Transforming Joint Air Power

The Journal of the JAPCC

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It is my great pleasure to present you the 22nd Edition of the JAPCC Journal. The opening article of this edition is an interview with The Netherlands' Air Chief Lieutenant General Schnitger, who offers us his perspective on future airpower requirements and how the RNLAF shall be kept *'Fit for the Future'* by a program called the 'Air Force 3.0'. We greatly appreciate his senior leader's perspective. In this editorial, I'll depart from my tradition of discussing upcoming articles to talk about a couple of things that are significant to Joint Air and Space Power in NATO today, Anti-Access/Area Denial (A2AD) and the Joint Air Power Strategy.

NATO Joint Air Power today is abuzz with talk of 'A2AD', which is a relatively new term describing a relatively old problem. A2AD is simply the ability to prevent opposing forces from entering an area and, if they are there, restricting their freedom of movement. As NATO has been focussing on operations outside of the European area of responsibility, our adversaries here and across the globe have been watching carefully, designing systems that are dedicated to prevent us from operating our military assets to their full potential should a conflict of interests materialize. On the one hand, it sounds like 'old wine in new bags', however, what's worthwhile noting is that the 'new' A2AD refers to an aggressively designed combination of cyber, electronic warfare, and highly capable integrated air defence systems woven together in a flexible and mobile fashion to create areas which are effectively impenetrable. How to effectively conduct operations in these contested or non-permissive A2AD environments is something to which NATO must turn its attention.

Recently, the North Atlantic Council tasked the NATO Military Authorities (NMAs) to draft a Joint Air Power Strategy for the Alliance. This strategy will first develop a conceptual basis for air power and then address the development of long-term air power capabilities. This work will be a continuation of the work started by the NMAs in their military advice to the Council, which was submitted to the Military Committee in late 2016. The JAPCC was honoured to be a part of the team that developed that advice, which recommended the development of the strategy, and we are honoured to have again been invited to participate in the drafting team.

Thank you for taking the time to read this edition of our Journal. I congratulate the authors on their contributions to this 22nd JAPCC Journal and I strongly encourage our readers to consider sharing your thoughts as you go forth and advocate for Air Power. The JAPCC team greatly appreciates your feedback and thoughts. Please visit our website at www.japcc.org, like us on Facebook, or follow us on Twitter and LinkedIn to tell us what you think.

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M **Denotes images digitally manipulated**

Fit for the Future

Interview with Lieutenant General Alexander Schnitger, Commander of the Royal Netherlands Air Force

The JAPCC is grateful to Lieutenant General Schnitger for taking the time to answer some questions, providing his insight into key issues facing the Joint Air Power community today. At the time this interview was held, he was still in active duty.

Looking around, a new world or a new society will develop at a pace faster than ever before in the next decades. How do you look to this changing world and how can we, as Air Forces, play a role in it?

Some call it the post-industrial age. I feel uncomfortable with this designation. The most influential driver of this new world, this new society, I believe is the exponential technological development witnessed in all areas of expertise. This technology development will significantly impact all forms and ways of life, with software playing an ever-increasing role. I feel therefore more comfortable with the term 'The Software Revolution'. This revolution will not only disrupt or influence the way we live as individuals, but will also prompt new forms of society. These developing societies will consequently determine new forms of government and alternate political systems, in turn completely changing the concept and resolution of conflicts. The technological progress will, sooner or later, lead to significantly enhanced situational awareness and understanding, specifically by third and fourth (space) dimension means. Superior awareness and understanding will subsequently enable us to move up in the security chain, with the ultimate goal of preventing conflict (escalation). This development gives rise to a new and unprecedented concept of the 'High Ground'. From this new 'High Ground', the role of the armed forces and specifically the role of third and fourth dimension military means the security ecosystem will transform to the new role of security custodian.

'Each and everyone needs to create its own asymmetry.'

In this fast changing environment, how will you as the Royal Netherlands Air Force (RNLAF) be able to continue to make a relevant contribution to international peace, security and freedom?

The concurrence of several aforementioned developments, including, but by no means limited to, the introduction of a fifth generation fighter jet, triggered a more forward-looking attitude within the RNLAF. Therefore, the RNLAF started a process of re-inventing and future-proofing the RNLAF resulting in a program we call 'Air Force 3.0'. It quickly became apparent that it is not sufficient to implement a range of different separate steps. To remain successful and relevant, we need to reinvent the Air Force. Not by making changes to the current organization, but by rebuilding the whole structure in innovative ways. More than ever there is need for coherence and setting out a new course. Hence, laying the foundation for the Air Force of the future. RNLAF 3.0 is all about innovation, transformation, technology, and cooperation. Central to this is the human being … the only, truly innovative capacity of the organization, the human that is leading the transformation, using the technology to be effective and working together with others to create an effective, relevant, and affordable Air Force of the future.

RNLAF 3.0 is more than the introduction of new weapons or closing locations. The business will be redeveloped. In the future, to be able to achieve high-quality training, despite the increasing complexity of military action, rising operating costs, and increasing peace constraints, new training concepts will be introduced. Furthermore, new maintenance concepts have to ensure the high availability of weapon systems will be achieved at manageable operating costs, and the organization and implementation of our platform tasks will be renewed to realize flexibility at the lowest cost.

'Sit back and relax is not an option.'

As you indicated before, this technology progress will, sooner or later, lead to significantly enhanced situational awareness and understanding, by third and fourth dimension means. That promises quite a bit for the RNLAF. How do you see the integration of all these new innovative technologies in your organization?

Over the last decades, military operations are showing a shift towards smaller, more rapidly deployable units. In this field, the use of the air and the space domains plays an increasingly important role. The third and fourth dimensions offer unique advantages for obtaining situational awareness, transport, assault, and defence.

My expectation is that the new developments in the field of communication and information technologies, sensors, unmanned systems, and the use of space will further increase the importance of air power in the decades to come. The development of the operational capabilities of the RNLAF focuses on optimizing the use of the third and fourth dimensions – air and space to influence (potential) conflicts. By achieving 100 per cent situational awareness, scalability, and precision, the intended effects can be identified and achieved with managed and minimal risk and collateral damage.

