], which collates all Nations' AAR procedures into one overlying AAR publication. These procedures were ratified by NATO in 2007 and now all tanker and receiver aircrew use these common procedures when conducting AAR. Before ATP-56 (B), every Nation published their own AAR procedures, with European Nations using the earlier version, ATP-56 (A), to standardise AAR procedures and ensure compatibility with receiver aircraft. The US used a completely different set of AAR procedures and the differences were evident every time a multi-national exercise or contingency took place. The confusion, which would mount due to lack of coordination between different Nation's tanker and receiver aircraft, was reason enough to bring everyone onto the same page with a single set of global AAR procedures. ATP-56 (B) fits this bill and is now used by all NATO and most non-NATO tanker and receiver aircrew. The JAPCC retains custodianship for ATP-56 (B) and Nations utilise the NATO AAR Panel to provide inputs and feedback to further improve the publication. Consequently, ATP-56 (B) continues to evolve and the ease by which Nations can make changes is even more reason for continued advocacy of its use.

New International AAR Clearance

In the past, very few Nations had the capability to conduct AAR operations. For a tanker to refuel with a receiver, the clearance process was simple because the aircraft were either developed by the same company or both tanker and receiver belonged to the same Nation. We now face a growing number of AAR-capable Nations with the ability to refuel receivers from multiple Nations. Nine NATO Nations currently have ten different types of tankers and are developing an increased global AAR capability. Many Nations have also purchased receiver aircraft, which would require an extensive testing and certification process to become compatible with all tankers. As more and more new tankers and receivers require AAR clearances, the tanker community is faced with the challenge of how to accomplish these clearances in the most economical manner. The development of standardised and streamlined processes that are agreed upon by all Nations involved is, therefore, critical. To this end, the progress made in the last year by the Aerial Refuelling Systems Advisory Group Conference, where US Transportation Command (USTRANSCOM) announced their vision of a global AAR strategy, has been substantial. This AAR initiative envisions a global tanker force where Nations share information to improve interoperability.

'The development of standardised and streamlined processes that are agreed upon by all Nations involved is, therefore, critical.'

An AAR clearance is comprised of many different functional areas, all of which must be captured in the new international tanker clearance process. The functional areas would include legal, financial, technical (engineering), training (maintenance and aircrew) and political clearances. The need to include maintenance in this list was raised since minimum maintenance standards must be met in order to ensure safe AAR. Where and how training requirements would be assured is still in initial discussions at the NATO AAR Panel and will need further debate. The AAR branch at USTRANSCOM is currently the US point of contact for all US tanker and receiver clearances and manages and stores AAR clearance data. They have volunteered to be the keeper of

non-US clearances in order to speed up the AAR clearance process. The storage system is currently under development and some Nations have expressed interest in depositing their data with USTRANSCOM.

Standardised AAR Equipment

In order to enhance NATO AAR interoperability, the standardisation of the primary equipment used to conduct AAR is paramount. The importance of AAR equipment standardisation can be seen through work conducted on the following standardisation agreements (STANAGs):

STANAG 3447 – Probe and Drogue
STANAG 7191 – Boom and Receptacle
STANAG 7215 – Signal Lights in the Hose and Drogue Systems

These STANAGs represent a push by NATO Nations to not only standardise their equipment on future tankers, but to also simplify AAR procedures. Receiver aircraft would certainly welcome standardisation of tanker equipment because their site picture[4] would never change while conducting AAR, day or night. A simplified site picture for all tankers would lead to a safer AAR environment where receiver aircraft would have more familiarisation due to standardised equipment and procedures, especially in combat environments. The Signal Lights STANAG represents a step forward in the influence of tanker design in order to standardise AAR procedures.

> 'Total global mobility will not exist without a global AAR management tool!'

Optimising Tanker Assets

ATP-56 (B) has broken the barriers of communication between all Nations for AAR procedures, while USTRANSCOM has provided momentum to realising a global tanker force through their global AAR initiative; however, we still do not have a NATO AAR database and monitoring system, which would provide Nations with visibility of all global tanker assets. Total global mobility will not exist without a global AAR management tool! A global AAR IT system would be a valuable tool for AAR agencies, such as USTRANSCOM and the Movement Coordination Centre Europe (MCCE), during peacetime operations. Receiver requests for tankers would be shared and worldwide AAR could be efficiently managed by using the assets closest to the requested AAR track, thus, maximising the fuel offloads available. That said, the problems associated with a global AAR tracking and monitoring system would need to overcome several obstacles. In particular, the security clearances and classification of higher priority missions would be a major issue. One solution might be to use an existing system, such as the Air Refuelling Management System and make it available for other agencies, such as the MCCE. The system would then provide visibility of tanker assets available and receiver requests to Nations and AAR agencies.

'Interchangeable' Capabilities

The future fleet of tankers will be 'interchangeable,' meaning that the same aircraft will have dual AAR and Air Transport (AT) capabilities. These new tankers are currently being acquired with interchangeable AAR/AT roles intended from design through acquisition policy and force organisation. This is a persuasive argument that transport will be more than the secondary role it is for most tankers today. This dual capability is significant to NATO because the same aircraft may be tasked in different roles, and more importantly, may be declared to NATO in different roles. This is clearly a good capability, but one which has to be planned for appropriately, and in ways we haven't dealt with in the past. A clear differentiation must be made by the command authority whether the AAR or AT capability will be tasked for each mission. The proper employment of these tankers matched with their designated capability will maximise their efficiency and provide planners with the guidance necessary to successfully accomplish the mission. To this end, the JAPCC is working on a Tanker Employment Manual. Its goal would be to give Combined Air Operations Centre planners the means to employ these limited assets in the most efficient manner.

'Maximising the efficiency of NATO tanker assets has become a priority, which cannot be overlooked due to the new AAR capabilities currently being developed in many Nations.'

A window of opportunity has opened for the development of a global tanker force through improved interoperability and international participation in realising a global standard for AAR procedures and clearances. Maximising the efficiency of NATO tanker assets has become a priority, which cannot be overlooked due to the new AAR capabilities currently being developed in many Nations. The solutions for many of the interoperability issues facing each Nation are already being implemented. ATP-56 (B) has standardised AAR procedures for aircrew from NATO Nations and must continue to be revised in order to improve upon instructions for international tankers to follow when inquiring about the clearance process. NATO must also continue to look at ways to improve tanker equipment in order to emphasise safety to tanker and receiver aircrew alike. These initiatives would not only improve interoperability, but ensure that the next generation of tankers will be used to their maximum potential. ■

1. Perry B. Griffith, 'Seven League Boots for TAC.' The Airman, IV, No 8, 44.
2. The international clearance process is currently limited to ensuring AAR compatibility of tanker and receiver aircraft. The reference for this process is ATP-56 (B) Part 5 Annex BA.
3. ATP-56 (B) can be accessed online at http://www.raf.mod.uk/downloads/airtoair56b.cfm.
4. The site picture is the view from the receiver's cockpit of the AAR system on the back of the tanker. More detail is provided in ATP-56 (B) Part 1, Chapter 4, Page 4–1 under Refuelling. ATP-56 (B) Part 1, CH 3 on Refuelling Equipment provides a detailed account of the STANAGs mentioned in the article above.

Space for Security & Defence: German and European Initiatives

Wolfgang Duerr, VP Security & Defence Germany at EADS Astrium

The United States national security is critically dependent upon space capabilities and this dependence will grow.

US National Space Policy, August 2006

Space systems are strategic assets demonstrating independence and the readiness to assume global responsibilities. The European Union increasingly relies on autonomous decision-making, based on space-based information and communication systems. Independent access to space capabilities is therefore a strategic asset for Europe.

European Space Policy, May 2007

Space plays a crucial role in our daily lives, in security and defence, protecting the environment, scientific and technical advances, tele-communications and a host of other services.

In consequence, both the civilian and the military sector are becoming increasingly dependent on services coming from space. This is clearly reflected and underlined within current space policies, both in the US and in Europe.

In the current security environment, we face the distribution of power among an increasing number of state and non-state actors, as well as rapidly evolving global challenges: a world economy in crisis, global security, regional tensions, climate change and sustainable development. One of the future challenges in this environment will be to preserve sovereignty and freedom of action within the space domain through collaborative efforts across the space powers and international organisations like the UN and NATO.

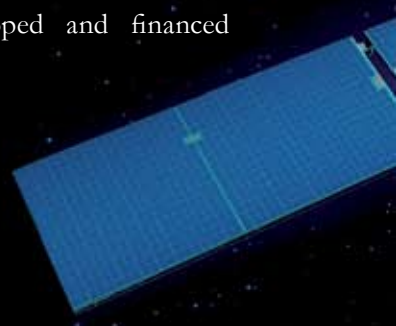
Key Enabler for Military Operations

For the military, space is an enabler for persistence, precision, flexibility and network-enabled operations. The main challenge is to bring the right information, at the right time, to the right people. Both the National and NATO defence sector face many transformation challenges in becoming a more expeditionary, network-enabled and joint military force. Common and harmonized requirements, standardisation and interoperability are a must on the technical side, as well as for recruitment and training of space professionals. NATO could play a major role in defining and enforcing these standards and to help to bridge the transatlantic gap.

Some examples of current German and European space programmes and initiatives, which could be of interest to NATO will be described next.

SAR-Lupe is the first German military owned satellite system for global strategic reconnaissance. The system consists of 5 satellites in 3 orbits and is operated by the Strategic Reconnaissance Command of the Bundeswehr´s Joint Services, with industry support. Full operational capability was achieved in 2008, and will run until 2017. The SAR[1] data coming from SAR-Lupe is complemented with optical ISR data from the HELIOS satellites under the terms of a German-Franco bi-lateral agreement. Astrium GmbH is currently leading the already initiated research and technology activities established for a SAR-Lupe follow on system to provide leading-edge SAR technology and improved ISR capabilities tailored to military requirements.

TerraSAR-X is the first radar satellite built in a Public Private Partnership in Germany. The German Aerospace Centre (DLR) and Astrium GmbH jointly developed and financed



this mission. Infoterra GmbH, a 100% subsidiary of Astrium GmbH, is exclusively responsible for commercial exploitation of TerraSAR-X data and services including training of SAR-operators. The system features a resolution of up to 1 m, excellent radiometric and geometric accuracy, a quick revisit access time of 2.5 days (2 days at 95% probability) to any point on Earth, and a unique agility (rapid switches between imaging modes and polarisations). TerraSAR-X has been in full operational service since January 2008, enabling weather independent high-resolution SAR data, as well as reliable data access services tailored to the civil and military customer (e.g. Bundeswehr, and NATO forces). A follow-on programme, TanDEM-X[2], an almost identical twin satellite designed to fly in an unique close formation with TerraSAR-X; it is scheduled for launch in October 2009. Together the 2 satellites will collect data for the generation of a homogeneous global Digital Elevation Model of unprecedented quality, which will be available to customers in 2013.

Another ISR programme, **MUSIS**[3], is an initiative of 6 European countries[4] for a common space-based imaging programme for security and defence purposes, which started in December 2006.

The aim of this government programme, managed by the European Defence Agency (EDA), is to effectively harmonize present and future military optical and radar observation systems (2015+). The objective of MUSIS is to move beyond the simple exchange of military intelligence images that currently exists among the European states. The aim is to give the users from the 6 countries free access to all space-based assets via a common User Ground Segment.

In addition to ISR satellites, Germany is active in satellite communications (SATCOM).

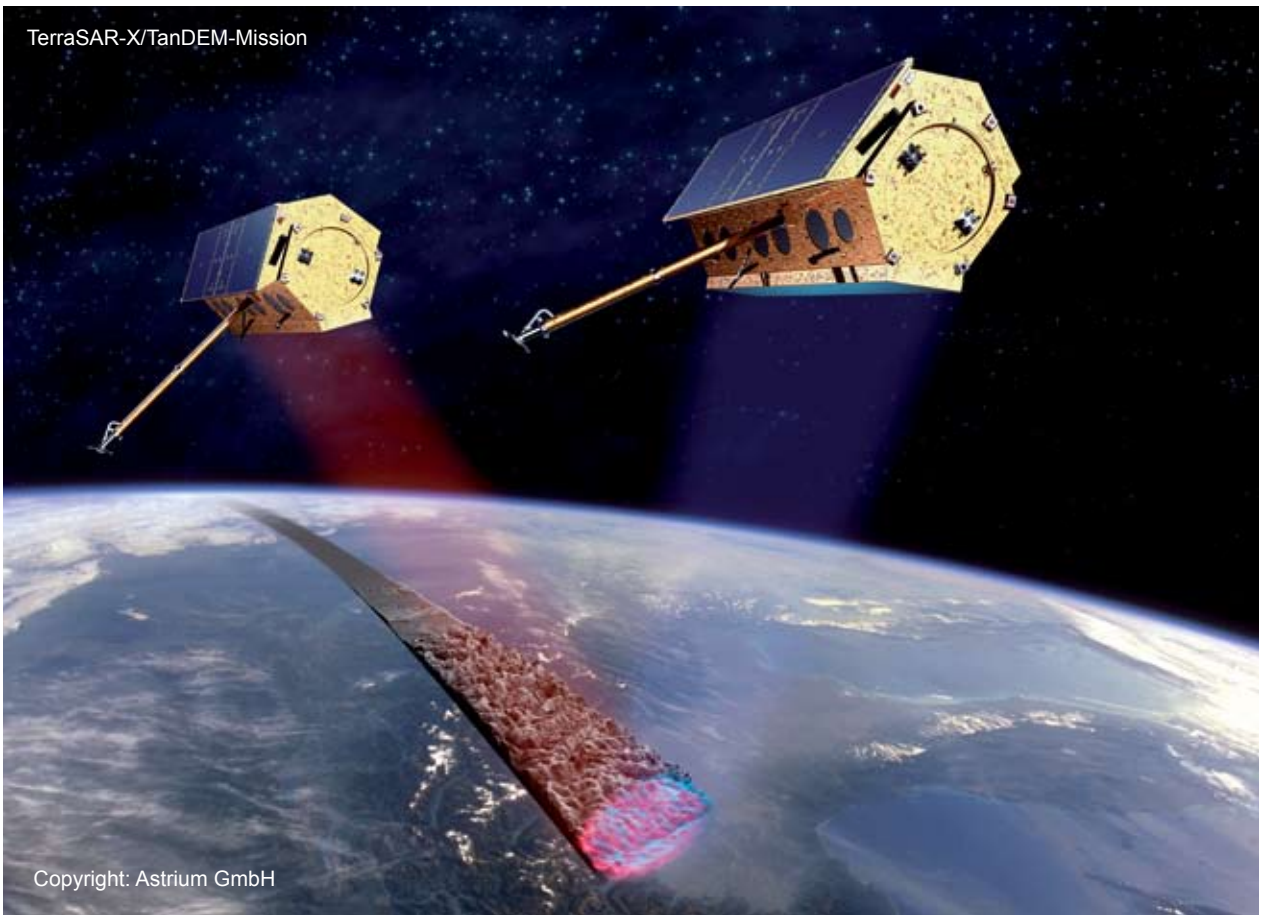
SATCOM Bw 2 will be the first German military satellite communication (MILSATCOM) system owned by the Armed Forces, joining the existing European MILSATCOM systems of France (Syracruse), Italy (Sicral), Spain (Spainsat), and Great Britain (Skynet). SATCOM Bw 2 will be an important step for the Bundeswehr in the current transformation process to gain independent and assured access to secure SATCOM. The system consists of two dedicated military satellites at 37° west and 63° east, and will include a significant extension of the existing SATCOM ground infrastructure. It includes the provision of fixed and mobile satellite terminals covering both military (SHF/UHF) and commercial frequency bands (C/Ku global, steerable spot beams). The military space capacity follows NATO interoperability standards. The contractor for the system is MilSat Services, a subsidiary of Astrium Services. The satellites are scheduled for launch on an Ariane 5 rocket, coinciding with the publication of this journal. Full operational capability is expected from early 2010, with a lifetime of about 15 years.

Another communication programme is the **Laser Communication Terminal (LCT)**. The LCT for optical data transfer was an R&D initiative of DLR with TESAT Spacecom GmbH, an Astrium subsidiary, as the prime contractor. A first transatlantic inter satellite link for in-orbit system verification between a US NFIRE and the TerraSAR-X satellite was successful in 2007 with a data rate of 5.5 Gbps. The LCT will most probably be part of future National and European communication satellite programmes (e.g. EDRS[5] or the German national SATCOM mission H2SAT).

> 'The long term objective is to establish a European SpSA System within the next 10–15 years …'

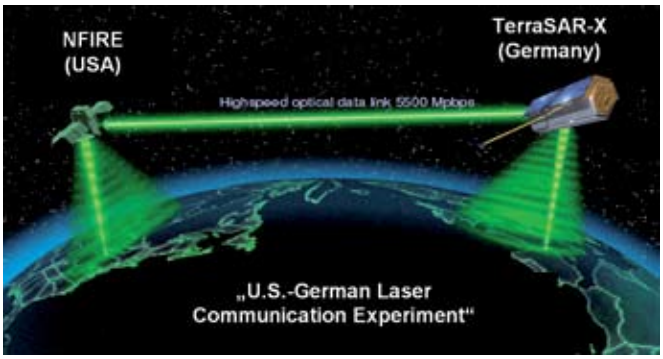
Welfare-Communication/ Services provide a full end-to-end-service for private communication purposes, including phone and internet access, to deployed military personnel on expeditionary operations, providing them with a means to contact their families and friends at home. In the UK, this is part of the unique 'Private Finance Initiative Skynet 5' initiated in 2003, where Paradigm provides all SATCOM requirements for UK forces. Astrium also provides Welfare Services to French forces (called 'Passerel') and is in discussion with the German MoD for a comparable service.

Another area of concern for NATO is Space Situational Awareness (SpSA). A Space Surveillance Network programme has been initiated by the European Space Agency (ESA) to support the European independent utilisation of and access to space for research and services. It aims to provide timely and quality data, information, services and knowledge regarding the environment, the threats and the sustainable



exploitation of outer space. ESA decided, in November 2008, to start with a SpSA Preparatory Programme (2009–2011). Whilst the overall responsibility rests with ESA, who is responsible for harmonizing civil customer requirements, military operational needs and requirements related to European SpSA capability development will be established and consolidated within the EDA. The long term objective is to establish a European SpSA System within the next 10–15 years in cooperation with international partners and with a main focus on the transatlantic partnership. Thus far, NATO has not determined what SpSA requirements are needed to support its strategic objectives, nor has it engaged with ESA or the EDA on this programme.