A prerequisite is improving C4ISR capabilities, integrating all operational capabilities and creating maximum flexibility by combining the characteristics of airpower: height, speed, and range. A first step will be the development of a NASOC (see info box), which will make the change from a platform-centric to an information-centric approach.

NASOC is the National Air & Space Operations Centre. Its core tasks are:

- Information platform for all aerospace operations.
- Autonomous access to all weapon systems and sensors.
- Information synchronization.
- Sharing information.

To continue being operationally effective, despite the small numbers of the RNLAF, people and technology should be matched, and should have the best equipment. Adaptability – continuous updating and improving of our operational capabilities – is therefore a continuing priority.

'Adaptability is crucial!'

In the next decade we will be aiming at the improvement and renewal of capabilities, in particular the improvement of the observation capabilities, both with regards to the range, duration of observation, distinctiveness, as to the use of a larger portion of the electromagnetic spectrum. We will concentrate on several domains: the ability to operate in information networks, further increasing precision, independent of place, time, and meteorological conditions; the development of non-lethal deployment means; increasing the use of unmanned systems, not only for observation but possibly also for armed deployment and air transport; and developing capacities to secure access to and use of the space and defence against threats from space.

In your introduction you indicated that people are central to all of this, but as of now it is all about technology and capabilities. What can your people expect, or, even better, what is furthermore expected from your people with all these upcoming changes?

'RNLAF 3.0 is a revolution through social and cultural innovation!'

As a result of the pace of change, the traditional processes and methods of the RNLAF organization – and the defence organization – are no longer sufficient. To make it possible for the RNLAF 3.0 airmen and -women to use their knowledge, skills and experience within the organization we will re-develop it in an innovative way. Where possible, hierarchical structures will be replaced by flexible and adaptive networks that make the best use of available capacity and give substance to the cooperation. Management will be based on trust rather than control. Thereby, the leadership determines the effect to be achieved, while the network determines the most effective and efficient manner to achieve the effect.

In order to respond better and faster to external developments, planning processes will be rearranged. Complex requirement and procurement processes will then be adapted to rapidly respond to current technological developments.

In addition, within the RNLAF, an innovation platform has been founded with the aim to increase the innovative capacity of the organization as a whole by providing support to innovative ideas, creative solutions, and new ways of thinking and acting. This makes us able to keep up with developments and – better yet – get ahead of what the future will bring us, so we can get a better hold on it. It is not enough to emphasize the importance of innovation. We also need to do something.

Hereby, the various actions are directed toward the airmen and -women by ensuring that innovative people from all layers of the organization are involved and that all employees are involved in the innovation process, to the culture by fostering an innovative environment where there is room for new ideas, and to the processes by ensuring that the conditions are set by which promising ideas can be taken up expeditiously and developed.

'Radical innovation is a must!'

At the same time, the innovation platform looks at future technological developments. This is done on two distinct tracks: incremental and radical innovation. The incremental track focuses on short term (< 2 years) opportunities to improve performance by fine tuning existing systems and processes. Radical innovation aims to develop new breakthrough technologies that will, in the mid to long term, enable the Air Force to achieve performance levels formerly thought impossible. A guiding principle for all our innovation is the concept of 'singularity', a term that refers to a hypothetical point in the future when artificial intelligence will surpass human. From this perspective we'll look further into the future at issues like artificial intelligence, advanced human-machine interaction, nanotechnology, large-scale connectivity, and parallel computing, energy, and the consequences for both the world in which we operate and for the Air Force in particular.

All initiatives together will deliver a contribution to the innovative capacity of our organization in order to remain effective, relevant, and affordable.

But as you already mentioned, the RNLAF is a small organization. What is the shelf life of these ideas in the much larger world outside the RNLAF and in an international context like NATO?

'Just buying the next generation is not enough.'

To perform our mission and achieve our vision, we are depending on cooperation with numerous agencies within and outside the defence organization. Such cooperation is not an end in itself but a means to increase our effectiveness within the available frameworks. These dependencies don't make us weaker but strengthen us. By interweaving ourselves with our surrounding partners and building what is in essence

a security ecosystem, we strengthen the base, and we are less vulnerable to developments in the world around us. Instead of a customer or supplier, we are a partner. By combining our strengths with those of our partners, we will achieve the maximum result within our means. We will make sure that cooperation will lead to increased effectiveness and not to some sort of budget cut.

To expand existing cooperation and to create new partnerships, we of course also look to effective partnerships with our allies. Where possible, we are improving our capabilities by embedding them internationally, as in the European Air Transport Command (EATC) or Strategic Airlift Capability (SAC) C-17. We are working together in an international context for a new Multi-Role Tanker Transport capacity. Where there are synergetic opportunities, we integrate our units in international operations, letting scarce skills be used as effectively as possible. Within the context of the European Air Chiefs (EURAC) and European Air Group (EAG), we give direction to the joint development of the European Air Forces. The RNLAF Vision for International Military Cooperation reflects our priorities for international cooperation for the coming years.

At the same time we will not avoid other collaborations. To increase effectiveness and reduce life cycle costs, the principle is that new capabilities will be acquired or developed as much as possible within international partnerships. Where effective and efficient use of our resources can be increased, we will also enter public-private partnerships.

'… creating an Aerospace cluster with a common intent and vision, and where information sharing is the norm.'

With research institutes and industry, we cooperate within the Aerospace cluster to monitor relevant developments and, where possible, to deploy innovative improvements. Via optimal use of the innovative strength of those parties, we increase the effectiveness of the RNLAF as an advanced and effective Air Force. Hence, we also strengthen the competitiveness of The Netherlands, by contributing to the development of the Netherlands as a country of innovation in general and, more specifically, in the field of aerospace. By strengthening cooperation with research and training institutes, we also anticipate a better availability of sufficient numbers of well-trained technical staff.

Your mandate as Commander of the RNLAF ends this year. What is the message you want to give to the air forces in general and to the staff of your own air force in particular?

'Allow your plans to fail, but … learn from it!'

The lively Air Force 3.0 debate expanded quickly and continuously. Important concepts such as 100 per cent situational awareness and understanding, exponential technological growth and the shifting security

ecosystem were incorporated. This led us to conclude that a broader discussion regarding strategic security thinking was needed.

Most of the discussions that absorb us today still focus primarily on the Air Force as we know it. We feel that the exponential changes we are starting to observe around us today increasingly demand a broader discussion about what the Air Force of tomorrow might look like. In this discussion we have to be willing and able to envision significant changes in our own mindset: who we are, what we do, and how we do it. But we also increasingly feel that it is no longer possible to separate this debate from a more comprehensive and maybe even more fundamental debate on our future as security and defence professionals. We want to position ourselves increasingly as responsible custodians of a broader security ecosystem encompassing a much broader range of actors who, consciously or even unconsciously, are involved in the security field.

We hope to trigger a broader discussion across the defence and security spectrum. We are acutely and painfully aware that we do not have all the answers. We are but one stakeholder – one stovepipe in a much broader ecosystem. A stovepipe that has been as fiercely parochial in our recent debates as our counterparts have been. But we want to start moving beyond the stovepipe austerity debates into a comprehensive balance of investment debates. The world is changing. If we wish to stay ahead of the curve, now is the time to start this discussion. We feel we would be neglecting our civic and professional responsibility as airmen and airwomen, as soldiers and defence and security professionals, if we did not at least try to stimulate this discussion.

Sir, thank you for your time and your comments. ●

'Look towards the future. It's closer than you think.'

Lieutenant General (ret.) Alexander Schnitger

was in charge of the Royal Netherlands Air Force (RNLAF) from March 2012 to June 2016. In 2012 the cutbacks in defence expenditure had come to a head. Therefore, his top priority was to steer the men and women of the RNLAF through this austerity campaign while maintaining relevance, readiness and affordability of the strike power of the Air Force. His personal creed is: 'People Matter.' That is why the key aspects in the evolution of the Air Force in the coming years will be creating trust and pioneer spirit, scope and cohesion, authenticity and diversity in leadership.

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How NATO Makes the Unknown Known

A Look at the Improvements to NATO Joint Intelligence, Surveillance and Reconnaissance

By Robert Murray, UK, Head of ISR, NATO Headquarters

Introduction

Joint Intelligence, Surveillance, and Reconnaissance (ISR) plays a vital role in all military operations. Decision-makers and action-takers use the information and intelligence gained from surveillance and reconnaissance missions to make informed, timely and accurate judgements.

While surveillance and reconnaissance can help to answer the questions 'what', 'when', and 'where', the combined elements from various ISR sources and disciplines provide the answers to 'how' and 'why'. When all of this is combined, you create Joint ISR.

Our experiences in Libya and Afghanistan demonstrated that, although we attached high value on the collection of information by Allies' ISR assets, there were challenges in the way in which NATO interpreted, handled, and shared information within our own organization. Whilst NATO arguably had a sufficient number of assets for ISR collection, those challenges such as managing the quantity of information, disseminating the information, and verifying the correct formats and product quality proved difficult. These shortcomings were primarily driven by insufficiently trained Joint ISR personnel, outdated NATO Joint ISR doctrine and procedures, and a lack of connectivity. In response, NATO launched its Joint ISR initiative at the

Chicago Summit in 2012 and re-confirmed this effort at the Wales Summit in 2014.

In February 2016, Allied Defence Ministers formally declared the Initial Operating Capability (IOC) of NATO Joint ISR. This achievement goes some way to addressing some of those shortfalls witnessed in both Afghanistan and Libya. Indeed, the IOC effort has been primarily focused on providing enhanced capabilities to NATO's Response Force 2016 (NRF16).

What Joint ISR IOC Has Achieved

NATO Joint ISR is about people, platforms, processes, and networks. All of these components must synchronize correctly if we are to provide intelligence and information to the right person in the right format at the right time and at the right place. With this in mind, NATO Joint ISR IOC centred its efforts on, people and training, processes, and networking, working across many of the 'lines of development' which, when combined, create a genuine capability.[1] To that end, the Alliance has delivered a number of improvements in these areas for not only NRF16 but also NATO as a whole.

People and Training. Through NATO's Joint ISR IOC, a great deal of effort has been made in the area of training personnel. Over 100 training courses from Allies are now available to the Alliance. This is more than triple the amount available during NATO's time in Afghanistan. In addition, advanced Joint ISR training objectives have been created for NATO exercises, ensuring NATO forces could conduct the business of Joint ISR together. In addition, an intelligence training STANAG has also been developed, which is a step forward for creating a recognized NATO baseline of standards for ISR personnel training across the Alliance.

Processes. Whilst efforts in training were ongoing, there was also a need to ensure our processes were up to date and relevant for the Alliance's contemporary operating environment. As such, NATO undertook a rewrite of the Alliance's intelligence capstone doctrine and also created a brand new ISR doctrine. Much effort went into ensuring these publications were mutually supportive and their development enabled further NATO ISR tactical publications and Standing Operating Procedures (SOPs) to be developed as part of the IOC effort. This common understanding of what Joint ISR is within a NATO context has helped develop significant improvements in the planning and execution of NATO Joint ISR Missions.

Networking. To make sure NATO is in a position to provide decision makers with the right information at the right time and in the right format, NATO needed a robust Joint ISR architecture which would span the NATO enterprise and include the ability for nations to 'plug and play' with their national ISR assets. This has now been established through the NRF16 and NATO's Joint ISR information exchange capabilities have been vastly improved. Indeed, NATO now has the ability to constitute a deployable mission network, which has been tested and verified in multiple scenarios. During the Joint ISR IOC process, the Alliance used various information flows to verify and measure its Joint ISR data and information abilities, including optimized bandwidth utilization whilst also employing significant numbers of operational ISR capabilities on these networks.

How NATO Joint ISR IOC Was Achieved?

It is important to understand how Joint ISR IOC was achieved because it highlights the array of committees, groups, Allies and staff involved and, more importantly, demonstrates that successful delivery involved much more than mere transactional interactions amongst actors.

Allies played a major role in the delivery of NATO's Joint ISR IOC. Indeed, Allies provided a great deal of governance and direction to the NATO staff regarding the Joint ISR IOC effort. The primary group responsible for this was NATO's Joint ISR Project Group which reported, and continues to report, to the Conference of National Armament Directors (CNAD). In addition, the Military Intelligence Committee had, and has, an active role in providing oversight for matters pertaining to the Capability Development for Intelligence, for which certain elements of NATO's Joint ISR IOC were relevant.