Finally, on the European horizon is **GALILEO.** It will be the future European satellite infrastructure for global position, navigation and timing (PNT) services. It will be independent from the existing American GPS and Russian GLONASS systems, which are both under military control and initially designed for military use. Apart from sovereignty, the intention of GALILEO is to involve Europe in the new generation of satellite navigation technologies, services and associated markets with a trigger for economic growth. GALILEO will be a civil controlled system, designed to satisfy various user requirements with 5 different services (Open, Safety-of-Life, Commercial, Public Regulated and Search and Rescue Service). GALILEO is planned to be compatible with GPS and GLONASS, as the combination of these systems will offer better availability and higher levels of accuracy. Two satellites (Giove A+B) are already in orbit for key-technology demonstration. The entire system will consist of 30 satellites and ground segments. GALILEO is planned to be fully operational in 2013.



Successful Inter Satellite Link with LCT established in 2007.

Copyright: Astrium GmbH

> ‘It would benefit the space industry if NATO could become a focal point to enforce standards and consolidate military requirements for the defence community with a strong trans-atlantic link …’

Way Ahead

Europe is on the way to more independence in Space. Current space programmes are recognised as key elements in support of EU security policies, particularly EU objectives like border security, crisis management, international treaty enforcement, maritime security and law enforcement. There is a spectrum of military space and dual-use-initiatives in Europe, mainly in the areas of persistent ISR, communication and geo-info support including PNT. The examples in this article should be of interest to NATO. NATO has heavily relied upon the US for space capabilities, but there are many new capabilities that could be integrated and used. Interoperability standards, however, are as important as consolidated and proper military requirements for space capabilities, to ensure the most efficient support of the joint warfighter and of decision makers at all levels. It would benefit the space industry if NATO could become a focal point to enforce standards and consolidate military requirements for the defence community with a strong transatlantic link and probably in cooperation with EDA. German and European initiatives in space for security and defence provide significant capabilities that NATO could potentially use in current and future operations. To use these newly available capabilities, NATO needs the right policies and agreements and must embed their potential into education, training and exercises. NATO can take advantage of these existing and planned space systems, providing it places a proper focus on Space for security and defence. ■

1. SAR = Synthetic Aperture Radar
2. TerraSAR-X add-on for Digital Elevation Measurement
3. Multinational Space-based Imaging System)
4. Germany, France, Italy, Spain, Belgium, Greece
5. EDRS = European Data Relay Satellite System

CIMIC and Air Power

Major Werner Schwulst, DEU A, JAPCC

The truth is nowadays, while we are very good at military planning for war and lavish huge resources on getting it right, we spend neither time, nor resources, nor energy on the civilian planning for what will happen the moment the war ends.

Lord Paddy Ashdown
UN High Representative
for Bosnia and Herzegovina 2002–2006

Belief in a wholly military solution to any of the crises in recent decades has been, if not completely discredited, at least severely dented. The lesson slowly being learnt is that, where military involvement is warranted, it can only ever be a part of a wider solution that includes non-military actors.

Current or potential future crises can only be resolved effectively through the collective efforts of a broad range of organisations contributing, within a crisis management strategy, to the prevention of such crises or to the stabilisation and reconstruction phases should they become necessary. Within the context of this collaborative approach to crisis management, CIMIC[1] provides the critical capability to establish and maintain NATO's links with key civil actors, including International Organisations (IO), Governmental Organisations (GO) and Non-Governmental Organisations (NGO).

CIMIC not only provides the military perspective to actors within a joint operating area, it also represents the military contribution to developing shared situational awareness, to the sharing of information, and to the de-confliction and co-operation with civil actors required by NATO's contribution to a Comprehensive Approach. Furthermore, CIMIC offers the prospect of supporting military planning and the conduct of operations by assessing and advising on possible civil implications.

This article seeks to outline the dynamic interrelationship between CIMIC and Air Power as distinct but related contributors to modern military crisis management. The certainties of the Cold War have been comprehensively superseded by the challenges of contemporary expeditionary operations set in the midst of a plethora of asymmetrical threats. A clearer understanding of CIMIC as a facet of Air Power, and vice versa, stands to make a crucial contribution to the adaptation of NATO forces to meet current operational needs. At first sight, it might appear that Air Power and CIMIC have little in common. On closer examination, however, a number of areas of activity emerge where they interact and support each other. This article explores such areas, and while acknowledging that not all of them are necessarily applicable in every mission scenario, it suggests that they do provide examples that illustrate alternative approaches to joint planning and interaction.

Influencing Activities

Since CIMIC is commonly perceived to be 'ground related' only, it may appear that its contribution to Air Power is limited to the attendant ground facilities. Intensive liaison with local authorities, regular interaction (including CIMIC field activities) with the local population or engagement with local key leaders all serve to support the inevitable

'hearts and minds' effort, thus mitigating as far as possible the requisite Force Protection requirement. While this is clearly important, CIMIC should not be regarded as a discrete function fulfilling a subordinate, though important Air Power role, but rather as being conducted in direct support of the Air Commander and his mission, sitting firmly on the Influence Activities (Information Operations) line of operation. This will include, for example, the increasing employment of fast air in non-kinetic roles (the 'fast, noisy and last warning'), representing a broadening of proportional options available to the Commander.

While 'classic' Air Power roles such as Close Air Support self-evidently remain important, the needs of the modern but 'unclear' engagement space, where potential adversaries may not stand out from the local population, demand both innovation and imagination. NATO's approach, undertaking kinetic and non-kinetic activities to achieve physical and cognitive effects within its Effects Based Approach to Operations (EBAO) will, on the one hand, add complexity to joint planning and the conduct and assessment of operations at all levels of command. On the other hand however, it will enrich the spectrum of effects-based and specific military actions within which CIMIC, together with Strategic Communications, Public Affairs, Psychological Operations and Key Leader Engagement, support the Information Operations line of operation. In particular, CIMIC assesses the impact of the civil environment on the military operation and identifies civil mission-critical factors.

'… desired military effects must be weighed against possible undesired civil effects …'

At the same time, the potential impact of the military operation on the civil environment must also be considered, and can only be accomplished by defining and estimating all desired and undesired effects of the use of Air Power. An example of this could be the destruction of a bridge. The military desired effect might be to sever an insurgent supply route, but this would also hamper the majority of the rural population by denying them access to the next largest city. From a CIMIC perspective, therefore, desired military effects must be weighed against possible undesired civil effects, the latter capable of generating an even greater problem for commanders. Self-evident though it is, this requirement to balance short term gains against the longer term impact of a particular course of action is too often overlooked.

Relationships

As well as contributing to the Joint Targeting Process, CIMIC support to Air Power must also include advice and information on civil facilities, potential sites for air-related infrastructure projects, the movement on main supply routes of convoys mounted by IOs, GOs and NGOs, relevant aspects of national cultural and religious heritage, the location of refugee camps, displaced persons and refugee movements. With the potential for the scale and physical demands of Air Power basing and support requirements to impact adversely in these areas, the role of CIMIC specialists becomes

Key Leader Engagement allows CIMIC to assess civil environment impact on military operations.

CIMIC offers a unique insight towards the targeting process to achieve desired military effects while reducing undesired civil effects.

pivotal if short term operational expediency is not to be at the expense of mission success and ultimately theatre exit. They must, therefore, consider the effects over time of decisions on the location of air bases, including their regional importance, possible future use by local governments, IOs or by the population itself, along with operation and management considerations; this is essential if the Comprehensive Approach is to be applied in reality as opposed to merely notionally. Even in the short term, the presence of NATO air forces is also likely to create artificial economic effects by distorting local labour markets and commercial activity. CIMIC specialists can help in assessing the military impact on factors including local market prices, the decreased availability of vital resources to the population and increases in local wage rates and land prices. Consideration of such factors stands to add value to overall military planning and can also contribute to the minimisation of collateral damage. The absolute imperative, pragmatically as well as morally, of avoiding collateral damage wherever possible, underpins the utility of CIMIC. It offers a unique perspective and viewpoint to help select tailored (kinetic or non-kinetic) activity to achieve a desired military effect while reducing to the minimum any undesired effects. If these effects are nevertheless both unavoidable and mission critical, CIMIC will also serve to mitigate their impact. Again, while the utility of CIMIC in this respect is clear, recent operations suggest that it remains under-exploited.

> '… the state-building process of re-establishing or creating a functioning state is central to its role …'

Furthermore, the relationship of CIMIC and Air Power encompasses the exploitation of other air capabilities, notably the provision of air transport in support of Humanitarian Assistance Operations. Operations of this kind may benefit from CIMIC's coordinating role. Although not a typical military task, NATO's forces may have to assume temporary responsibility in these circumstances because of the absence of other key players and in order to avoid an unacceptable power vacuum. Further contributions may be made through the exploitation of ISTAR for humanitarian purposes, providing a better understanding of the engagement space and an assessment of the civil situation, including newly detected refugee camps, damage after natural disasters and the condition of roads. The sharing of such information with IOs or the Host Nation contributes to shared situational awareness, improving crisis management and exchanging security-related information. From a military perspective, this hastens the migration of responsibilities back to the appropriate governmental or civil organisation.

Nation Building

Given that NATO's military operations are mandated by the political will of contributing nations, the state-building process of re-establishing or creating a functioning state is central to its role, both from a political and civil point of view. This is likely to involve assistance in enhancing a government's legitimacy and influence throughout their country by supporting national elections via transportation of ballot papers and the movement of senior politicians and other public figures to provide a visible manifestation of governance. Air Power is well suited to this support. Similarly, with governance, the economy

and security all contributing to the establishment of a functioning state, the creation and nurturing of nascent civil and military air capacity, including the training of pilots, the provision of aircraft and airfields, and the establishment of support capabilities such as air traffic control, air movements and passenger handling facilities, will be critical. CIMIC and Air Power specialists have a pivotal role to play in these activities, seeking to exploit the air expertise of contributing nations and other agencies, including NATO's Civil Emergency Planning organisation.

Modern crises are complex and multidimensional. NATO Air Power has an important contribution to make in managing and resolving such crises, whether in responding to the consequences of natural disasters or to the challenges of re-establishing viable commercial activity and sound governance in a post conflict setting. In doing this, it must have recourse not only to the most obvious manifestations of its air capability – fast jets and strategic and tactical airlift for example – but also to CIMIC specialists well versed in the specific characteristics of Air Power and how to exploit them. CIMIC is also capable of anticipating, avoiding and, where necessary, mitigating Air Power's undesired effects, whether physical or psychological. It thereby adopts, adheres to and reflects NATO's Comprehensive Approach, involving all relevant actors and entities whilst establishing and maintaining key linkages. In Air Power terms, the role of CIMIC, which supports all aspects of air capability during all phases of an operation, is thus fundamental, and the uniquely synergistic relationship between the two warrants the clearest articulation, doctrinally and operationally. Both Air Power and CIMIC are ubiquitous and, through their mutually supporting roles, each contributes to achieving the desired, coherent effects that will support the overall military (and political) mission end state. Both are also inherently concerned with the long-term establishment of viable structures including, crucially, the machinery of civil and military air capacity. Lord Ashdown best summed up the long view of crisis management thus: *Avoid the conflict if you can – it will be much cheaper that way. But if conflict cannot be avoided, remember that it is not over when the fighting is finished. In fact the tricky bit is probably only then just beginning.*

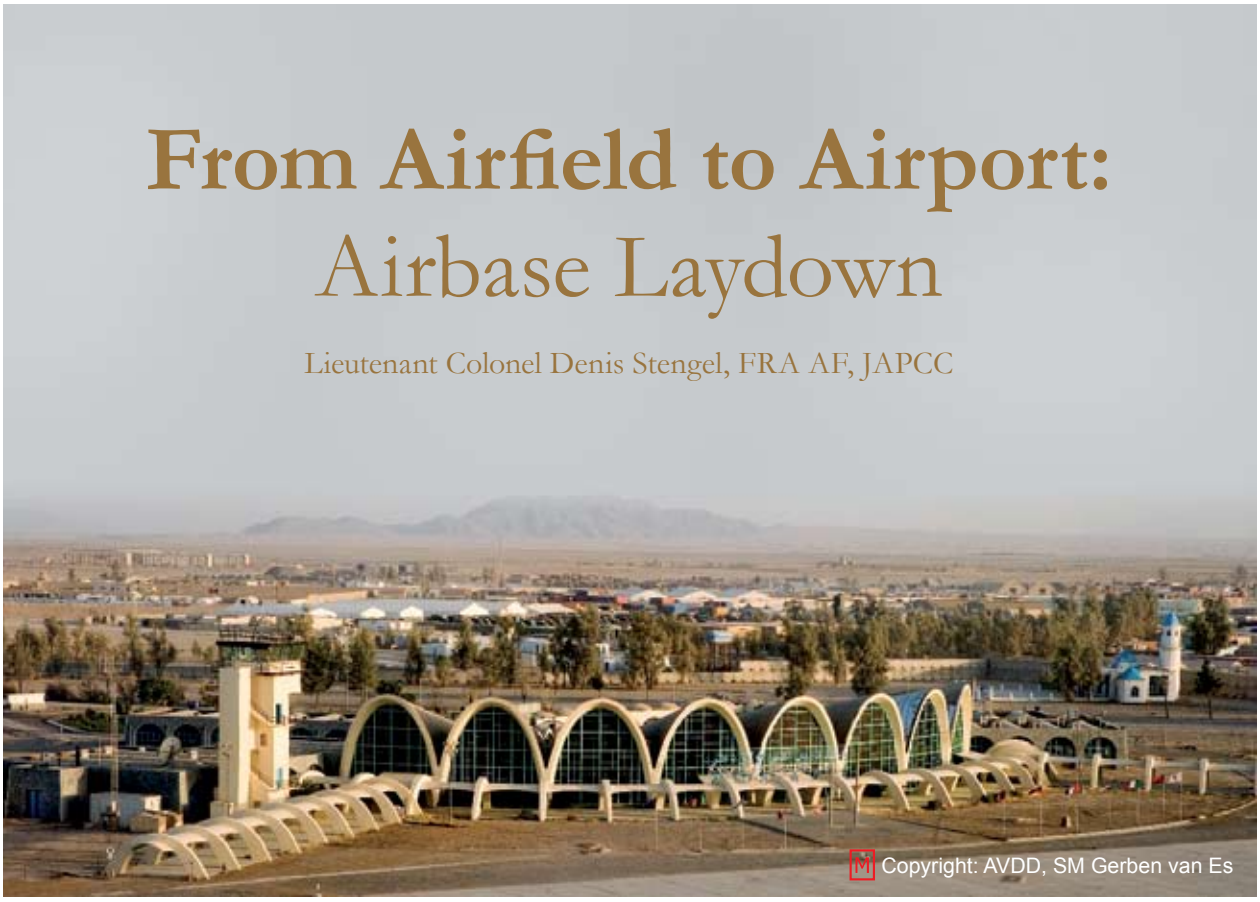
'… through their mutually supporting roles, each contributes to achieving the desired, coherent effects that will support the overall military (and political) mission end state.'

1. Defined in NATO as 'the co-ordination and co-operation, in support of the mission, between the NATO Commander and civil actors, including national population and local authorities, as well as international, national and non-governmental organisations and agencies'

Information sharing with IOs (like the Red Cross) contributes to improved crisis management.

From Airfield to Airport: Airbase Laydown

Lieutenant Colonel Denis Stengel, FRA AF, JAPCC



It has often been said that military planners make the mistake of planning to fight the last war. Whether or not there is truth in this general observation, one area of recent coalition operations does appear to suggest that we repeatedly omit to plan far enough ahead to prevent avoidable mistakes. Specifically, how many of us with recent operational experience have seriously considered the central question of, 'What will the country where we are engaged look like after we leave?' My impression is 'Too few!' The advantages of the multi-dimensional Comprehensive Approach (CA) to planning and conducting NATO operations are now well recognised, and the development of NATO's CA seems set to continue. A key feature of this is the contribution by military forces to the creation of an environment that facilitates the development of economic activity and a return to full civil governance. In the field of post-conflict air capability, both civil and military, the need to plan, early and comprehensively, a strategy that includes the re-establishment of a Host Nation's (HN) air capabilities has perhaps not yet gained the broad acknowledgement that it warrants. As a consequence, there is a need to identify, consider and articulate the factors and issues to be addressed in order that the requirements of post-conflict air capability can be included from the outset of the planning process.

Aim

The aim of this article is to describe how these factors and issues are currently being explored by the JAPCC via its Airbase Laydown project. In seeking to strike a chord with readers, its supplementary aim is to elicit views which will contribute to the development of an approach to post-conflict air capability that acknowledges and avoids a repetition of earlier mistakes. The term 'Airbase Laydown' in this article covers the entire process of selecting, configuring, operating and the closure/handover of one or more airfields within the broader context of the development of an air strategy. Such a strategy will need to consider the benefits of establishing an early balance between the potentially conflicting interests of civil and military aviation interests, with workable compromises achieved through full coordination and cooperation of all those with an interest. Were I to seek to encapsulate the philosophy of JAPCC's overall approach to the Airbase Laydown project, it might be in the leitmotif 'whatever NATO builds for its short term operational needs should be seen as a legacy to the HN, enabling it to develop and be self-reliant as soon as possible.'

The JAPCC team has already identified 2 distinct areas that need to be investigated: the initial planning phase; and the

subsequent introduction of efficient routine working procedures and coordination between military and civil actors. If both have been successfully achieved, the ultimate handover to the HN and the redeployment of forces will take place smoothly and as early as practicable.

Early Post-Conflict Planning

The benefits of early planning for the desired post-conflict air strategy are self evident. It would allow the establishment of an optimal compromise between military operations and the requirements of short and mid-term humanitarian aid, as well as long term economic development. From the outset, NATO planners will need to engage with the various actors, including International Organisations (IOs), Non-Governmental Organisations (NGOs), NATO organisations and agencies, and HN and other national agencies and bodies. In seeking to better understand the requirements of such non-military entities, the JAPCC project team has begun to examine relevant case studies (including Sarajevo, Basra, Baghdad, Kabul and Mazaar-esh-Sharif) and to consider the specific issues to be included in early inter-agency discussions. While the general requirements for military Air Ports of Debarkation (APOD) are covered both by existing NATO documents and by earlier work including the JAPCC Deployable Airfield Activation Wing (DAAW) project, this project will focus its attention on the particular questions of military-civilian interoperability and coordination, and their contribution to an effective exit strategy.