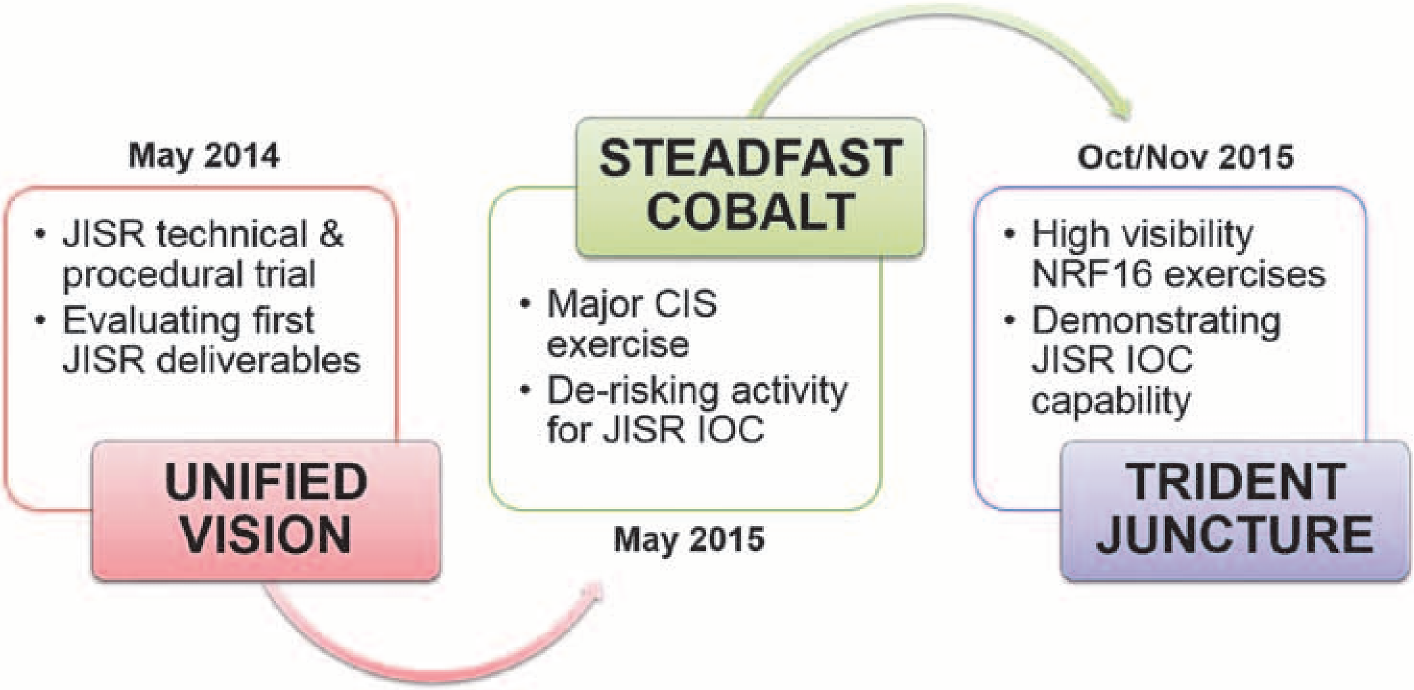


Figure 1: Joint ISR Achievements Through NATO Trials and Exercises That Helped Achieve IOC.

With over ten NATO committees involved in the success of Joint ISR IOC[2], a staff body representing as much of the enterprise as possible was needed to provide access to all pertinent areas of the NATO Joint ISR Capability Development and Delivery environment. This was achieved through the NATO Joint ISR Task Force led by NATO's Joint ISR Capability Area Manager. This Task Force was a 'team of teams'[3] unified by one single effort – the completion of IOC with a special focus on the NRF16.

The Multi-intelligence All-source Joint ISR Interoperability Coalition 2 (MAJIIC2) and the Battlefield Information Collection and Exploitation Systems (BICES) also played very important roles in helping to develop and deliver NATO's Joint ISR IOC. MAJIIC2's development of technical and procedural standards regarding the processes for Information Requirements Management and Collection Management (IRM&CM) and the technical underpinning of the Coalition Shared Database (CSD) servers were fundamental to much of what was achieved.[4] BICES utilization of CSDs on the BICES network and BICES subsequent developments, alongside the NCIA, of cross domain solutions have enabled the sharing and synchronization of data and information across multiple networks. This is a significant step forward for sharing information and intelligence in an Alliance setting, as well as delivering Joint ISR IOC.

All of the technical advances of Joint ISR IOC were vigorously tested through several trials and exercises, as depicted in Figure 1.

In the Unified Vision 2014 Trial, which was an evaluation of the first Joint ISR deliverables for Joint ISR IOC and NATO obtained a much better understanding of the Alliance's Joint ISR capabilities. From this trial, the weak areas of architecture and processes were noted. These areas were then evaluated and subsequently addressed. In May of 2015, exercise Steadfast Cobalt took place. This large communications exercise allowed for a de-risking of activities for Joint ISR IOC and those NRF16 affected force elements by testing primary networking and communications equipment in an operational environment, all of which built on the lessons from Unified Vision 2014.

Finally, Trident Juncture 2015 was NATO's largest exercise in over a decade and was a high visibility NRF16 event. It demonstrated Joint ISR in a collective training environment and was the final proving ground for the recognized fulfilment of Joint ISR IOC allowing NATO commanders to recommend to the North Atlantic Council the achievement of NATO's Joint ISR IOC.

Challenges Joint ISR and IOC Have Faced

Joint ISR IOC was a challenging accomplishment, in that it involved so many people, organizations and Allies. Communication and cooperative agreements involving so many entities proved difficult at times, but challenges were eased with the creation of the Joint ISR Task Force, which helped communications amongst actors and provided a more holistic environment to track the progression of Joint ISR IOC.