The enduring importance of the location of in-theatre air infrastructure is clear, as is the availability of facilities, current capacity and scope for expansion. The selection process, however, is likely to be complicated by the need for urgency driven by the immediacy of short term requirements. There is always a risk that 'wrong' choices could be made, hampering the achievement of longer term aims. Therefore, the decision on the in-theatre location of air forces must take into account the interests of the other actors, including IOs, NGOs, potential private investors, and local/regional government agencies. It is likely that consultation will identify a range of potentially conflicting priorities. For example, different actors and agencies will have differing air infrastructure needs, driven by such factors as population centres, transport and communication links and access to natural resources. Other factors may include threat levels, ethnic, cultural and religious distinctions and the disposition of opposing forces. It is axiomatic that planners must also consider the likelihood that NATO forces will be engaged in the 'Three Block War', with peace enforcement, peacekeeping and humanitarian relief operations being conducted simultaneously, with implications for Airbase Laydown in terms of security, multiple demands on resources and prioritisation.[1]

Fundamentally, the longer term implications of early decisions on post-conflict air infrastructure are inextricably related to the key

The enduring importance of the location of in-theatre air infrastructure is clear.

task of setting the conditions for the return of the civilian aviation sector. The re-establishment at the earliest opportunity of an airway structure, potentially over territory previously denied as a result of regional tensions, will pay immediate dividends by bringing funding into the local air economy.

Even more critical will be choices made in selecting and using airbases. Again, decisions made at the outset can have profound effects later on and, therefore, the desired strategic endstate must influence such decisions. Too often in the past, commanders have failed to appreciate fully the pivotal role that airfields stand to play in long term economic recovery; they have occupied and exploited civil airports, with all the attendant infrastructure – motorways, hotels and so on, without considering the downstream implications. Even when such considerations have been included, the alternative – for example building military facilities around the main airport access – has not necessarily served the nation's longer term interests either. In short, airports are good for the economy, and if we aspire to turn an international airport – perhaps that country's only one, into a military base, we need to consider the extent to which the obvious but limited beneficial impact on the local economy compares with the much greater benefit flowing from the re-establishment of a major civilian airport, potentially putting the region into an altogether different economic league.

A second set of choices with which planners are confronted from the outset concerns the actual laydown of forces on the selected airbase(s). Factors such as security, the availability of ramp space, fuel storage and distribution capacity, air traffic management, passenger and freight handling, storage and distribution, and many others, must all be taken into account. Again, both the initial needs of all agencies and their longer term aims must be considered if short term expediency is not to constrain future freedom of manoeuvre and the range of options subsequently available.

Whatever NATO builds short term, needs to be seen as a legacy to the host nation.

While the potential advantages of CA-based consultation are clear, the cost may be to extend timelines, perhaps delaying the achievement of in-theatre air Initial Operation Capability and increasing costs. However, to do otherwise risks our ability to develop and implement viable air structures and ultimately to effect the transfer of responsibility to civil actors. The creation of firm foundations based on NATO's CA, on which future cooperation and the progressive migration of responsibility can be built, must therefore take precedence.

Civil-Military Coordination

Having conducted comprehensive early planning, agreed priorities and established air operations in-theatre, the challenge will be to manage the specific requirements of different agencies. As well as sharing access to air capabilities, this may also involve the provision of services from one agency to another. Notwithstanding that this will predominantly take the

form of military support provided to other agencies, military users may themselves obtain services from non-military entities. This could include air traffic control, freight handling or the provision of aviation fuel, and may extend to fire and crash cover. Against the pragmatic advantages of civil-military cooperation, there is a traditional reluctance on the part of NGOs to be perceived as being too closely aligned with, or dependent on, military forces. The NGOs' concern is that such engagement risks compromising their neutral status. Equally, while acknowledging the need for cooperation, NATO commanders may be unwilling to place the humanitarian goals of NGOs above the demands of ongoing military operations, particularly where such operations are a necessary prerequisite for the establishment of security for other agencies to be able to pursue their own aims.

A further area of civil-military coordination that presents a variety of opportunities and risks is that of 'dual-use' facilities. As well as the challenges of third-party service provision outlined above, the sharing of capabilities may be necessary to avoid the duplication of structures. That said, the establishment of dual-use facilities offers the prospect of a progressive handover of responsibility from military to non-military actors, allowing confidence-building and experience to be gained by those who will ultimately assume sole responsibility for the maintenance of these facilities. In assessing the implications of dual-use, the likelihood of outsourcing services and facilities must be considered, together with the resulting influence on the development of a post-conflict air strategy: there are likely to be legal, regulatory, procedural and commercial factors to consider. Considerable experience already exists in the field of contracting for support to military operations, including via NAMSA. Similarly, other entities such as NATO's Civilian Aviation Planning Committee (CAPC) and the Senior Civil Emergency Planning Committee (SCEPC) will also have significant input.

Concluding Thoughts

The importance of early planning in establishing optimal – or the least sub-optimal – air infrastructure, and the need for close coordination in the subsequent multi-agency use of airbase facilities are already evident to the JAPCC Airbase Laydown project team. Both considerations also underline the importance of NATO's CA in conducting thorough planning and action. Together, they represent key factors in developing an air strategy that encourages the development or regeneration of a nation's civil (and military) air capacity, thereby contributing to the establishment of conditions that allow the timely handover of authority to legitimate non-military entities. In themselves, they do not however represent the totality of air-related requirements and factors necessary to ensure mission success and the re-establishment of post-conflict economic, political and social norms. The further development of an overarching strategic concept that addresses these other factors – whether concerned with economic viability, international standards, airspace control and a myriad others – therefore represents the JAPCC team's challenge.

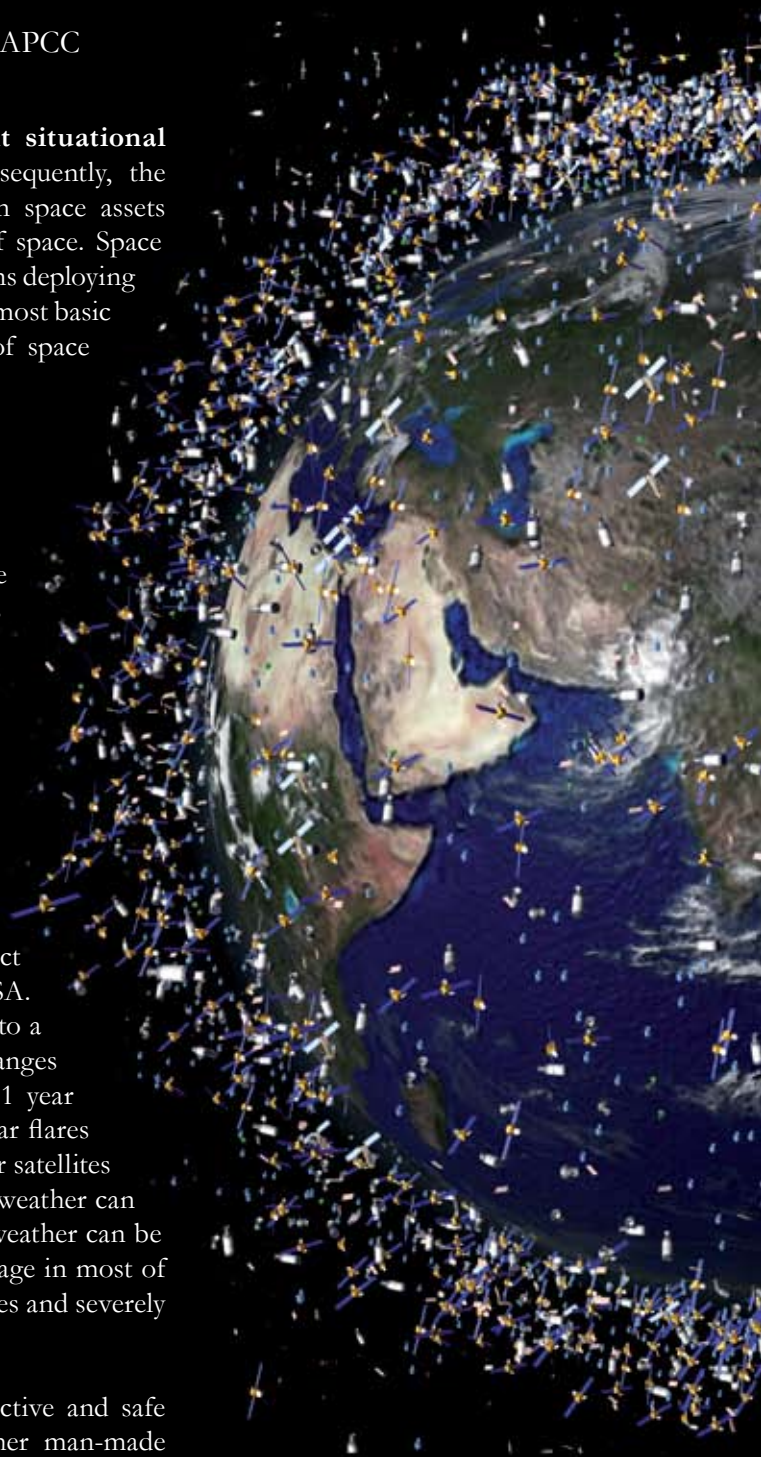
If this article has struck a chord, readers with views or experience of the development of approaches to post-conflict air capability, or have experienced the consequences of planning that did not address the range of issues identified above, are invited to contribute to this project. JAPCC POC is: stengel@japcc.de.

1. The concept of the Three Block War has been attributed to Gen Charles Krulak, who postulated that military operations on the modern battlefield will include a complex spectrum of challenges, with full scale military action, peacekeeping operations and humanitarian relief taking place concurrently within the space of three contiguous city blocks.

Establishment of dual-use facilities offers the prospect of a progressive handover of responsibility from military to non-military actors.

Is There Enough Space in Space?

Lieutenant Colonel Lothar Pichler, DEU AF, JAPCC



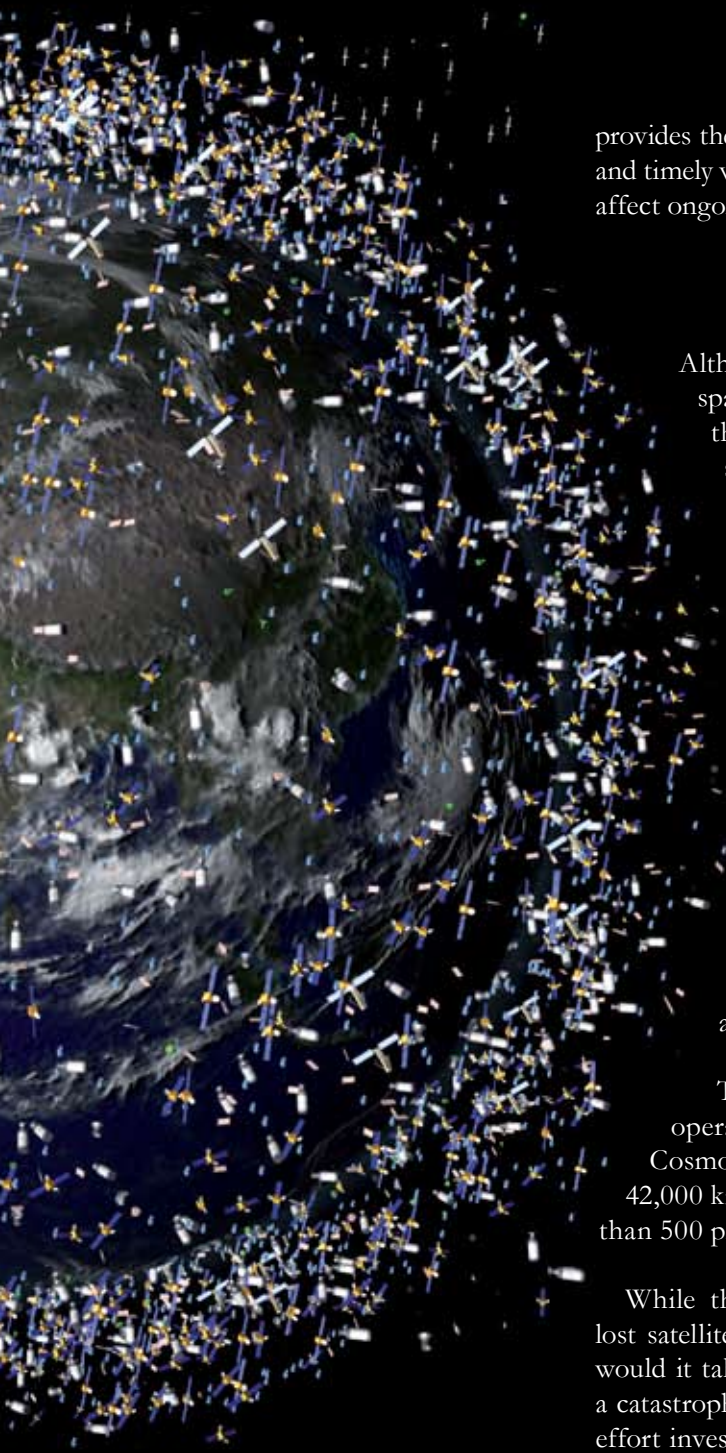
Military operations conducted without sufficient situational awareness are neither effective nor efficient. Consequently, the growing dependency of modern military operations on space assets and capabilities requires proper situational awareness of space. Space Situational Awareness (SpSA) is a key element for all nations deploying and operating space assets. Building SpSA involves, in its most basic form, collecting data on the position and movement of space objects in order to assure safe space activities.

It is more than just knowing where the 'Dots' are

By conducting conjunction analysis for all man-made and natural objects orbiting the Earth, collision hazards can be predicted and timely warnings given to allow preventive actions to be taken. The malfunction of a space asset might have multiple possible causes. It could be an onboard technical problem, damage inflicted by collision with space debris or another satellite. From a military perspective, even a hostile action should not be ruled out. SpSA would help to answer why a malfunction has occurred.

Predicting the space weather environment, and its impact on space activities, is the second functionality of SpSA. Whilst the sun's activity seems to be absolutely constant to a casual observer, it does in fact change over time. These changes are especially noticeable during the peak times of its 11 year activity cycle. The energy outbursts of the sun create solar flares that can cause communication and direction problems for satellites and other man-made space objects. The effects of space weather can even alter a satellite's orbit; indeed, the impact of space weather can be severe: a geomagnetic storm in 1989 caused a power outage in most of Quebec and intense solar storms in 2003 damaged satellites and severely disrupted air traffic in the same region.

A military SpSA capability must go beyond the effective and safe operation of owned assets. Collecting data on all other man-made space objects and assessing their capabilities is required for a common recognised space picture. Detecting, tracking and imaging these objects



provides the necessary raw data for space intelligence. Threat assessment and timely warnings of when, where and how opposing space assets could affect ongoing operations are a vital contribution to Force Protection.

Nine Times the Speed of a Bullet

Although, from a military perspective, hostile action against space assets would be the most dangerous threat, the most likely threat is space debris. Even the smallest objects can inflict serious harm to a space asset with speeds reaching 50,000 km per hour. The potential for these 'hypervelocity' impacts demands that all debris orbiting Earth bigger than a few inches to be tracked and catalogued – a Herculean task.

Moreover, the Jan 2007 Anti-Satellite Weapon test by China and its resulting cloud of debris clearly demonstrated the requirement for a capability to track, identify and assess even the smallest space objects. China's intentional destruction of its Fengyun-1C weather satellite created a hazard comprising more than 900 pieces of clutter bigger than 10 centimetres. NASA estimated the amount of smaller objects to be more than 3500. This cloud of debris now encompasses all of low Earth orbit at an average altitude of 850 kilometres. The debris will continue to pose a threat to man-made space assets for a considerable time.

The most recent space collision was in Feb 2009 between an operational Iridium 33 Satellite and a non-operational Russian Cosmos 2251 satellite. Accidentally running into each other at 42,000 km/h caused the destruction of both satellites and left more than 500 pieces of debris big enough to be tracked.

While the commercial company Iridium was able to replace the lost satellite with one of their in-orbit spares fairly quickly, how long would it take the armed forces within NATO to compensate for such a catastrophic loss, particularly considering tight defence budgets? The effort invested building a SpSA capability might then seem well spent, particularly if a timely collision warning could prevent the loss of a critical operational asset.

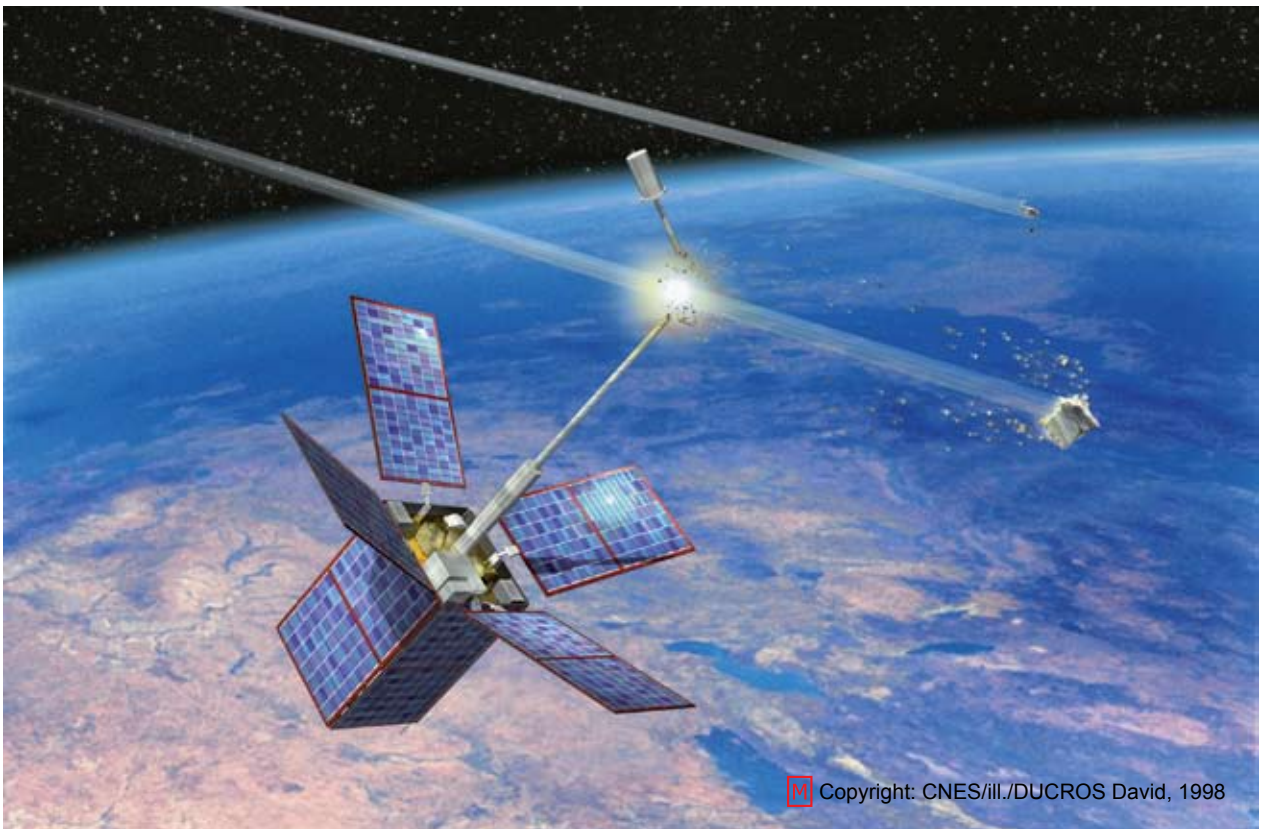


Illustration of 1996 collision of catalogued space debris object from an Ariane rocket with a military reconnaissance satellite (Cerise).

Kessler Syndrome

The preferred orbits in space are filling up quickly. With the number of space launches worldwide growing exponentially, the need for a comprehensive framework to sustain safe space flight activities has never been more timely. In 1978, NASA scientist Donald Kessler described a scenario in which the amount of space debris reached a critical threshold that triggered a chain reaction where one collision creates more debris, which again leads to more collisions creating even more fragments resulting in an exponential growth in the collision rate and debris population.[1] Quite clearly, there isn't unlimited space in space after all.

Find, then Track

The US remains the only NATO Nation with a fully operational capability to conduct SpSA. Seen as a foundation to US space operations, the US Air Force operates a broad network of sensors across the globe to track and identify objects orbiting the Earth. This Space Surveillance Network feeds into the Joint Space Operations Center (JSpOC) located at Vandenberg AFB. The JSpOC fuses this data with other sources to provide SpSA for the US military and other customers. Among other products, the Space Object Catalogue contains thousands of objects. With the exception of certain sensitive data, this catalogue is available publicly on the internet.[2] The enormous amount of already catalogued data must be maintained by tasked-based tracking. Tasked-based tracking involves looking in space where something is predicted to be, tracking and then confirming it. Finding new objects is a different matter altogether and can be more problematic. For objects in low to medium earth orbits, the US has built an S-band radar system across the southern United States. This sensor system is called 'the fence' and consists of several radar sites that create a narrow, continent-wide planar energy field in space. Every object above a certain size that passes this fence will be detected.

> '… a clearly defined data sharing policy has to be agreed upon …'

Arguably, Europe's growing activity in space operations also requires an autonomous capability to conduct SpSA.[3] The European NATO Nations continue to expand their National SpSA assets, but are well aware that a common European approach is necessary if significant progress is to be made.[4] Obviously, a clearly defined data sharing policy has to be agreed upon to ensure the different user requirements are satisfied.

In 2005, the French company Onera delivered a sensor system called GRAVES to the French Air Force. Using conventional radar technology, GRAVES is designed to watch satellites in altitudes up to 1,000 km. The system tracks some 2,000 objects and provides orbital

parameters – quite a technical accomplishment for a system that relies on a single sensor. In addition to GRAVES, France operates a telecommunication ship called BEM Monge. The Monge is a missile range instrumentation vessel that can also be used for space surveillance by the French Space Agency CNES. Fitted with supercomputers, some of the data gathered is processed on board. Of note, the ship is painted white to reflect the heat of the sun and prevent deformation of the shell, which would otherwise degrade the accuracy of the onboard radar equipment. The Monge is successfully used to gather and process data during Ariane 5 rocket launches and contributes to conjuncture analysis for the French Spot-Satellite.

Another national contribution comes from the German Tracking & Imaging Radar (TIRA). TIRA is operated by FGAN, a German research institute, and is used for experimentation as well as operational requirements by military and civil customers. Operating in the L-band for tracking and the Ku-band for imaging, TIRA is able to track 2 cm objects at a 1,000 km altitude and provide images of objects as small as 6.3 cm for identification purposes.[5] The German Armed Forces recognise that SpSA is a key capability when operating and relying on space assets. The Weltraumlagezentrum is a current project to establish an initial military SpSA functionality.[6] One possible location is at CAOC 2, located near the JAPCC in the Kalkar/Uedem area. This is also the operating location for the German Air Force Air Operations Command and the National Air Policing Centre.

While NATO still needs to define and clearly state its intention concerning space activities through a NATO Space Policy, Europe has acknowledged the strategic, economic and military significance of space to its member nations by signing a European Space Policy in 2007. In 2008, the European Space Agency (ESA) started a SpSA Preparatory Programme[7] as a first step to a full functional European SpSA capability. ESA has already established a catalogue called Database and Information System Characterising Objects in Space and operates a space debris telescope in Tenerife, Spain, the ESA Optical Ground Station.

Burden Sharing

The tracking systems mentioned previously should not lure us into a false feeling of security. Thousands of objects are orbiting Earth without being catalogued. SpSA is a fundamental aspect of space activity relevant to all nations operating or relying on space assets. The growing number of space objects orbiting Earth can best be managed by sharing the burden, while still respecting national interests and sensitivities. Close cooperation and coordination between national assets, the European systems and across the Atlantic is necessary to improve current SpSA. ■

1. Donald J. Kessler, The Kessler Syndrome, 08 Mar 09
2. http://www.space-track.org
3. French President Nicolas Sarkozy, speaking at Kourou (European Space Centre) on 11 February 2008
4. Draft recommendation xiii, Document C/2035, EU Security and Defence Assembly, 06 May 09
5. **Dr. Ludger Leushacke, Radar zur Weltraumaufklaerung,** FGAN
6. German MOD, KonzWRLageSys, 15 Dec 08
7. ESA Ministerial Council, 25–26 Nov 08

TIRA serves as the central experimental facility (e.g. detection and reconnaissance of objects in space.

Creating a Favourable Air Environment:

Key to Successful Crisis Response Operations

Colonel Eugeniusz Cieslak, Ph. D., POL AF,
Director, AF Institute, National Defence University

Ongoing discussions related to a favourable air environment in operations short of war focus almost exclusively on stabilisation operations, and the freedom to fly the skies seems to be the only benchmark for success. There is a need to broaden the scope of thought to benefit fully from Air Power's unique characteristics in such operations. To that end, this article points the reader's attention to problems in assuring a favourable air environment within humanitarian operations, as well as factors determining the effectiveness of its employment.

Discussions about the role of Air Power in operations short of war tend to focus on those involving the use or threat of force. The humanitarian side of the equation seems to be less frequently visited. The ongoing discussions and proposed solutions are not new: even within NATO. As the Cold War ended, numerous research and doctrinal developments took place in the field of military operations other than war (named OOTW by NATO at that time). Finally, when the idea developed into non-Article 5 Crisis Response Operations (CRO) in NATO doctrine, a separate chapter was proposed in AJP-3.3 devoted to Air Power in CRO. However, the chapter disappeared in the next proposed version of the document (AJP-3.3A). The subject has also been discussed at the last two JAPCC conferences.

'During NATO's commitment to ISAF in Afghanistan, such operations are often perceived as combat operations that fall short of outright war – this simply isn't true.'

Comprehensive Approach

Operations short of war is not a new term with respect to discussions about CRO. During NATO's commitment to ISAF in Afghanistan, such operations are often perceived as combat operations that fall short of outright war – this simply isn't true. CRO may involve the application of military force to accomplish either combat or humanitarian tasks as well as some sort of combination of the two. Usually, employment of military assets is just a part of a comprehensive response to crises.

As crises need to be managed in a comprehensive manner for a protracted length of time, there are normally a number of civilian and military participants involved. In many cases, the military will not be the most important actor, but will be expected to support other specialised organisations or agencies. Because NATO involvement in these operations will invariably be part of a multinational response, it is not unusual that there will be some legitimate differences in national and organisational objectives and strategies. A perfect example of this situation was the NATO – UN led operation in Bosnia Herzegovina back in the early nineties. At the beginning, the UN restraint in using force consistent with its peacekeeping philosophy placed tight controls on NATO Air Power. Eventually, a dual arrangement was adopted for air command and control, which required UN commanders to approve NATO air strikes. This situation, along with other minor factors, precluded the effective use of Air Power for almost two years. Such factors influence the way Air Power is perceived and how air strategy is developed and executed in operations short of war.[1]

Definitions

To start a more detailed examination on how to assure a favourable air environment in operations short of war, we need a definition of such a situation. In combat or complex scenarios, this author's definition of a favourable air environment is similar to the description found in current NATO air doctrine – a situation in which the extent of the air effort applied by the opponent's air assets is insufficient to prejudice success of friendly force operations. However; in complex scenarios the overall success will rarely depend on military forces alone.

If we acknowledge the role of IOs and NGOs in achieving long-term solutions to crises, we should probably ask what type and level of protection they need to operate efficiently. To what extent may they be protected by Air Power? To win hearts and minds, the local population should also benefit somehow from the favourable air situation. Historical evidence shows that employment of Air Power for protection of NGOs and the local population against irregular enemies will neither be easy nor fully effective. At the same time, leaving friendly NGOs or local population without any protection from the air may prove disastrous in long run.

How should we define a favourable air situation in humanitarian scenarios? Probably the best way of doing it would be

> '… low-cost alternatives are needed for the detection and classification of unauthorised activities.'

a measurement against efficiency and speed of relief in humanitarian efforts. Not surprisingly, the safety of military air assets is not seen as decisive criteria by humanitarian organisations and NGOs.

Costs

Another crucial issue in any discussion about assuring a favourable air environment in this context is cost. Who will pay and how much will they pay for assuring an acceptably favourable environment?

The NATO experience of enforcing no-fly zones in the Balkans showed that the overall costs of employing high-demand, low-density assets such as AEW may become prohibitive in the long run. The assets may also be needed elsewhere. If NATO wants to possess the capability to monitor airspace in operations short of war, some low-cost alternatives are needed for the detection and classification of unauthorised activities. Of course AEW is just the beginning of a long list of air assets needed to impose control over airspace.

Threats

Who may deny NATO a favourable air environment in operations short of war and how? There are plenty of hints of what to expect in combat or complex scenarios.

Since the 1990s, there have been numerous lessons learned by Alliance Members from operations in the Balkans, Iraq and Afghanistan. In the past, threats such as MANPADS, small arms or RPGs were directed predominantly against aircraft to challenge NATO forces in the hope of gaining disproportionate results; it is hard to believe that they will remain the only threats in the future. Should hypothetical enemies learn from Hezbollah, we had better be ready for more coordinated rocket, primitive cruise missiles or UAV attacks against Alliance forces sometime in the future.[2] All of these would be fired from behind human shields to benefit from the 'targeting of innocent civilians' should NATO decide to respond. Such a situation leads to a question about the right mix of ground-based Air Defence systems, especially those last-ditch defences like artillery assets with AHEAD[3] munitions.

> '… the credibility of deterrence relies on political will to use force …'

For humanitarian operations, our most difficult enemy may remain the same – us. We will probably continue to create barriers in sharing information between military and humanitarian relief communities, let bureaucracy slow our response and put Air Power into small boxes thereby losing its flexibility. A closer look at UN OCHA lessons learned suggest we are slow to learn, forget quickly and then have to re-learn the next time.[4]

Creating a favourable air environment in operations short of war has never been an easy task and rarely ends with full and unconditional success. In combat and complex scenarios, the application of lethal force to achieve control of the air may

Close cooperation between military and humanitarian organisations is the key for timely and efficient relief efforts.

be limited by concerns tied to the influence of Offensive Air action on the ground environment and the actors involved there. An air presence, coupled with credible deterrence, seems a more appropriate way of gaining and maintaining the levels of control of the air required by NATO forces. However, the credibility of deterrence relies on political will to use force and quick decisions to allow precise and timely military responses to the actions of belligerents. In recent times, this particular requirement has not always been met. For the efficient use of force in the future, it is important to secure detailed agreements on the acceptable methods and levels of escalation before starting operations.[5]

For humanitarian scenarios, close cooperation between military and humanitarian organisations is the key for timely and efficient relief efforts. Assuring a favourable air environment will require responsive liaison between all actors involved in a given operation and the early establishment of airspace control systems so that

'It will be healthy to limit expectations to reasonable levels …'

help from the sky can be delivered. Crisis response exercises that involve IOs and NGOs would be a beneficial tool for the humanitarian and military communities to get know each other better, prior to any future contingency.[6]

Summary

Although it is an underlying assumption for airmen that Air Power will always be decisive, decades' long experience of operations short of war suggests a more balanced approach. It will be healthy to limit expectations to reasonable levels when thinking of ways, means and ends related to assuring a favourable air environment in operations short of war. While not all answers to future challenges may be found by studying history, it will be easier to look for them if we know what type of questions should be asked. ■

1. Bucknam R.,Responsibility of Command. How UN and NATO Commanders Influenced Airpower over Bosnia, Maxwell AFB, Alabama: Air University Press, March 2003.
2. Arkin W. M., Divining Victory. Airpower in the 2006 Israel – Hezbollah War, Maxwell AFB, Alabama: Air University Press, March 2007.
3. **A**dvanced **H**it **E**fficiency **A**nd **D**estruction munitions are a type of air-burst munition used for Counter Air.
4. UN OCHA Civil Military Coordination Lessons Observed, Available from www.ocha.unog.ch/CMClessons/default.aspx; INTERNET.
5. Daadler I.H., and M. E. O'Hanlon. Nato's war to Save Kosovo. Brookings Institution Press 2001
6. Resetting the rules of engagement. Trends and issues in military – humanitarian relations, HPG Research Report 21, London: March 2006, p. 19.

MANPADS, small arms or RPGs were directed against aircraft to challenge NATO forces in the hope of gaining disproportionate results.

Interview with General László Tömböl, Chief of Hungarian Defence Forces

Gen Tömböl was recently promoted to the position of Chief of Hungarian Defence Forces. He is the first Airman to hold this position …

What are your goals for the Hungarian Defence Forces (HDF) and what do you hope to accomplish during your time in the office as Chief?

Some three years ago we launched a military reform with the aim of creating an effective force and command structure which can help elevate the level of readiness and capabilities of the HDF and accomplish our missions in homeland defence and Allied commitments. We have attained considerable results towards these goals; nevertheless, there are still many challenges ahead. A constant and meaningful transformation orchestrated with the Allied vision has a top priority on our agenda. We are highly determined to strengthen the professionalism of our young all-volunteer force, transformed from conscription 5 years ago. Our very first priority is training. We do our best to improve our troops' preparation and find proper military answers for new security risks. This process needs to develop and deepen a new culture of military service responding to 21st century demands while remaining rooted in our historical heritage. I am strongly convinced that the success of the whole transformation and the change to a higher level of quality supposes a strong, highly motivated, outstanding commanding officer corps, especially in that of the younger generation. We are also very well aware of the importance of a supportive social background and a high level of responsibility over home defence, both shared by Hungarian society. I am determined to further enhance the visibility of the HDF and of our servicemen's efforts to accomplish the missions we are assigned.

> 'We considered participation in Allied Operations a must from the very beginning.'

As for the Hungarian Air Force, I am very pleased that we have managed to modernise some indispensable parts of our Air Defence. We are very proud to have a multi-role, state of the art fighter fleet. The JAS 39 Gripen gives a new impetus for the HDF in capability building.

Nevertheless, we have a quite demanding task list to realise our vision to operate an effective, deployable Air Force. Our legacy MiG-29 and L-39 aircraft will be withdrawn from service by the end of this year. The MiG-29 will be replaced by 14 JAS-39 Gripen fighters. While the solution of how to provide sufficient and cost effective flight hours for our tactical aircraft pilots is still under consideration, possible solutions include leasing or procurement of L-159 training aircraft.

It is inevitable that the HDF will acquire new helicopters to maintain our rotary wing transport capability. While the specific type of helicopter has not been decided, the acquisition plans include procuring new transport helicopters starting in 2012. Additionally, we've initiated plans to procure new tactical transport beginning in 2017. To maintain capabilities, we will keep some of our existing AN-26 transport aircraft operational until the end of the next decade.

We have also developed a long term concept to modernise our Ground Based Air Defence System, including the short range MISTRAL system and the replacement of SA-6s. In addition, 3D mobile radars are planned for procurement by 2016–17.

It's been almost ten years since Hungary became a full member of NATO. How has Hungary's entry impacted its Armed Forces and specifically the Air Force?

NATO membership has opened new dimensions for the HDF. Our missions have extended to include readiness for Article 5 operations. This brought new requirements, not only for interoperability and deployability, and created a higher level of demand for developing expeditionary capabilities. We considered participation in Allied Operations a must from the very beginning.

'The entire HDF experienced a demanding transformation period before and after the accession, and the Hungarian Air Force had a unique responsibility when Hungary became part of the NATO integrated airspace.'

An overarching NATO orientation programme inside the HDF commenced when Hungary joined the Partnership for Peace programme in early 1994. As full membership got closer, a set of minimum military requirements was adopted. Interoperability and compatibility became key words for us. We are grateful that the 'older' member nations and the Alliance itself provided strong support in that process. It has been a long journey and we are still working on the longer term goals, aided by NATO transformation, a real driving force.

The entire HDF experienced a demanding transformation period before and after the accession, and the Hungarian Air Force had a unique responsibility when Hungary became part of the NATO integrated airspace. The strong message of Allied solidarity expressed in the NATINEADS itself was very well received in the whole Hungarian military community and everyone worked hard to prepare our readiness. The NATO Security Investment Programme supplemented our National resources to build the required basic infrastructure; moreover, new technological developments, close cooperation with allies in education and training, active participation in multinational and allied exercises and various common projects, such us the NATO Airborne Early Warning and Control (NAEW&C) Programme and the Strategic Airlift Capability (SAC) initiative, helped us raise the professional knowledge and preparation of our Air Force personnel to a standard we are proud of. One of

Heavy Airlift Wing (HAW) Opening Ceremonies at Papa Airbase.

the real operational confirmations of their abilities was the recently completed lead nation role at Kabul International Airport; a successful mission, which provided us with tremendous experience for the future. Being aware of our successes and difficulties, I have to admit that there is still a wide range of issues to be addressed: from completing our 3D radar system to providing sufficient flight hours for our pilots, as well as the need of some essential technical developments.

From an operational perspective, Hungary has participated in SFOR/KFOR and, more recently, taken over the leadership of the Baghlan Provincial PRT in Afghanistan. How have your people adapted to this expeditionary posture?