Given its focus on the short-term delivery, the IOC programme did not rely on standard NATO resourcing methods. Instead, an ad hoc approach was utilized that proved workable. However, In future iterations of NATO Joint ISR improvements, a more stable resourcing methodology will be adopted.

The Future of Joint ISR

After the formal declaration of Joint ISR IOC, work is not slowing down. Due to continuously changing technology and the ever shifting geo-political environment, NATO Joint ISR will never have a Full Operating Capability (FOC) declared. Instead, NATO Joint ISR will be continually evaluated and enhanced via an iterative improvement cycle. This will enable the Alliance to keep up to date with current technology and improve NATO's need for continued strategic awareness.

A very important future Joint ISR project is the Alliance Ground Surveillance (AGS) system. AGS is based on the Remotely Piloted Aircraft (RPA) platform RQ-4 Global Hawk along with its deployable ground stations. AGS will enable the Alliance to perform persistent surveillance over wide areas from high-altitude for long periods of time. Using advanced radar sensors, these systems will continuously detect and track moving objects throughout observed areas and provide radar imagery of areas of interest. However, the real jewel in the crown will be the advanced exploitation centre at Sigonella, Sicily, from where AGS missions will be commanded and intelligence produced. AGS will be a NATO-owned and -operated capability along with the NATO Airborne Early Warning & Control (AEW&C), the airborne Command and Control platform.

Unified Vision 2014 Operations Room: Fusing multiple ISR feeds for commanders.

Another important upcoming Joint ISR activity will be the trial Unified Vision 2016 (UV16). This trial will be a Joint ISR event that will test and verify National, multinational (BICES) and NATO networks for cross domain activity so as to facilitate, a relatively new concept in NATO colloquially known as Federated PED (Processing, Exploitation and Dissemination). Federated PED allows for a more joint operative environment by allowing the sharing of data between intelligence fusion centres known as PED sites. This trial will lead to a better architecturally equipped Alliance and will benefit future NATO activities including AGS.

Conclusion

Joint ISR IOC was initiated to address those operational shortfalls witnessed during NATO operations in both Afghanistan and Libya and to make the Alliance more capable and interoperable. Joint ISR IOC had the potential to be unsuccessful due to its complexity and breadth across the NATO enterprise. However, thanks to the exceptional trust and sense of purpose Joint ISR IOC engendered across the NATO community, a true desire to complete Joint ISR IOC was created and, indeed, IOC was achieved. However, it should be remembered that, whilst the business of ISR needs networks, processes and collection assets, at the heart of Joint ISR are our people. If we continue to develop well-trained personnel who understand the end-to-end business of ISR and who are then supported by those various STANAGS, processes and technical endeavours, NATO's ISR development will continue to go from strength to strength. ●

1. NATO's Lines of Development are: Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities, Interoperability.
2. North Atlantic Council, Military Committee, Military Intelligence Committee, Military Committee Working Group (Intelligence), Military Committee Joint Standardisation Board, Joint Intelligence Working Group, Joint ISR Panel, Conference of National Armament Directors, Joint ISR Project Group, Joint Capability Group ISR, Consultation Command and Control (C3) Board, Resource Policy and Plans Board, BICES Board of Governors and Directors (non-exhaustive).
3. Joint ISR Capability Area Manager, Military Senior Coordinator for Joint ISR, NATO HQ – International Military Staff Intelligence Division; Defence Investment ISR Section; NATO Office of Resources; Defence Policy Plans; C3 Staff – Allied Command Transformation (ACT), SHAPE, Allied Command Operations (ACO – Joint Forces Command Brunssum and Naples), BICES Group Executive, NATO Communications and Information Agency, NATO Airborne Early Warning and Control Programme Management Agency, NATO Alliance Ground Surveillance Management Agency, NATO Airborne Early Warning and Control Force Command, Alliance Ground Surveillance Staff Element Implementation Office.
4. CSDs are a type of digital organizational library that the Alliance can utilize to help Process, Exploit, Disseminate (PED) and retrieve data throughout the NATO enterprise in a very rapid and efficient manner.

Robert Murray

is the Head of Intelligence, Surveillance and Reconnaissance (ISR) within NATO Headquarters. He is in part responsible for NATO's ISR Capability Development policies, plans and their subsequent implementation. Prior to joining NATO, Rob was a British Army Officer specializing in ISR and as such deployed on multiple national and multinational operations. Rob is a graduate of the UK's Qualified Weapons Instructor ISR course and holds a Master of Arts degree in International Policy and Diplomacy as well as a Master of Science Degree in ISR Management.

Air Command and Control in the Amphibious Environment

By Commander William A. Perkins, USA N, JAPCC

Introduction

Although NATO, as an Alliance, has never executed an opposed amphibious landing, it continues to grow, maintain, and exercise its amphibious warfare capability and the role of Air Power in support of Landing Operations continues to evolve. Although exercises such as the recently concluded Trident Juncture series emphasize combined arms maneuver from the sea and have brought amphibious landings back into vogue, the stark reality is NATO as an Alliance has not had to execute that aspect of maritime warfare in generations.

Improving interoperability between maritime air forces of many nations, integration with the land-based air component to perform Joint Air Power functions, and decreasing the time between 'call for support' and Close Air Support (CAS) strikes by improving the command and control structure inside the Amphibious Objective Area (AOA) are all key elements of NATO's amphibious force training today. This article will review the history and development of amphibious tactical air control and identify potential focus areas for future amphibious joint force training so that the force may be better prepared for the change in air support to amphibious operations capability that will occur with the fielding of the F-35.

The Origins of Tactical Air Control

During Operation OVERLORD in June of 1944, Air Power provided only limited support directly to the amphibious landing, but through indirect support, 'crushing air power' was the decisive factor in the invasion's success.[1] Although a significant amount of Air Power was employed, it was not a well-integrated effort supporting the landing. Its main uses consisted primarily of photo-recce and paratrooper insertion missions, strikes deep in country on aircraft manufacturing and repair facilities, and executing air-to-air engagements over the English Channel. Remarkably, 'no in-theater formalized structure linked the Ninth [Air Force] and its subordinate commands directly to specific land forces units' and CAS was not executed until after the landing was already well underway.[2]

Concurrently, in the Pacific, Air Power became more integrated into amphibious operations with the advent of ship-launched CAS aircraft and an integrated

Close Air Support in the World War II Island Hopping Campaign.

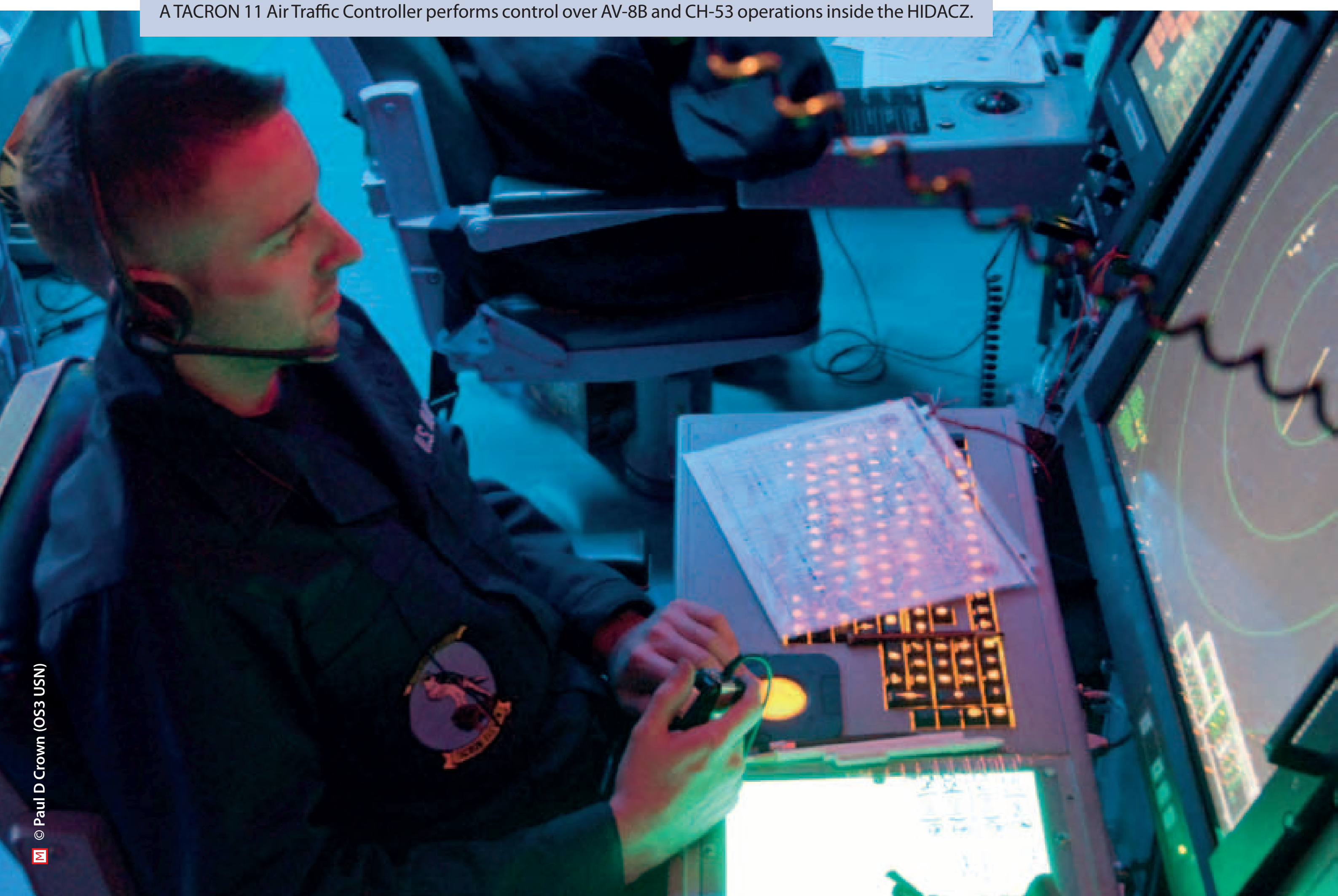
fires concept. The concept of Tactical Air Control for amphibious operations,[3] with the specific function of overseeing planning of air missions from within the naval force and exercising control of those same missions within the AOA, was born during the island hopping campaign in the Pacific, beginning with the assault on Tarawa.

A secondary function of tactical air control was to provide Air Support Coordination, deconfliction and integration with the fires control center, which was co-located afloat aboard the amphibious flag ship. In many cases, calls for fires support on the beach were routed in a cumbersome Command and Control (C2) arrangement through the land component chain of command then to the flag ship at sea and finally to the aircraft. Despite the challenging C2 procedures, naval gunfire and shore bombardment from the air became an integrated function in preparation for the deployment of the Landing Force and CAS missions were developed into a full-time requirement. Although attributed to the Pacific campaign, significant effort in coordinating air strikes as requested by the Land component in near real time had also been developed for operations in the Mediterranean, notably for the reclamation of Sicily, including the use of radar for final control of fighters and bombers.[4]

Air C2 in the Amphibious Objective Area

Each NATO nation with an aircraft carrier or amphibious assault ship capability has developed a different internal command structure to execute these air integration functions. Stemming from lessons learned in the Pacific, in 1946 the US re-designated the Air Support Coordination element as Tactical Air Control squadrons (TACRONs) and embarked a TACRON on each amphibious assault ship to oversee the planning and execution of Tactical Air Control inside the AOA, an arrangement which still exists today. However, aboard US and French nuclear powered aircraft carriers (CVN), organic ship's company departments coordinate with the embarked Carrier Air Wing in the planning, development and execution of air missions.

A TACRON 11 Air Traffic Controller performs control over AV-8B and CH-53 operations inside the HIDACZ.



Since the CVN's primary mission in an amphibious operation is support and protection of the Amphibious Task Force (ATF), its unique C2 model should be set aside during a more detailed review of the internal air C2 functions imbedded within the ATF. The UK employs an Air Support Operations Centre (ASOC) that performs the functions in a blend between the US CVN and US Amphibious model. Italy and Spain rely upon the Amphibious Task Force Commander's staff for the planning and upon the embarked Maritime Air Operation Centre or the ship itself for the control and execution of air operations. For those not familiar with amphibious air operations, this may be a confusing C2 arrangement. The key takeaway is there are multiple methods in use for the coordination of air in the AOA.