The HDF contribution to Allied and multinational peace operations at the moment is more than 1000 troops in 11 different missions on 3 continents. The most significant deployments are in Afghanistan and the Balkans. The Balkans, with its proximity and direct impact on Hungary's security, has been our important priority from the very beginning of the Balkan peace operations. We started with an engineer unit building roads and bridges in Bosnia and Herzegovina and recovered the Old Bridge of Mostar from the Neretva. Recently, however, Afghanistan has occupied the first place on our priority list while still maintaining our Balkan commitments. We are running a PRT and an OMLT in Baghlan province. We also deployed a platoon-level temporary reinforcement for the election period and a SOF team in theatre. Additional contributions are under preparation, including an Air Force training team for ANAAC helicopter pilots and a helicopter attachment for in theatre airlift. We are still in Iraq, the Sinai, and on the African continent – just to mention some examples. Aware of the current security situation and the Alliance's strategic priorities, we have started to examine possible new deployment options to avoid 'any surprise' in the sense of professional military preparation.

> '… it [Heavy Airlift Wing] will set the example for how to run an effective multinational unit.'

With the adaptation to this expeditionary posture there are challenges, but we are gaining experience and learning important lessons. The HDF has a long tradition in participating in peace operations, from the 19th century to monitoring the Vietnam Peace Accords in the 1970s. Nowadays, we live in a dynamic and increasingly complex world; today's armed forces have to respond in a competent and flexible manner to new challenges. The HDF is currently undergoing an intensive transformation process aimed to improve operational effectiveness. The first action we have taken to meet these challenges was the transformation to an all volunteer force that is, in our opinion, more capable to meet new requirements. The other step is training and doctrine. We are doing our best to get our structure, units and individual servicemen ready for expeditionary tasks and I am happy to tell you they understand the necessity of changes quite well; they are excellent partners to this process.

This applies to the Air Force as well, but financial obligations have been a strong obstacle for using their capabilities in peace operations. Despite all difficulties, they proved their abilities running KAIA in Afghanistan, and we are close to having new, essential Air Force contributions to Allied operations.

As for the technical side, despite limited financial resources we are determined to modernise our forces in a gradual and transparent way. The new National Military Strategy adopted by our Government at the beginning of 2009 gives us direction for capability areas to be improved: communication and network-enabled capabilities, reconnaissance, mobility and protection of the units and individual soldier combat equipment modernisation.

Strategic airlift has been a long-standing critical shortfall for NATO. The recently signed

'… Afghanistan has occupied the first place on our priority list …'

SAC MOU established a Heavy Airlift Wing (HAW) with C-17 aircraft based at Papa Airbase, Hungary. The first of 3 C-17s have been delivered with the other two due near publication of this journal. Can you tell me the factors that went into Hungary volunteering to base the HAW and the current and potential challenges of this basing?

SAC is vital to ensure NATO countries can deploy their forces and equipment quickly to wherever they are needed. We fully support the NATO Secretary General Mr. Anders Fogh Rasmussen's standpoint, emphasised in his first interview, that multinational approaches to defence are essential in capability building within the Alliance. Ten NATO countries (including Hungary) plus two Partner countries (Finland and Sweden) realised that common effort might be the most efficient, cost-effective way to establish a SAC.

For Hungary, strategic airlift is one of the most critical elements in supporting our troops beyond home territory. Having Allied C-17s registered under the Hungarian flag makes us proud that the participating nations have confidence in our abilities and efforts to create a supportive background for operating this vital capability of the Alliance. This challenging task has had an inspiring effect on the cooperating and hosting units and the personnel involved. We estimate that it will set the example for how to run an effective multinational unit.

Indeed, there have been some considerable challenges on the military and civilian side while creating the HAW. Finding adequate national resources to modernise the base, building the necessary infrastructure and the difficulties of a small town providing proper education for families of an international community are only examples of problems that had to be faced. We are grateful to our collaborators at home and those from the nations and organisations involved in a fruitful and effective cooperation with a sound result. The airfield, its infrastructure, military function and hosting communities are ready to assume further responsibilities in Allied programmes. Talks have already been started to invite other organisations to take advantage of an effective common operation and choose this facility as their home base.

Hungary is also involved with other NATO common programmes such as the NAEWF. Do you see such arrangements as an attractive way for your Air Force to contribute to and gain from Alliance membership?

These initiatives are really essential, especially for smaller nations like Hungary, who are not able to build such strong capabilities. At the same time, I'm convinced that common projects, like the NAEWF, are providing a great platform to gain benefits, not only for Hungary and countries with limited resources, but for the entire Alliance as well – it is the very essence of our enterprise. New security challenges of the 21st century are almost impossible to meet within national framework.

Our airmen and women are highly motivated to participate in these common projects. After working in the NAEW programme, colleagues return home and use their international experiences in national assignments; their knowledge strengthens the respective units' interoperability and they become an engine of Air Force transformation.

Sir, thank you for your time in doing this interview. ■

ASSURING THE SPACE DOMAIN

Strategically Important to NATO

Lieutenant Colonel Thomas G. Single, USA AF, JAPCC

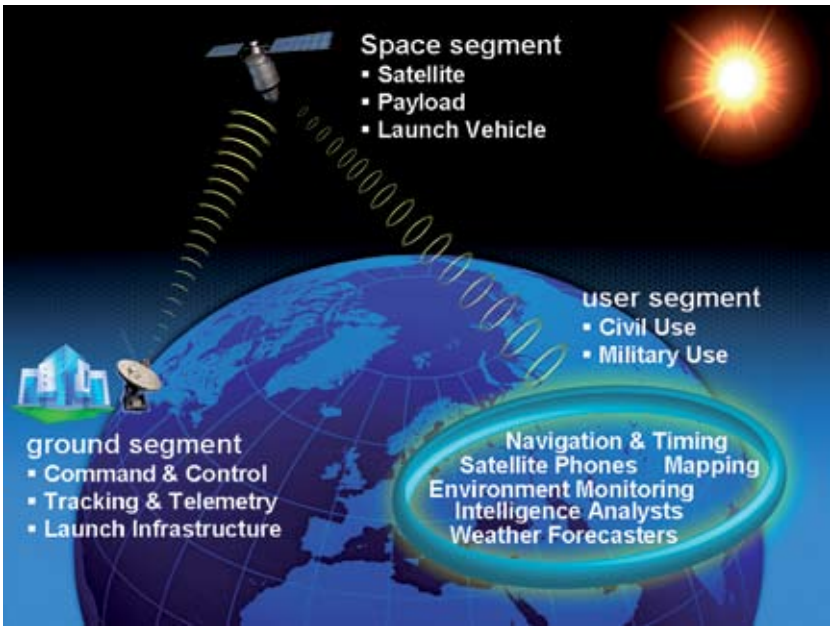
Space-based services have become integrated into our daily lives. Civilians, industry, government and military users have become dependent upon services such as weather, global navigation and timing and satellite communication. From a NATO and State perspective, Space Power is strategically important. Current and future crises require the combined and effective use of Land, Air, Sea and Space capabilities. Space systems are developed because they provide a capability that is only possible from Space or because they are a more cost effective solution to other methods.

Becoming a member of the 'Space Club' is seen as a source of national pride and can result in popular support for government leaders. This requires strategic principles of Space be understood at all levels in the government and military. Our diplomats and policy makers need to become more aware of the role of Space Power. Some state leaders have recognised the importance of the relationship between Space activities and national security. US Representative Terry Everett, the Ranking Member of the House Armed Services Subcommittee on Strategic Forces stated: *I strongly hold to the belief that Space is no longer a sanctuary. What has become increasingly clear over the last several years is the need for great Space situational awareness and protection of our Space assets.*[1]

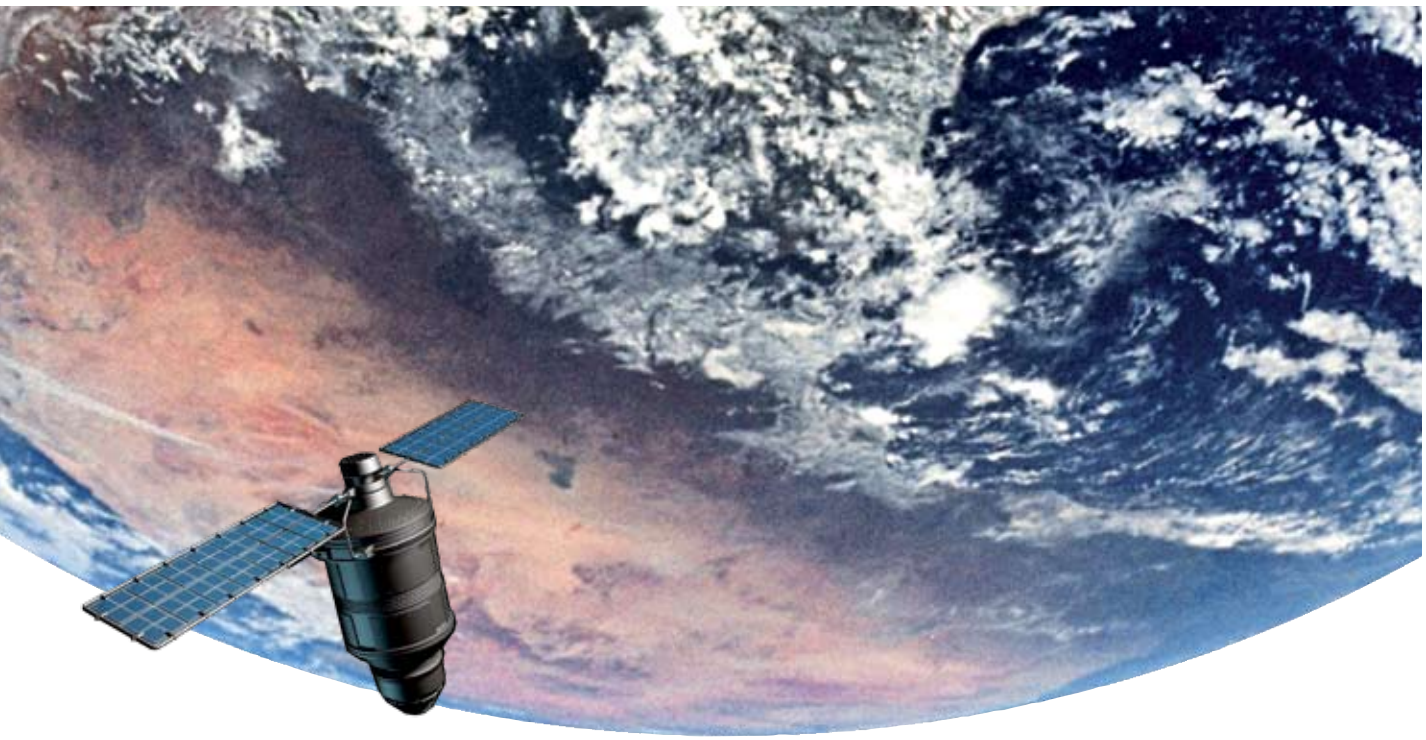
Space-based information can affect a nation's power and help ensure its national security. Information gained through Space systems has been used by NATO and its member nations as an instrument of foreign policy. It is necessary to protect one's interests and security by taking sufficient measures to ensure that information services can be used at all times. The inherent value of Space is the utility and access it provides and this utility and access are a Line of Communication (LOC)[2] that must be protected. History indicates that nations with a LOC providing significant political and economic advantage will protect their interests no matter where they lie. Space is no different. Increasingly, nations are viewing Space as a medium where national power and security are played out. Many will see Space systems as attractive targets to achieve parity in future conflicts.

Current Threats

Space Power is more than just physical Space assets. The US defines Space Power as 'the total strength of a nation's capabilities to conduct and influence activities to, in, through, and from Space to achieve its objectives.'[3] Space Power can be influenced by military, environmental, and political means. Military influence is primarily focused on the physical Space system. A Space system (see illustration below) consists of a



Depiction of a complete Space System.



ground segment, Space segment and user segment. The ground segment includes industrial sites such as satellite and rocket assembly facilities. It also includes the command and control networks (antennas, computer networks and the like), launch facilities and data processing and dissemination centres. The Space segment includes the rocket that launched it into orbit, the satellite (commonly known as the 'bus'), the mission payload (transponders, sensors, etc.), and one could even consider the orbit/location part of the Space segment. The user segment encompasses all the receivers, information systems, and various customers of Space-based services. This complex and interdependent system of systems has many threats and vulnerabilities. To hold Space capabilities at risk, an adversary merely has to interfere or break one of those often fragile links.

Significant effort has been spent by the US to understand the military threats to Space systems. At the most basic level, standard military doctrine and tactics apply: deception, disruption, denial, degradation and destruction. Sensors and tracking systems can be deceived, communication links and Space services can be disrupted, denied or degraded through network attack or electronic warfare, and the systems themselves can be destroyed. Space is a contested environment, facing numerous threats and subject to many vulnerabilities.

'… technology for these [GPS & SATCOM] jammers is easily available and for surprisingly low cost.'

Media attention is typically focused on anti-satellite (ASAT) capability, such as direct ascent and co-orbital systems. The Soviet Union, US and China have successfully demonstrated an ASAT capability. Nuclear and high altitude electromagnetic pulse weapons are still considered a threat to Space systems.[4] Other exotic weapons such as laser 'dazzlers' to blind satellite sensors are most likely in development by several nations. Many nations have already demonstrated GPS and SATCOM jamming capability. The technology for these jammers is easily available and for surprisingly low cost. However, the most vulnerable part of a Space system is the ground segment: the launch, assembly, manufacturing, and command and control locations. There are very few of these critical facilities, they are in well-known locations, and are easy to attack with conventional or terrorist weapons. Also to be considered as vulnerabilities are the Geosynchronous (GEO) and certain Low Earth Orbits (LEO). There are a limited numbers of key locations and a WMD or ASAT attack could create enough Space debris to make an orbit unusable for hundreds or thousands of years.

Space power can also be influenced by the 'soft' powers. Environmental concerns are from both outer Space and the terrestrial environment. The Space environment is still the biggest threat to satellites; the Sun is an 'adversary'. Space systems must contend with maintaining orbit, charged particles and radiation from the Sun, micro-meteorites, and of course trying to avoid collisions with objects moving in excess of 7 km/s (in LEO). The US

is tracking over 18,000 objects in orbit with many tens of thousands more that can't be tracked. Furthermore, the atmosphere can disrupt radio signals and block sensors from being able to view the earth's surface or ground sensors from being able to track satellites.

Diplomatic activities can also influence Space Power. Being a major player in Space brings influence to shaping international treaties and regulations. Smaller nations can now get a seat at the Space table relatively easily, since the cost of entry has been greatly reduced. They (individually or as a coalition) can then assert a diplomatic presence to influence any new agreements or treaties.[5] Moreover, Nations have not yet put Space on the agenda for discussion and this has in effect slowed efforts to make significant progress.

Information and economic activities can also influence Space Power. Information activities can have influence on orbital slots, frequency management, and use of Space capabilities to verify treaties, such as providing images of violations or misuse. Information activities can assert influence on Space Power by news campaigns on polices, programme goals, funding, etc. There are only a few nations and companies that can launch satellites. They can influence when you get on the launch schedule, which commercial providers sell what services to whom and for how much.

In addition to the military and 'soft' influences, there are also potential threats from terrorists and pirates. Terrorists engage in activities to strike fear in people and create a large media impact. Attacking a Space launch, or ground stations that would take out television, internet, power grids, etc., provide tempting targets for terrorists. 'The risk of terrorism spilling over from Earth to Space is real and latent. However, the threat of 'Space terrorism' is currently to a large degree neglected by decision-makers.'[6] Furthermore, pirates off the Horn of Africa have taken ships for ransom money and been paid millions of Euros. They are in effect, attacking that maritime LOC; it may be just a matter of time before a major Space LOC is held hostage to pirates' demands (there have already been jamming and piracy attacks on satellites). As most UAS[7] use commercial SATCOM for command and data links, this could greatly impact military operations in the Middle East.

Operation SILENT SENTRY detects and geo-locates satellite interference and jamming.

As can be seen with just this short overview, assuring access to the Space domain is quite a daunting task! Assuring the Space domain is a global issue, and NATO is but one stakeholder. There is no simple solution to the challenge and it requires the cooperation of the international community. NATO must have assured access to Space in order to support decision making and operations. NATO is already dependent on Space, and as the Space domain has become an increasingly contested domain, it must take a more active role to ensure the Space LOC is assured.

Mitigating the Risk

The first step that NATO must take is to clearly acknowledge that Space is a distinct domain and that it is as important as Air, Land, and Sea Power. Space is already briefly mentioned in some guidance, doctrine and other documents. However, with no focus, no executive oversight and lack of direction from the Military Committee, Allied Command Transformation or Allied Command Operations, it will continue to be near impossible to make significant progress. With this issue aside, is there anything that we can do to mitigate risk?

Space includes as many different missions and systems as Air, but there are very few personnel trained and experienced to service NATO's needs. The Space warrior must be knowledgeable in all Space mission

areas, how Space can support each component, the strategic objectives of the mission, which tactics to employ, what commercial and national capabilities exist, and how to employ them. Therefore, Space expertise must be developed. This includes addressing establishing a core of specialists, developing education and training, and providing the necessary command, control and equipment to perform their mission. The JAPCC suggests a 'people first' approach to developing NATO Space Power.

To protect one's interests, there must be offensive and defensive capabilities, no matter what the domain, and Space is no different. The weaponisation of Space has been hotly debated for some years. It is vital to mitigate the creation of Space debris and through transparency and cooperation, to ensure freedom of access to Space for all nations. For the foreseeable future, there is no need for NATO to have access to offensive weapons in Space. However, terrestrial capabilities that can deceive, deny, or degrade adversary Space capabilities are a viable option.

NATO could improve its defensive strategy. For the Space segment, satellites could be further hardened against radiation, lasers, jamming etc. However, satellites are limited in size and weight due to constraints by existing launch systems. Robust defensive measures mean additional weight, cost and less room for the mission payload. A more viable solution is improving security of the ground segment and user segment. This includes increasingly robust encryption and network security measures. Another alternative is the use of many small satellites. Small satellites allow more flexibility, defence in depth, dispersal of assets, and shared risk between the Nations.

Most importantly, political influence should be better focused. There is no Space traffic management or international Space police force. We must maintain order, protect assets, ensure access and enforce treaties, laws and regulations. What should NATO's role be? Can we keep adversaries out of the Space club? Probably not. Would a better Space security strategy be making many more nations interdependent on the same Space systems, thereby making them less likely to attack those systems? We should be prepared to answer how NATO would respond to an attack on its Space capabilities, what national caveats there would be, and define the Rules of Engagement.

'The need for military capability to protect the growing level of interests in space will only increase with time.'

A key part of any Space security strategy is to deter an attack on Space systems. One of the most vital parts of deterrence is attribution of actions. Space Situational Awareness (SpSA) is needed to characterise actions. SpSA is the ability to determine what actions are taking place, and to provide enough information for decision making. In Space, how do you prove hostile intent versus damage from a meteorite? Since most satellite activities are classified, what can you share with the public? NATO does not require Space surveillance systems, it requires access to a Space common operating picture for the systems it uses and that are of interest to its member nations.

The Road Ahead

The US deems assured access to Space vitally important and recently established a Space Protection Program (SPP). The program was stood up on 31 March 2008, to 'preserve national security Space effects through an integrated strategy and to articulate vulnerabilities, assess threat impacts, identify options, and recommend solutions leading to comprehensive Space protection capabilities.'[8] Lt Col Patrick Brown at the SPP stated that 'the US [NATO implied for this article] must apply innovative thinking to exploit the inherent advantages of the Space medium and enhance Space capabilities to help solve the security challenges we are faced with today and in the future.'[9] The JAPCC couldn't agree more and have advocated for the establishment of a Space Office in NATO. This office could be established at SHAPE or NATO HQ and include assuring the Space domain as one of its responsibilities.

NATO can certainly better utilise Space capabilities, and it has a long way to go in order to provide assured access to those capabilities. Having Space services denied to civilians, industry, government or the military would cause severe disruption and negatively impact global security and stability. The need for military capability to protect the growing level of interests in Space will only increase with time. We can no longer afford not to address this pressing issue. NATO, it's time to take the lead and move forward! ■

1. Terry Everett, 'Work Worth Doing,' HQ AFAPC *High Frontier*, Vol 5, Number 1, p. 3
2. LOC: used for movement of trade, materiel, supplies, personnel, spacecraft, electromagnetic transmissions and some military effects. John Klein, p 51.
3. US Joint Publication 3–14 Space Operations, 6 January 2009.
4. The Starfish Prime was the first successful high altitude nuclear weapon test, accomplished in 1962. 3 satellites in LEO were disabled by EMP and the man-made radiation belts from the test eventually destroyed one-third (7) of all satellites in low orbit. Accessed on 15 Aug 2009 at http://en.wikipedia.org/wiki/Starfish_Prime.
5. John Klein, *Space Warfare – Strategy, Principles and Policy*, p 151.
6. Nina-Louisa Remuss, 'The Need to Counter Space Terrorism – A European Perspective,' European Space Policy Institute (ESPI) *ESPI Perspectives*, Number 17.
7. Unmanned Aerial System (UAS)
8. Dr Andrew Palowitch, 'First Steps Towards a Strategic Position,' HQ AFAPC *High Frontier*, Vol 5, Number 1, p. 7. The SPP is jointly led by Air Force Space Command (AFSPC) and the National Reconnaissance Office (NRO).
9. Patrick Brown, 'Rescuing Apollo: Building Consensus toward a National Strategy for Space,' HQ AFSPC, *High Frontier* Vol 4, Number 4, p. 38.

Automation Airmanship: Optimising Aircrew Performance in a Modern Air Force

Lieutenant Colonel Colin Keiver, CAN AF, Canadian Forces Command & Staff College

The quality of the box matters little. Success depends upon the man who sits in it.[1]

Baron Manfred von Richtofen, 'The Red Baron,' 1918

On the night of July 12, 2006, the crew of Tusker 914, a CH149 Cormorant search and rescue helicopter, was about to conduct practice night boat hoists with the Canadian Coast Guard. Tragically, while approaching the hover, the aircraft impacted the water and three crewmembers lost their lives. The causes of this accident were directly related to the pilots' use of aircraft automation and loss of situational awareness. In short, the loss of Tusker 914 was directly attributed to human factors.[2]

This accident served as a catalyst for a deliberate effort to assess the ability of the Canadian Forces (CF) to safely and effectively operate modern, highly automated and integrated aircraft. Created in conjunction with the development of the 1st Canadian Air Division Automation Philosophy, the Automation Policy and Planning Development (APPD) Project was initiated in 2008 and its findings, conclusions and recommendations have now been accepted.[3] At its base level, the APPD Project is primarily concerned with developing a robust human factors programme that optimises aircrew performance to fully exploit new technologies, best described as 'automation airmanship.' Achieving optimum levels of performance is entirely dependent upon the ability of Canada to focus efforts aimed at delivering automation airmanship, while instituting organisational and cultural change.

The APPD Project and its Lessons

The APPD Project observed three areas as being common to high performing aircrew:

- Clear aircrew automation task definition throughout all flight documentation, supported by clearly defined automation performance measures and standards.
- Flight procedures and documentation that support the development and maintenance of a robust automation culture.
- Aviator flight discipline incorporated into procedures and automation policy.

The analysis showed that Canadian aircrew on aircraft procured and operated on the basis of civil-compliance certification, such as the Airbus A310, performed at a high level due to the reliance on industry operating methodologies and documentation. The analysis also revealed that overall aviator experience is not necessarily an accurate indicator of flight crew performance. One of the most effective crews observed consisted of two recent graduates of the new multi-engine syllabus that fully incorporates industry best practice in automated training. The exposure to appropriate automation training and the measurement of automation performance enabled this relatively inexperienced crew to perform at a high level. The crews that did not exhibit a high level of automated flight performance had at least one of the three identified areas missing. In determining where the weaknesses resided, it became necessary to consider not only aircrew in-flight performance, but all inputs that directly or indirectly contributed to that performance. The scope of the findings within the APPD Report[4] is thus significant.

> 'The level of performance expected from aircrew in modern aircraft is neither defined nor measured.'

The APPD Project concluded that the current regulatory structure does not contain policy identified within industry, both civil and military, that supports the operation of modern aircraft. The Report also concluded that flight procedures and documents currently in use within the Air Force did not adequately support the Automation Philosophy. Critical documents, such as aircraft operating instructions and checklists, reflect a wide variety of guidance, in some cases contradicting themselves within the same fleet. All differ in terms of content, language, terminology and organisation. Deliberate effort is, therefore, required to standardise and harmonize flight procedures and documentation within and across all fleets, while concurrently incorporating the changes to documents and procedures mandated by the introduction of new technologies.

The APPD analysis revealed that automation performance measures and standards do not exist in the Air Force and as a result, aircrew performance in all areas of training and operations is negatively affected. The level of performance expected from aircrew in modern aircraft is neither defined nor measured. This also directly impacts the ability of the Air Force to create a common culture and language that permits it to efficiently describe and communicate issues associated with automated flight performance.

It was concluded that current Air Force aircrew training and evaluation methods are not capable of achieving or sustaining the Automation Philosophy. Instead, they rely on individual proficiency in performing technical skills attained through a prescribed 'hours' based programme, with most training delivered through single-pilot, manoeuvres-based events. Consequently, many of the skills required to safely fly complex multi-crew aircraft are neither defined in current training guidance nor are they evaluated, representing an incomplete

A CH149 Cormorant search and rescue helicopter (much like Tusker 914) conducting hoists with the Canadian Coast Guard.

assessment of the crew's ability to operate the aircraft while failing to promote the close coordination of tasks between all crew members in all phases of flight.[5]

The reliance on legacy training and evaluation criteria is also manifested in the use of simulation. The APPD Report describes the current attitude towards simulation as 'Sim-Phobic.'[6] In many fleets, Canada already possesses the simulators required to implement the Automation Philosophy, but is failing to use them in this manner. In particular, it fails to recognise that replicating the warnings, cautions and advisories associated with the failure of multiple interconnected subsystems on modern aircraft, and the required crew reactions/interactions to effectively deal with them, can only be done in a simulator.

Aircrew performance on civil-based aircraft is higher due to reliance on industry methods/documentation.

The analysis conducted by the APPD Project included the flight safety system and an examination of flight safety occurrences since 1998. One of the more noteworthy of investigation reports examined was that for another CH149 Cormorant incident in 2004; the human factors and automation causes were virtually identical to that of Tusker 914. In both cases, the automated systems on the aircraft were used inappropriately, resulting in a failure that was further exacerbated by the crew's reaction to it. The APPD Project assessed the flight safety system as challenged to identify and report automation and human factors related issues, due to the absence of both automation and Human Performance in Military Aviation (HPMA) performance measures and standards.

The APPD Project concluded that the Air Force had evolved into strong vertical, fleet-based organisations – 'stovepipes of excellence' – with little or no transfer of information between them. Consequently, the Air Force was not achieving the levels of standardisation and synchronization that would allow it to implement and sustain the Automation Philosophy. Instead, it was expending effort on basic, common problems with multiple independent solutions.

Canary in the Coal Mine

Although the Air Force had invested significant time and effort in the HPMA Programme, the APPD Project found little evidence of its use in operations. Two fundamental reasons were identified.

First, the Air Force had not created HPMA performance measures and standards. Aircrew are educated in HPMA concepts, but are neither trained to use them nor evaluated on their use. This is reinforced by the culture of single-pilot training and evaluation.

Secondly, HPMA concepts have not been integrated into Air Force operating procedures. HPMA-driven aircraft operating procedures can have powerful positive results for disciplined aircrew, and even the 'most difficult HPMA converts' can perform at very high levels if afforded well designed operating procedures. The relative failure of the HPMA Programme provides a valuable lesson about cultural change. Regardless of good intentions and the efforts of dedicated staff, meaningful change in behaviour on the flight deck will only occur after first legislating it through orders and regulations, then through follow-on assessment. The shortcomings in the successful implementation of the HPMA Programme must be learned and applied to the development of an automated culture if it is to be successful.

Real Causes of Tusker 914

While the most common explanation for an accident is operator error, a more frequent cause is faulty design of the sociotechnical system (that is, people and technology in combination) in which the operator is embedded.[7]

Marc Gerstein

Significantly, almost all of the findings of the APPD Project were described in the Tusker 914 Flight Safety Investigation Report. Cormorant pilots were being trained

using single-pilot, manoeuvres-based methodologies; HPMA and automation performance measures were non-existent; standardisation was an issue; and the changes required in training and operating methodologies as a result of the introduction of new technologies had not been captured.[8]

The Air Force has struggled with systemic problems that have impeded change efforts and resulted in ad-hoc responses to change requirements. These have impacted its ability to formulate policy and deal effectively with recent challenges.[9] The loss of Tusker 914 is a manifestation of these systemic problems. The 'Swiss Cheese Model' of error, developed by James Reason, considers human performance within the broader context of the system in which the humans operate. Simply put, if the slices of cheese represent the layers of defence against error, the holes represent potential shortcomings in each layer. Accidents are prevented when the organisation is able to prevent the holes from lining up.[10] The systemic failure to deliver policy, procedures and training relevant to automated aircraft, coupled with the weaknesses in the HPMA Programme, left the crew of Tusker 914 with only basic aircraft handling skills as a defence. When those were used in a manner incompatible with the automation, the 'holes' aligned and the accident was the result.

The Solution

The Air Force must develop and implement a robust culture of automation airmanship to optimise aircrew performance in the 21st century. It must be a standardised, disciplined and integrated operating strategy that uses all available resources on an aircraft, including the crew and aircraft systems, and integrates traditional technical, automation and human factors skillsets to achieve optimum situational awareness and mission effectiveness. It needs to facilitate responsiveness to, and exploitation of, advances in technology, operations and training methodologies. All this will demand the deliberate, coordinated and systematic development of policies and procedures to support the Automation Philosophy.

The 'Swiss Cheese Model' of Error

'Preventing similar accidents by the attainment of an Automation Philosophy will require a deliberate effort …'

As identified in the APPD Report, the critical first step in developing automation airmanship is to address current Air Force command and control relationships. This mandates the creation of an Air Force standards organisation that is able to lead, advocate and coordinate the various components essential to the development of automation airmanship, while promoting the development of a common language across functional areas. The desired level of automation airmanship across the Air Force is readily achievable provided that sufficient focus is applied.

The failings in automation airmanship that directly contributed to the loss of Tusker 914 were the result of systemic failings. Preventing similar accidents by the attainment of an Automation Philosophy will require a deliberate effort to deliver policies and procedures. While this article focused primarily on changing Canadian Air Force culture, pursuit of this Automation Philosophy would allow all NATO Air Forces to fully exploit existing and planned technical and human potential. The message of the Red Baron from over 90 years ago rings as true today as it did then. Air Forces must continue to develop a high level of aircrew performance if they are to safely and effectively exploit the capabilities of the 'box' that aircrew find themselves sitting in. ■

1. Manfred von Richtofen, *The Red Fighter Pilot* translated by J. Ellis Barker (London, UK: 1918) Chapter 12. Available online at http://www.richthofen.com/index.htm (accessed January 21, 2008). Originally published as *Der Rote Kampfflieger* (1917).
2. Directorate of Flight Safety, *Flight Safety Investigation Report 1010-149914* (Ottawa: Directorate of Flight Safety, 22 January 2008).
3. A comprehensive summary of the APPD Project has been published in the Canadian Air Force Journal, Spring 2009, Vol. 2, No. 2 and can be obtained at www.airforce.forces.gc.ca/cfawc/eLibrary/Journal
4. R. D. Kobierski and C. Stickney, *Automation Analysis Report* (Winnipeg, MB: Air Force Automation Policy and Planning Development Project, 29 Sep 08). Prepared for DND under PWGSC Contract No. W8485-0-XKCF/01/BQ. Available at www.astraproject.ca
5. Ibid, 3.26.
6. Ibid.
7. Marc Gerstein, *Flirting with Disaster: Why Accidents are Rarely Accidental* (New York: Sterling Publishing, 2008), 102.
8. Ibid.
9. Allan English, *Command and Control of Canadian Aerospace Forces: Conceptual Foundations* (Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2008), 80.
10. David O'Hare, 'Aeronautical Decision Making: Metaphors, Models, and Methods,' in *Principles and Practice of Aviation Psychology*, eds. Pamela S. Tang and Michael A. Vidulich (Mahwah, NJ: Lawrence Erlbaum Associates, 2003), 228–230.

Law and the Aviator:
Legal Aspects of the Air Environment

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No man is above the law and no man is below it: nor do we ask any man's permission when we ask him to obey it.

Theodore Roosevelt

It is axiomatic in addressing the multiple complex scenarios that NATO Air Power currently faces, whether over NATO territory or on Expeditionary Operations, that the achievement and maintenance of a favourable air environment is a prerequisite. Not only will commanders need to establish operational freedom, they will also need to work towards the stabilisation of ungoverned space and begin the process of developing an acceptable exit strategy that acknowledges the role of civil aviation in state-building. Among the myriad factors that will contribute to the achievement of a favourable air environment and consequential mission success, the importance of legal considerations, and in particular the legality of any proposed air activity, attracts less attention than it deserves. Furthermore, the potential legal implications for friendly and neutral states whose national airspace abuts a No Fly Zone (NFZ), or who are affected by Air Policing operations either in their own national airspace or an adjacent country's, warrant detailed consideration.

The aim of this article is to highlight the relevant law associated with achieving a favourable air environment, and thereby to encourage a dialogue on the associated legal challenges. Only by considering these issues at the earliest stage of campaign planning can we ensure their potential to impact on mission success is addressed and resolved.

The Basics

Unsurprisingly, the law as it relates to airspace is largely derived, at least in terms of its principles, from the Law of the Sea (LOS). The first attempt to codify the rules concerning aircraft overflight and transit passage took place at the Chicago Conference on International Civil Aviation in 1944; the resultant articulation of rules became known as the 'Chicago Convention'. The Chicago Convention reflects what is known as 'customary international law', with airspace being classified as either national airspace – defined as that over the land, internal waters, archipelagic waters, and territorial seas of a nation – or international airspace. International airspace is defined by the Chicago Convention as that which sits above contiguous zones, exclusive economic zones, the high seas, and territory not subject to the sovereignty of any nation: Antarctica is the most obvious example of the latter. The overall effect of this bi-categorisation of airspace is to establish a right of overflight of international straits and archipelagic sea lanes, whilst conferring on each nation complete and exclusive sovereignty over its national airspace.

Aircraft

The Chicago Convention differentiates between two specific categories of aircraft – 'state aircraft' (military and police/coastguard) and 'civil aircraft' (everything else). While the Convention applies to civil aircraft *in toto*, it does not provide the same privilege to state aircraft. For example, under the terms of the Convention, state aircraft are not permitted to fly over another state's territory without prior authorisation, and in issuing regulations for state aircraft, all states must have 'due regard' for the safety of the navigation of civil aircraft.

Airspace

Subject to certain exceptions,[1] the aircraft of all nations, whether state or civil, are free to operate in international airspace without interference by other nations. Aircraft are, therefore, free to operate in international airspace without interference from coastal nation authorities; this allows aircraft to engage in 'flight operations,' including ordnance testing and firing, surveillance and intelligence gathering, and support of other naval activities. The key caveat is that all activities of this sort must take into account the rights of other nations and the safety of other aircraft and maritime vessels.

Navigation Rights

In contrast to the right of innocent passage of vessels through territorial seas or archipelagic waters, no such right exists for aircraft travelling through national airspace over such waters. Consequently, unless party to an international agreement to the contrary, all nations have complete discretion in regulating or prohibiting flights within their national airspace (as opposed to a Flight Information Region), with the sole exceptions of over-flight of international straits pursuant to transit passage, and archipelagic sea lanes pursuant to archipelagic sea lanes passage. Foreign aircraft wishing to enter national airspace must identify themselves, seek or confirm permission to land or to transit, and must obey all reasonable orders to land, turn back, or fly a prescribed course and/or altitude.

In accordance with the Chicago Convention, civil aircraft in distress are entitled to special consideration and should be allowed entry and emergency landing rights. Customary international law recognises that foreign state aircraft in distress are similarly entitled to enter national airspace and to make emergency landings without prior permission. The crew of such aircraft are entitled to depart expeditiously and the aircraft must be returned. While on the ground under such circumstances, state aircraft are entitled to immunity from the jurisdiction of the courts of the State where they have landed. This, however, does not preclude a state from examining the aircraft, as was the case with a US Navy EP-3 that made a forced landing on Hainan Island in China. The incident arose from a mid-air collision between

EP-3 involved in Hainan Island incident after it was returned to the US.

the EP-3 and a Chinese interceptor, which resulted in an international dispute known as the Hainan Island Incident. The US aircraft was operating about 110 km away from Hainan Island, but within an Exclusive Economic Zone (EEZ) derived from the UN 1982 LOS Convention.[2] China interprets the LOS Convention as allowing it to preclude other nations' military operations within the EEZ, while the USA maintains that the Convention grants free navigation for all countries' aircraft and ships, including military.

Outer Space

The upper limit of airspace is the highest altitude at which an aircraft can fly and below the lowest perigree[3] of an Earth satellite orbit. Beyond this is outer space.[4] All nations enjoy a freedom of equal access to outer space and none may appropriate it to its national airspace or to its exclusive use.