The ATF will operate in waves, transiting both in surface landing craft and in rotary/tilt-rotor lift aircraft from the ships to the landing zone multiple times to land the entire Landing Force. Therefore, a High Density Aircraft Control Zone (HIDACZ) is normally constructed within the boundaries of the AOA to assist with deconfliction from aircraft not originating within the ATF. Routes inside the HIDACZ are developed for lift aircraft to transit from sea-based staging areas (Sea Echelon Areas (SEA)) to objectives ashore and are specifically designed to account for and avoid Fire Support Areas (FSA) containing ships providing Naval Gunfire bombardment, air defence aircraft orbits, and staging orbits for CAS and other aircraft which may be operating inside the AOA (Anti-Submarine helicopters or Maritime Patrol Aircraft for example). A fully developed airspace structure designed to safely permit operations of all aircraft, both rotary and fixed wing, is generated by the TACRON working closely with the embarked air elements. Air controllers exercise positive control over air missions inside the HIDACZ and work hand in hand with the maritime Air Defense Commander for identification of friendly forces transiting into the AOA.

The function of amphibious air C2 is not limited to control of the organic amphibious air missions; the Navy Tactical Air Control Center (TACC – manned by the TACRON on US LHDs) is a control facility which exercises C2 over all air missions inside the HIDACZ,

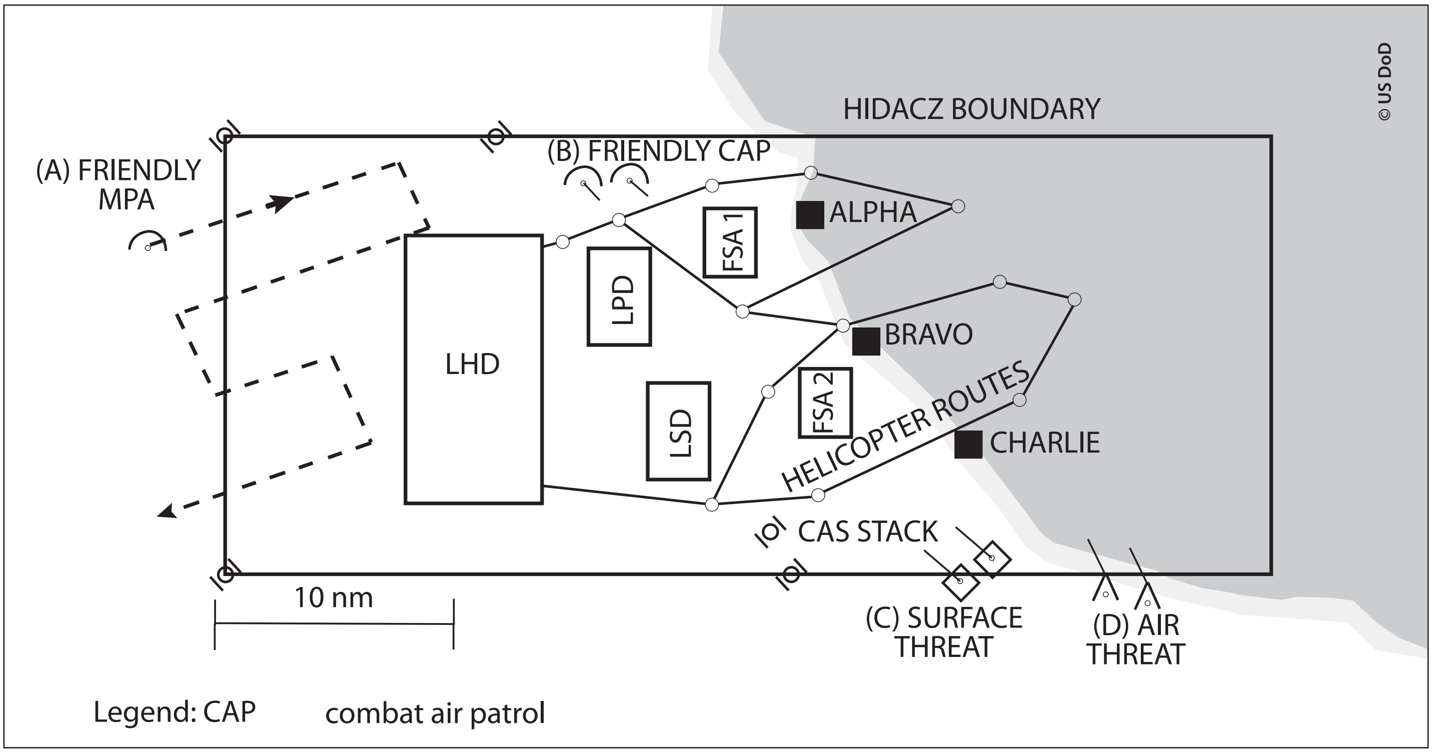


Figure 1: Notional depiction of a HIDACZ Airspace Control Measure.

F-35B Lighting II embarked on USS Wasp.

including joint missions from other services. The TACC can be employed even if the Landing Force is not actually conducting a landing. In Operation Odyssey Dawn and the subsequent NATO Operation Unified Protector (OUP), multiple nations' amphibious forces were positioned off the coast of Libya in preparation for possible operations. Although national restrictions on 'boots-on-the-ground' prevented the employment of the Landing Force, the TACC aboard the USS Kearsarge provided the only C2 capability in the Joint Operations Area until NATO's AWACS arrived on day 5. During the first 12 days of operations, the TACC provided 9-line strike targeting, Air Intercept Control of Combat Air Patrol stations, and served as tanker coordinator for 318 tanker/750 strike aircraft missions (accounting for 66 per cent of all fuel transferred).[5]

Inter-Service Challenges?