International Airspace

Throughout the world, states and defence pacts operate Air Defence Identification Zones (ADIZs) or Air Policing Areas (APAs). ADIZs and APAs often extend hundreds of miles beyond national airspace into international airspace. These ADIZs and APAs do not extend national airspace, but simply serve as an area for identification or as a means of early warning to mitigate the speed of aircraft and air launched weapons. The

> 'The question remains whether NATO interests would be best served by establishing a specific international forum to adjudicate on air law as it applies to military operations …'

legality of an ADIZ or APA is based on Article 1 of the Chicago Convention and Article 51 of the UN Charter.

On occasion, states can temporarily declare areas of international airspace to be 'warning zones' through a Notice to Airmen (NOTAM). Such notices are cautionary rather than mandatory, however, and do not provide the power to prohibit another state or civil aircraft from flying through that airspace. That said, any civil aircraft operator failing to comply with a NOTAM risks voiding its insurance and, accordingly, will usually observe them. During conflict, states may impose War Zone Restricted Areas (WZRA) or NFZs: both may include national and international airspace. The legal basis for a WZRA or NFZ is either customary international law (the right of self defence) or an appropriate United Nations Security Council Resolution and their creation must be promulgated effectively.

Importantly, the creation of a WZRA or NFZ does not of itself permit the engagement of any state or civil aircraft; any such engagement must be in accordance with the Law of Armed Conflict, particularly that the aircraft in question is a legitimate military objective and that any engagement is proportionate. The legal status of restricted air space will always be important for NATO. After Iraq was forced from Kuwait, Saddam Hussein focused his attention on the revolt of the Kurds in the North and the Marsh Arabs in the South. On 8 Apr 91, the UN agreed to establish a safe haven for the Kurds and 2 days later the first NFZ was created. The

Challenges may arise from deliberate incursions into a state's national airspace.

UN resolution provided the legal argument for the imposition of the NFZ. In Aug 92, the Southern NFZ was created without UN authorisation and its legitimacy was a source of controversy throughout the conflict.

Enforcing Access

If maritime nations appear to acquiesce in excessive maritime claims or, on the contrary, do not exercise their rights actively in the face of constraints on international navigation and over-flight, those claims and constraints may, in time, be considered to have been accepted by the international community as reflecting the practice of nations and as binding upon all users of the seas and airspace lying immediately above it. Consequently, it is incumbent upon maritime nations to protest diplomatically all excessive claims of coastal nations and to exercise their navigation and over-flight rights in the face of such claims.

The US Freedom of Navigation Program challenges claims through diplomatic protests by the Department of State and by operational assertions by US Armed Forces. US assertions are designed to be politically neutral, as well as non-provocative, and have encouraged nations to amend their claims and bring their practices into conformity with the LOS Convention. An International Tribunal for the LOS was set-up in Hamburg, Germany on 18 Oct 96 to deal with disputes arising out of the interpretation and application of the LOS Convention. Similarly, although seldom used and never for 'state aircraft', the International Civil Aviation Organisation (ICAO) Council has quasi-judicial power to settle disputes under the Chicago Convention. Whether NATO's aims and goals would be served by this or a bespoke forum for the resolution of air law issues arising from the application of Air Power is a key question.

The establishment of a favourable air environment will necessitate the successful combination of a wide variety of distinct, but interdependent, factors. Among these, establishing the legality of any proposed course of action and gaining a clear understanding of the attendant legal implications will be essential. Furthermore, the consequential implications for those states and actors not immediately affected, but who may wish to assert their rights or to challenge the claims of others, will also need to be taken into account. Challenges may, for example, arise from: deliberate incursions into a state's national airspace; the denial of access to international airspace by a state in contravention of customary international law; the basis upon which WZRAs or NFZs are imposed; alleging the failure of a state or other entity to properly promulgate the creation of such restrictions; or the legal structures supporting the establishment of Air Policing.

This article has not set out to provide a detailed review of the law in this area. Instead, it has sought to encourage discussion by highlighting that the establishment of a favourable air environment is to a considerable extent reliant on a complex and interrelated set of customary and international laws, that these laws are articulated and applied through various treaties and conventions, and that mission success can only be achieved by acknowledging and adhering to them. The question remains whether NATO interests would be best served by establishing a specific international forum to adjudicate on air law as it applies to military operations: it is clear that the utility of the LOS Tribunal is reflected in states' regular recourse to its adjudication of disputes unlike the ICAO Council. It also seems likely that a bespoke body could usefully be employed on air law related issues involving 'state aircraft'. ■

1. The principal exceptions are in respect of treaties or other international agreements between nations that limit this freedom.
2. The 1982 LOS Convention, which replaced a number of older treaties, defined the rights and responsibilities of nations in their use of the world's oceans.
3. 'Perigree' is defined as the point at which an object in orbit around the Earth makes its closest approach to the Earth.
4. Outer space is defined here as the region of space immediately beyond the Earth's atmosphere.


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Governance of NATO Common Air and Space Assets

Lieutenant Colonel Huseyin Duman,
TUR AF, JAPCC

Although most of NATO's Air & Space forces are maintained under National auspices, there are a growing number of Alliance assets that are pooled under several multinational arrangements. In this article these assets are referred to as NATO's Common A&S Assets. The common assets not only provide alternative solutions to fill capability gaps, but also help Member Nations save money by avoiding unnecessary overlaps in capabilities. As cooperative initiatives fulfil the capability gaps of individual Nations, the Alliance might also gain access to the new military capabilities.

There are many common assets in NATO, however, it is interesting to note that most are related to Air & Space. At the top end, there is the ACCS[1], including (D)CAOC[2], CARS[3] and (D)ARS[4] structures, which will soon be fully integrated into the NATO Command Structure. Elsewhere, we have an impressive array of assets, from the NAEW&C Force to air transport and, potentially, rotary wing elements under varying degrees of command, control and governance. To this list, Alliance Ground Surveillance (AGS) will soon be added.

Common A&S assets are usually established by foundation documents such as a Memorandum of Understanding (MoU) or similar types of agreement. These foundation documents define the level of governance, which covers the collection of mechanisms that allow the organisation to make decisions. However, the diversity and complexity of the governance models may result in inefficiencies or even unavailability when such assets are most needed for NATO operations. There is a need to explore the governance models of the common assets, examine the various mechanisms in place for their use and determine how they might be optimised for NATO's collective benefit. There are also advantages in developing standardised templates, adjustable to context, in order to improve operational Air Commanders' access to these assets.

This article identifies the important aspects of establishment and employment of the common assets and then explores the governance conundrum. Such issues will be addressed by defining tiers of commonality and by grouping assets according to their attributes. Using this methodology, it may be easier to define commonalities, formulate requirements and provide recommendations for the future.

Establishment of Common Assets

There are several factors that influence the decision to establish a common asset. They include similarity of capability requirements, burden sharing and return on investment (ROI).

The need for a multinational approach may arise from NATO Force Goals or national requirements. If the specific capability requirements of nations are similar, it may be easier to initiate a multinational acquisition programme and establish a common asset. Availability of a commercial or military off-the-shelf capability may also accelerate the acquisition process.

Another driver is burden sharing. Establishing a common asset gives more nations the opportunity to acquire a capability that they may not be able to afford individually. That said, it is not surprising that occasionally some of the Sponsoring Nations may need to take a bigger share of the cost in order to allow smaller nations to join the programme.

The participation of a Member Nation may also be driven by potential ROI or other industrial benefits. As the investment is dispersed over more countries, more nations are likely to become involved in these programmes. Finally, participation in these programmes gives nations influence over their use – as we will see, this is a double-edged sword.

Strategic trends and estimates on defence budgets show that the number of common assets in NATO will increase in the future. As the number of common assets grows, the governance issues become increasingly important for the Alliance.

Employment of Common A&S Assets

Despite many hurdles, one might think that acquisition of NATO common A&S assets is a good indication of the solidarity between the Member States. However, the establishment and peacetime operation of a common asset is not an end in itself. A common asset must also be able to provide effective support to all types of NATO operations. More recently, the cumbersome and lengthy process of deploying

'One way to address these problems could be by focusing on governance issues to classify the common assets.'

NATO E-3A aircraft to support the NATO International Security Assistance Force (ISAF) mission has increased concerns over the ready availability of common assets when they are most needed.

Most of problems encountered in the governance of the common assets are closely linked to the foundation documents. The foundation documents usually require consensus among Sponsoring Nations for the employment of the common assets in NATO operations. However, Member Nations may have a different perception with respect to the required involvement, especially in non-Article V situations. Additional time and effort may be required to reach a common policy against an emerging crisis situation. Even if the Members agree to act against an upcoming threat, some of the Members might decline to contribute to the force generation process. Additionally, the constitution of a Member State might impose some constraints on the number and types of military personnel, which can be deployed outside the country, as well as mission types.

Clearly, there is a need to address these problems in order to optimise the employment of common assets for NATO's collective benefit. One way to address these problems could be by focusing on governance issues to classify the common assets. Diversity and complexity of the governance models lead us to define tiers of commonality.

Tiers of Commonality

In order to classify common assets according to their attributes, several criteria may be identified, such as community of interest, foundation document, and cost sharing. Based on these criteria, several tiers of commonality could be suggested:

Tier-I is the group of common A&S assets like (D)CAOC, CARS and (D)ARS that are established by NATO Capability Packages. The mission systems are procured and operated by common funding of the NATO Alliance. These assets are part of the NATO Command Structure and they are under direct control of NATO Commanders. Therefore, they are available for support to all NATO operations.

Although Tier-I assets provide NATO with the highest level of governance, some of the Member States may still apply National caveats on the deployment of their own personnel and equipment assigned to those assets. In this case, these common assets may still accomplish the mission, but possibly with reduced efficiency.

Tier-II is the group of common A&S assets, including NAEW and AGS, which are established by Multinational MOUs. The mission systems are procured and operated by the Sponsoring Nations and the infrastructure is supported by the NATO Security Investment Programme (NSIP). Because of the critical combat support capabilities of the common A&S assets at Tier-II, availability of those assets to NATO operations remains a significant issue.

If it is possible to conduct the mission without deployment, the decision making process may be less complicated. However, participation to a NATO operation in a non-Article V situation brings additional cost to the Sponsoring Nations. In order to improve the access of NATO Commanders to these assets at Tier-II, a new governance model might be needed for sharing additional deployment and sustainment costs through common funding.

Tier-III is the group of common A&S assets which includes the Strategic Airlift Capability (SAC), European Expeditionary Air Wing (EEAW), Movement Coordination Centre Europe (MCCE) and European Air Transport Command (EATC). These were all established by Multinational Agreements, some of which may also include non-NATO member nations. The mission systems are procured and operated by the Sponsoring Nations.

Most of the common assets at Tier-III provide direct support to the individual Nations and support the deployment and sustainment of their National contributions to a NATO operation. Although still applicable, the National caveats would not have the same level of impact as the common assets at Tier-II. Moreover, the governance models of these assets may be more flexible in order to extend their support to non-member states as well as NATO Nations.

Tier-IV is the group of common A&S assets that includes the Czech Chemical Biological Radiological Nuclear (CBRN) units and other niche capabilities which are normally under National auspices, but may support a NATO operation when committed by the owner Nation. They are capable of making a serious contribution to the support of NATO operations.

Niche capabilities may be considered as a more flexible way of fulfilling the capability gaps in NATO than other multinational approaches. The NATO Members continue to invest in combat systems modernisation programmes, while the capability gaps in NATO Defence Planning are more focused on the supporting functions of Air Power. Member Nations that have very limited resources might be encouraged to invest in niche capabilities in support functions. Such initiatives would not only fill some of the capability gaps, but

Tier-I	NATO Owned-Common Funded
Tier-II	Multinational MoU Sponsors
Tier-III	Multinational Cooperation
Tier-IV	Niche Capabilities
Tier-V	Contracting/Outsourcing

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may also improve the visibility and influence of those new Members to the Alliance.

Tier-V is the group of common A&S assets which includes Strategic Airlift Interim Solution (SALIS) and other NATO Maintenance & Supply Agency (NAMSA) contracts in support of NATO missions. Where such outsourcing agreements provide support to multiple Nations, they may also be considered common assets.

Contracts in ISAF are facilitated by NAMSA and provide critical support to many members, in turn helping reduce the logistics footprint in the deployment and sustainment of forces in Afghanistan.

The governance concerns for the common assets at Tier-V may still urge Nations to maintain some organic capabilities in support functions against possible unavailability of contracting support in a high threat environment.

Way Ahead

Although it is not possible to draw clear lines between all the common A&S assets in NATO, the tiers of commonality defined in this article may highlight some of the governance issues at each tier.

Initial study reveals that at each tier there are several issues to be considered. The common assets at Tier-I provide NATO Commanders with more flexibility in terms of governance compared to the other assets. However, the deployment of Tier-II type common assets for non-Article V operations may require common funding, since they are indispensible for most types of NATO operations. While the common assets at Tier-III provide a good balance between governance and availability, the NATO Alliance may find it more cost effective to invest in Tier-IV type niche capabilities.

In addition, a thorough examination of the foundation documents may also reveal a need for the establishment of a high level NATO body for common A&S assets, which could provide strategic oversight and guidance.

Indeed, it might be considered ironic that the environment with a surfeit of common assets – Air & Space – is the one area within the Alliance without an obvious strategic focus. The highest levels of command in Air & Space reside at CC Air – higher level tactical commanders. Given the operational and strategic nature of Air & Space, this might also be a good starting point for solving the governance challenge for NATO's common Air & Space assets.

Conclusion

This article has (purposely) provided more questions than answers. It is the JAPCC's intention to further progress this topic over the remainder of 2009 and it will be a focal point of our upcoming Conference. If we have whetted your appetite, please contact the author.

(ACCS, (D)CAOC)	Tier-I
(NAEW, AGS)	Tier-II
(SAC, EEAW, MCCE, EATC)	Tier-III
(CZ CBRN)	Tier-IV
(SALIS, NAMSA Contracts)	Tier-V

1. Air Command and Control System
2. Deployable Combined Air Operations Centre
3. CARS is the abbreviation of 4 C2 elements: **C**ombined Air Operations Centre (CAOC), **A**ir Control Centre (ACC), **R**ecognised Air Production Centre (RPC) and **S**ensor Fusion Post (SFP).
4. (D)ARS is the deployable version of 3 elements of CARS: ACC, RPC and SFP.

NEWS

UAS CONOPS

The JAPCC has recently completed a project entitled *Strategic Concept of Operations for Unmanned Aircraft Systems (UAS) in NATO*. This document provides the NATO vision for the operation, integration, and interoperability of UAS through 2025. It describes a capabilities-based approach to UAS, which enhances joint guidance for optimum UAS employment across a full range of military operations. Additionally, this document should assist with the development of Joint/Coalition, Service doctrine, CONOPS, and operational plans.

This project has recently been presented to the Joint UAS Panel for comment and consideration and includes the following areas of examination:

UAS Family of Systems – A detailed discussion of the UAS family of systems is included and describes key terms and related employment concepts. UAS components (aircraft, payload, communications, control, support, and human aspects) are indentified and discussed. Also, NATO UAS categories are defined and an overview of UAS capabilities is provided.

Planning and Employment Considerations – A list of what we believe to be the most important issues regarding UAS employment in the near term is presented as well as a discussion of the specific challenges faced by Joint Planners.

UAS Support to Joint or Coalition Force Operations – Top-level discussion for optimised employment of UAS based on current doctrine and near-to mid-term concepts is conducted.

Countering Air Orientated Terrorism Forum

JAPCC is planning to host a Countering Air Orientated Terrorism (CAOT) Forum over the period 24–25 November 2009. The intention is to bring together the Defence Against Terrorism (DAT) community including military, intelligence, law enforcement, academia and industry to discuss the current threat of terrorism in the air domain. The focus of the event will be on emerging threats using improvised weapons systems not yet deployed by the terrorist, and which, if deployed, would be difficult to counter using conventional means. A draft JAPCC paper will be issued as read-ahead material nearer to the event and a central component of the forum will be discussion focussing on how the terrorist could attack a major public event from the air in order to capture world media attention. Point of contact for the event is Wg Cdr Jez Parkinson, reachable on JAPCC extension 2252 or via e-mail at parkinson@japcc.de

The Contribution of Air Power to ISAF's C-IED Fight

Following engagement earlier this year with Allied Joint Force Command (JFC) Headquarters Brunssum, the JAPCC is conducting a review of the use of Air Power in ISAF Counter-Improvised Explosive Device (C-IED) operations in Afghanistan. This work aims to help ensure that current Air capabilities are used to optimum effect and to consider whether additional capabilities or capacity could make a difference to the fight.

The use of IEDs by insurgents has become a key characteristic of the asymmetric threat faced by ISAF personnel, Afghan National Security Forces (ANSF) and the Afghan people: indeed, IEDs are at present the single most significant cause of coalition, ANSF and civilian casualties. Countering this threat has been identified as one of ISAF's highest priorities, and protection of the civil population is at the heart of COMISAF's recent Counterinsurgency Guidance.

The approach being adopted by the JAPCC project team reflects current NATO doctrine, which advocates a combined, multi-layered strategy that concurrently seeks to defeat the IED network (or 'system'), to defeat the device

itself, and to provide specific training and education. A particular challenge is to establish the extent to which Air Power can be used to engage the constituent elements of IED systems, such systems being inherently non-hierarchical and non-linear, and characterised by decentralised command and control. A wide range of JAPCC subject matter experts are involved in this project, including specialists in Intelligence, ISR, combat operations, force protection, and policy, concepts and development. Additional support is being provided by JFC HQ Brunssum, CC-Air Ramstein and HQ ISAF, as well as by individuals and organisations in Alliance Nations. Comments on, and contributions to this work are invited, in the first instance to john@japcc.de

Strategic Look at Air-Land Integration

The JAPCC has recently been asked to take a strategic look at Air-Land Integration as a larger part of the CAS/FAC programme of work. Among other things, this study will include the following: an examination and further development of Joint Fires Observers (JFO) for NATO, ways to improve situational awareness and control mechanisms of Forward Air Controllers (FAC) in Type 2 and 3 terminal attack controls, and issues concerning land component commander integration and coordination with air assets and joint ISR/targeting. The context of this examination will be detailed analysis of issues, given lessons learned by ISAF in Afghanistan, and will discuss both current and future assets and capabilities. As a result, recommended focus areas for NATO will be identified. As the JAPCC embarks on this extensive undertaking, we will undoubtedly identify additional issues and areas worthy of in-depth examination.

Space News

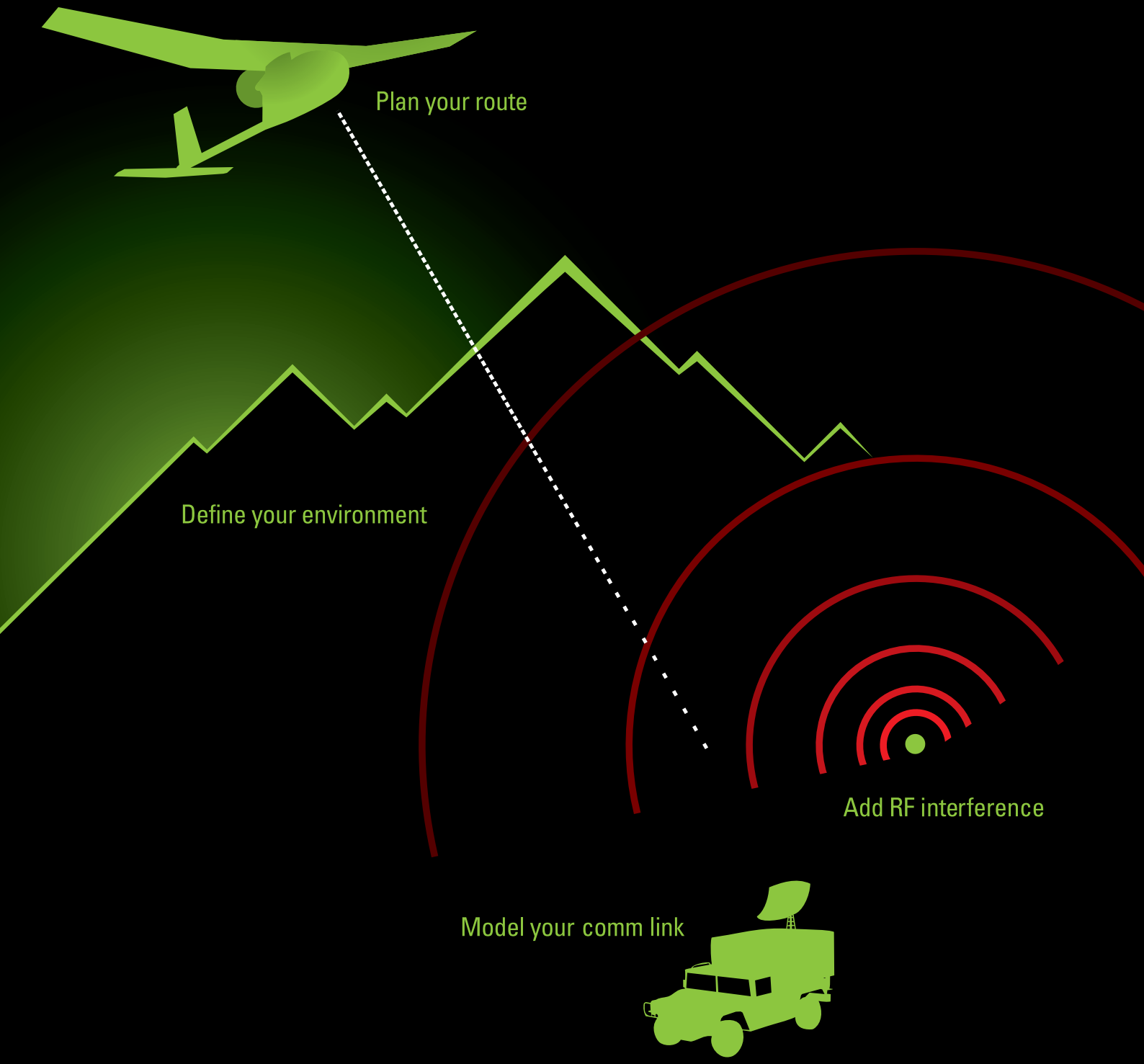
The JAPCC continues to lead the way for NATO space efforts. We'd like to welcome Lt Col Eduardo Miacci, ITA AF, to the Future Capabilities branch in a newly created Space position. Our Executive Director will be a guest speaker at the NATO Road Ahead conference in Prague. Our Assistant Director Capabilities has been invited to the Strategic Space Symposium in Omaha this fall. The JAPCC is currently providing support to ACT's DRR11 and several RTA research teams. Additionally, a paper is in development looking at Space training courses available to NATO. USA, GBR, CAN, FRA and DEU have courses that are being analysed for areas of duplication and potential gaps. The paper will be available this fall. Lastly, Lt Col Single will be deploying as the ISAF Space LO and will be gone Dec '09 until Apr '10. After mid-Nov, contact Lt Col Miacci for any space issues at miacci@japcc.de.

ITA AF Air Power Congress

The ITA AF is hosting an International Air Power Congress in Florence from 26–27 Nov 2009 at the Aeronautical Military Science Institute, Florence, ITA. The two-day event will be centred on 2 themes – the first day will cover *New Challenges for a Safer Future* while the second day will revolve around *Support & Combat Operations*. Discussions will include: Air Power and the Comprehensive Approach; Future Scenarios and Strategies; Global Deterrence; Symmetric v. Asymmetric Warfare; Missile Defence; Russian and Indian Air Power Perspectives; Interoperability; Challenges and Opportunities in Logistics Support; Intra-theatre Rotary Winged Airlift; Security and Stabilisation Operations and a myriad of other timely topics.

The JAPCC Director has been invited to attend and speak at the event and the JAPCC Executive Director is currently a confirmed featured guest speaker. For more information, please contact:

airpowercongress2009.po@aeronautica.difesa.it



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Biographies

General László Tömböl is the Chief of Defense of the Hungarian Defense Forces. A graduate of the U.S. Air War College in 1996, he started his military career as an Air Defense technician officer. He has served in various staff and command positions at battery, battalion and brigade levels. His tours abroad include Chief of Hungarian Liaison Team to NATO AFSOUTH during the NATO accession period and Chief of Military Cooperation Branch NATO JCS Verona, Italy. At higher level, he served as Chief of Staff HUN Air Force Command, Chief of HDF NATO Integration, Director of Defense Staff MoD and Deputy Chief of Defense Staff. Prior to his present position, he commanded the HDF Joint Force Command, established in 2006.

Major General Stephen D. Schmidt is the Commander of NATO Airborne Early Warning and Control Force Command, co-located with Supreme Headquarters Allied Powers Europe in Mons, Belgium. A graduate of the U.S. Air Force Academy in 1979, he has served as an instructor/evaluator pilot in bomber and trainer aircraft. The General has commanded at the squadron, group and wing level. His staff tours include duty as Director of Logistics, Headquarters Air Education and Training Command, Chief of Staff at U.S. Strategic Command, Chief of the Strategic Nuclear Policy Branch on the Joint Staff, and he also served in the Secretary of the Air Force Staff Group. A command pilot, he has more than 4,200 flying hours, mostly in the B-52H.

Colonel Thomas H. Lorber (DEUAF) is Chief of the Air and Missile Defence Section, NATO HQ – International Military Staff. Since his graduation from the Command and General Staff Course in 1995, he served as J3 in the Armed Forces Intelligence Office; Staff Officer for Contingency Planning in the Air Force Command; Staff Officer for Joint Air Defence Defence in the MoD; Commander of SAM Groups 38, 42 and 14; Branch Chief in the Air Force's Center for Transformation and as a Lecturer for Air Operations/Air Doctrine in the Air Force Faculty of the Armed Forces Command and General Staff College.

Colonel Kees Snip is the Branch Head of Policy, Concepts and Development at the JAPCC. He joined the Air Force in 1976 and has 3700+ flying hours in the NF-5, T-38 and F-16. He has been the Deputy Detachment Commander of a RNLAF detachment operating out of Villafranca AB, Italy and Detachment Commander of a Dutch-Belgium F-16 Detachment operating out of Amendola, Italy. After an assignment in the Air Staff Fighter Branch, he served as the Deputy Air Base Commander, Volkel AB. He joined the JAPCC in December 2008 from his previous assignment as Branch Head A3 Air Ops in Ramstein and a tour in Afghanistan as Chief Air Plans ISAF HQ in Kabul.

Lieutenant General Friedrich Wilhelm Ploeger's career started in 1967. He was trained as an intercept controller and remained in the radar control specialization throughout various assignments until 1980, when he attended the German General Staff Officers´ Course. He served at various National and NATO positions including Chief of the Nuclear Planning, Policy and Strategy Section with the German delegation to NATO, Assistant Chief of Armed Forces Staff Division Politico-Military Affairs and Arms Control at the Federal MoD and Commander 2nd German Air Division. Lieutenant General Ploeger holds a triple-hatted position at Kalkar/Uedem as Commander German Air Force Air Operations Command, Commander Combined Air Operations Centre 2 and Executive Director Joint Air Power Competence Centre.

Colonel Eugeniusz CIESLAK, Ph. D., is the director of the Air Force Institute, National Defence University in Warsaw, Poland. After graduating from the AF Academy in 1988 he served in staff and command positions including deputy squadron commander, instructor and Chief of Air Operations Division at the NDU in Warsaw. He teaches air operational art and researches problems of Air C2 in multinational operations.

Group Captain Dai John is the JAPCC's Combat Service Support Branch Head. Commissioned into the RAF in 1986, he has completed flight commander tours in Germany and the Falkland Islands, has undertaken a variety of logistics and training-related HQ appointments, and has commanded the operations squadron of the Tactical Supply Wing. He has also completed staff tours in HQ Air and the UK PJHQ, and has commanded 85 (Expeditionary Logistics) Wing. He has served on operations in Northern Ireland, the Balkans, Iraq and Afghanistan, latterly as COS in the UK NSC HQ. He is a graduate of King's College London, (MA in Defence Studies) the Open University (MA in History, BA in Philosophy), and Leicester University (LLB).

Wing Commander David Keefe is in the Policy, Concepts and Development Branch of the JAPCC. He has broad experience in the Royal Air Force as an RAF Regiment Officer in various appointments: Force Protection and SHORAD roles in the UK, Cyprus, Middle East, Germany, Falkland Islands, Turkey and Afghanistan; staff appointments at HQ 11 Gp, the Air Warfare Centre (Tactics Division), UK CAOC/JFACHQ, PJHQ, Defence Equipment & Support (Requirements Manager); and training appointments at the Royal Air Force College Cranwell. He has also been a UN Military Observer (FRY) and TACEVAL team member. He is a graduate of Cranfield University, MSc in Defence Acquisition Management, and the Air Battle Staff Course.

Biographies

Lieutenant Colonel Lothar Pichler joined the Future Capabilities Branch of JAPCC in August 2008. In 1987 he joined the German Air Force after graduating from the Munich Military University in Aeronautic and Space Technology and initially served as a Weapon System Officer on the F4-F Phantom. After several staff positions within the Fighter Wing 71 'Richthofen', he was assigned to the US Naval Postgraduate School in Monterey, were he graduated with a MA in National Security Affairs. Before coming to JAPCC, he worked for the Intelligence Sub-Division of the Allied Command Transformation in Norfolk.

Lieutenant Colonel Huseyin Duman has been a member of JAPCC Policy, Concepts and Development Branch since 2007. He joined the Turkish Air Force in 1991 as a logistics supply officer. In 1995 he graduated from the US Air Force Institute of Technology with a Master of Science degree in Operations Research. In 2003, he attended Turkish Air Staff College. His areas of expertise include logistics planning, force planning, operational analyses, modelling and simulation. He served at Logistics, Plans & Policy divisions and Decision Support Branch, Turkish Air Force HQ. His assignment before joining the JAPCC was Head of Operations Branch, Turkish Air Logistics Command, Ankara.

Lieutenant Colonel (ret.) Wolfgang Duerr is Vice President of Security & Defence Germany at EADS Astrium. He is a graduate electrical engineer and started his military career in the Fighter Control/Air Battle Management Branch. He served as the ADC of the Commanding General GAF Command South/Commander CAOC 4, before taking command of the Tactical Air Control Squadron 111. He is a distinguished graduate of the Air University/ACSC, awarded the 'Brigadier General Robbie Risner International Officers Leadership Award' and received a Master Degree in Military Operational Art and Science. He was responsible for Space Operations and Information-/Knowledge Management at the GAF Development Centre/Air Power Center before he retired from the GAF in July 2008.

Major William Clements is a member of the JAPCC Combat Support Branch. He is a senior navigator with over 450 hours as instructor and evaluator in the KC-135R/T. He recently deployed to Tyndall AFB, Florida to be the Tanker Duty Officer for Homeland Defense at the CAOC. He has also served as the Assistant Ops Officer for Tanker Operations during Operations ENDURING and IRAQI FREEDOM in 2006. He has a BS in Electrical Engineering. In his previous assignment, he was Assistant Director of Operations at Robins AFB, Georgia under Air Mobility Command. He arrived in Kalkar in July of 2008 and serves as the JAPCC subject matter expert on air-to-air refuelling.

Lieutenant Colonel Tom Single is a member of the JAPCC C4ISTAR Branch. His operational experience includes ICBM, space and AOC weapon systems. He has combat experience in support of OIF and OEF and has participated in several major exercises as a theater space operations duty officer. He has a BS in Aerospace Engineering, a MBA and a MS in Space Operations from the Air Force Institute of Technology. In his previous assignment, he was the Chief of Theater Support at HQ Air Force Space Command. He arrived in Kalkar in March of 2007 and serves as the JAPCC subject matter expert on space operations.

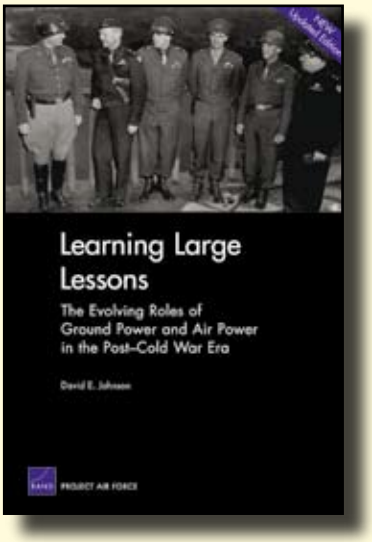
Lieutenant Colonel Denis Stengel is a logistician at the JAPCC. He joined the French Air Force in 1980 as an apprentice mechanic at the age of 15. He has an engineering background in Control & Reporting Centres. After graduating in Literal Arabic Language & Civilisation, INALCO Paris, during Higher Military Education, he served as intelligence analyst and in the field of international relations. Prior to coming to the JAPCC he was an analyst at the Interministerial Commission for the Study of Military Hardware Exports, at the Secretary General for National Defence.

Lieutenant Colonel Colin Keiver, while on exchange from 2001–2004, was the Director of Safety and Standardisation at the first US Marine Corps KC-130 squadron to convert to the KC-130J. His 'love-affair' with the field of human factors and the impact of automation on aviation was born during that time. In 2004 he was posted to 1 Can Air Div HQ where he was heavily involved in the introduction to service of the C-17 and the development of the C130J project. He was also the Project Authority for the Automation Policy Planning and Development (APPD) Project within the Canadian Air Force.

Major Werner Schwulst is a German Army Infantryman who joined the Combat Service Support Branch of JAPCC in May 2007 as a CIMIC SME. He has served with various light, mountain and mechanised infantry units. He has gained his CIMIC expertise since 2004, with the German CIMIC Zentrum in Nienburg, Lower Saxony (DEU). Serving as a CIMIC staff officer in this unique and specialised CIMIC unit gave him a wide variety of CIMIC experiences – highlighted by assignments with the NATO Response Force (Steadfast Jaguar 06, Cape Verde Islands) and ISAF (2006/07) as Deputy J9 and CIMIC Liaison Officer with the RCN in Mazar-e-Sharif, Afghanistan.

Mr. Jim Lovell is Head, Air Defence Section in the NATO HQ Defence Investment Division and Secretary of the NATO Air Defence Committee and NATO-Russia Council on Theatre Missile Defence Ad-Hoc Working Group. He served 24 years as a US Army Air Defence Officer in a number of command and staff assignments including HIMAD (Nike Hercules, Patriot) and SHORAD units. Mr. Lovell graduated from the United States Military Academy with a Bachelor of Science Degree and has a Master of Science Degree in Operations Research from the Georgia Institute of Technology.

Learning Large Lessons: The Evolving Roles of Ground Power and Air Power in the Post-Cold War Era
by David E. Johnson
RAND cooperation, 2007



This report reviews Post-Cold War operations and the roles US Ground and Air Force played in those operations. Although the services have made significant contributions to Joint Operations, the assessment of the 5 operations clearly shows important lessons haven't been learned, are ignored or are interpreted only within specific service perspectives – and have, therefore, not led to true Joint Doctrine. The study assessed the hypothesis that a shift has occurred in the relative roles of ground power and Air Power in warfighting and notes two trends. First, due to the use of new technologies, Air Power showed a growing level of effectiveness and robustness and has seen its role commensurately grow. The second trend is that despite the gradual acceptance of individual Army officers, Army doctrine is not being revised to accommodate the reality of Air Power effectiveness.

Within many NATO Nations, you will find the same misunderstandings or perceived dominant behaviour between services. Most often, lack of detailed knowledge of the other's capabilities are the main cause. During ISAF operations, there is the same lack of coordination in certain parts of the Area of Operations. Just like US Joint Doctrine, NATO Doctrine is a collection of service perspectives and much work remains to attain a truly joint NATO Force capable of performing the broad range of all military operations.

Reviewed by Kees Snip, Colonel, NLD AF

Space Warfare – Strategy, Principles and Policy
by John J. Klein
Routledge 2006

US Navy Commander Klein evaluates air, land and naval strategies in order to develop a framework for Space warfare, strategy and policy. This book provides a well researched and methodical approach by comparing historical frameworks and strategies. He advocates that there are enough similarities between Space and Maritime activities to warrant consideration of Maritime strategy for the development of Space strategy. While there are areas of similarity, he acknowledges that Space is a unique operating environment and requires its own distinctive strategy development. A strong case is made for the importance of Space and the need to develop strategy and policy while also highlighting many obstacles that must be overcome.

While the author attempts to comprehensively cover this topic, it has several shortfalls. The analysis is often simplistic, ignoring recent Space activities, technology and tactics. Furthermore, many ideas are often repeated, offering no additional insights or meaning. Moreover, some concepts become confusing or are misapplied as he tries to fit Space into a naval framework. Although I disagree with some of his conclusions and analysis; this book is a quick read (164 pages) and serves as a very good introduction to the subject and should be read by anyone attempting to understand the complexities of space at the strategic level.

Reviewed by Thomas G. Single, Lieutenant Colonel, USA AF