Differences of opinion regarding the use of Air Power to support an amphibious landing developed from the Land and Air Component Commanders. As witnessed in both the Pacific and European theatres in World War II (WWII), Air Power was not as effective at removing defensive positions on the beach as was originally envisioned. 'Despite the intensive air and naval bombardment of coastal defences, those defences were, by and large, intact when the invasion force "hit the beach". This was particularly true at Omaha beach, where American forces suffered serious casualties and critical delays. Despite a massive series of attacks by Eighth Air Force B-17s, V24s and medium bombers in the early hours of June 6, the invading troops were hung up on the beach.'[6] Additionally, in WWII, necessity dictated a significant portion of the land-based Air Force to defend the afloat task force and a philosophy emerged 'that in a NATO war, naval forces could be protected by land-based aircraft. [Even as numerous post-war exercises failed to show the validity of the prevailing philosophy], the fiction was maintained, probably because to admit that a need existed for carrier air defense would have entailed ruinous expense.'[7] As NATO aircraft carriers were developed in the subsequent decades, the vast majority of aircraft carriers and amphibious assault ships were constructed with this pervasive philosophy as a backdrop, resulting in

limited or no carrier based defensive (air-to-air) or Airborne Early Warning (AEW) capability, with the French Charles de Gaulle and the eleven US Nimitz/Ford class nuclear carriers being notable exceptions.

The discussion about which service is responsible for defending ships at sea still colours the conversation today and remains one of the impediments to NATO functioning as a truly integrated Joint Force. In fact, some nations have doctrinally assigned aircraft embarked on an aircraft carrier directly to the Air Component Commander instead of the maritime component. In this case, the afloat Task Force Commander desiring aircraft to fulfill defensive anti-shipping or overwater air defence roles must request apportionment of the assets currently sitting on his or her flight deck from the JFACC. Exemplifying the Wales Summit concept of Pooling and Sharing, it has been proposed that a US Marine squadron will embark on the HMS Queen Elizabeth whilst the UK awaits delivery of her fleet of Lightning II aircraft.[8] If this deployment proceeds, the supporting tactical air control construct must be carefully designed and communicated across the force to ensure comprehension, as the two countries have dramatically different models of amphibious air C2.

The Future of Tactical Air Control

Until recently, amphibious force aircraft have lagged behind in C4I upgrades against their fighter and ground-striking peers. Only in the last few years has the US outfitted its Marine assault support aircraft with a datalink. The lack of a robust C4I capability was also resident in the TACC. Only the ship's operations center could utilize the Link-11 or Link-16 architecture, and the vast majority of air control, including 9-line and mission report (MISREP) exchanges during OUP, was executed via voice. With the advent of Link-16 into MH-60R SAR helicopters and the pending C4I upgrades to the MV-22 and assault support helicopters (AH/UH-1 series), embarked aircraft will soon be able to generate as much or more situational awareness regarding the battlespace than the controllers in the TACC on the ship. This dichotomy of situational awareness has caused some level of friction between air controllers, who typically operate without access to datalinks, and aircrew, whose equipment is typically more modern, and the challenge will only increase with the advent of the F-35.

The F-35 will bring a host of C4I capability, eclipsing the awareness of any controller position on the ship. Additionally, NATO planners must start to conceptualize the change in overland strike capability this aircraft will bring. No longer will the organic amphibious aircraft (AV-8B Harriers and various vertical-lift platforms) be solely relegated to movement and assault support operations. Although the existing AV-8B Harriers have some capability to project power ashore, their primary role is normally CAS for the Landing Force, and their ordnance load and range limitations restrict most deep strike operations. The F-35 will bring an increased strike capability to the amphibious force. However the F-35B will have a profound, and in many ways unforeseen, impact on all aspects of amphibious air missions. Some of these impacts may be anticipated through assessment of the F-22's current interoperability with 4th generation fighters. Today, the F-22 has become a force multiplier by improving the capability and Situational Awareness (SA) of all aircraft around it. 'The F-22 essentially acts as a quarterback for all of the aircraft airborne and increases the SA of the entire force. Today, the Joint Force Air Component Commander in Central Command rarely launches a force package into Syria without having an F-22 with the force because the F-22 enhances the entire effort.'[9] The F-35 will do the same for the aircraft operating in the amphibious objective area.

Conclusion

Operation OVERLORD was the pinnacle of European amphibious planning and execution, but it was executed in a manner befitting the strength of the force at that time – mass. Today's amphibious forces across NATO are much more lean and agile, and operate with integrated air, naval and marine elements as a combined amphibious force to conduct beach landings. Although not executed by the Alliance, amphibious operations have been employed at the national level, most notably by the Royal Navy/Royal Marines in Argentina and more recently by French forces in Mali. NATO doctrine reflects the fact the Alliance has limited experience as a joint amphibious force; in many cases, the doctrine reflects national perspectives that are unique to the capabilities of that individual nation. NATO's Naval and Striking Support Force (STRIKFORNATO) is exploring a review of seaborne air control concepts, such as the Maritime Air Operations Center, in an effort to improve the efficiency and integration of maritime air into joint operations (and vice-versa).

Perhaps most importantly, regardless of the nationally derived C2 model in use aboard a specific aircraft carrier, NATO doctrine, including Allied Joint Publication (AJP) 3.3, Allied Tactical Publication (ATP) 8, and other related publications, does provide a solid foundation for both air and maritime components executing joint air missions. Improving this element of the Joint Force coordination remains a primary focus of the Maritime Air Coordination community. As evolutions in aircraft capability emerge, NATO Maritime elements, to include Allied Maritime Command (MARCOM), Naval Striking and Support Forces (STRIKFORNATO), and national Maritime Operations Centres, should continue to review and revise Air C2 doctrine to evolve in conjunction with the increased capability demonstrated by aircraft upgrades and newly fielded aircraft types to ensure the amphibious force remains capable and relevant in the overwater air control domain.

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Commander William A. Perkins

graduated in 1994 from Maine Maritime Academy with an Unlimited 3rd Mate's License followed by completion of the Navy's flight training syllabus. Commander Perkins holds a Master's Degree in Strategic Foresight from Regent University and is a graduate of the Joint Forces Staff College. He is designated as P-3 Orion Weapons & Tactics Instructor (WTI) and on his 7 deployments he has flown combat missions in every operational theatre in which the P-3C operates. In 2012, Commander Perkins completed a successful aviation squadron command tour as Commanding Officer of Tactical Air Control Squadron ELEVEN. He recently served as Navigator of the USS George Washington aircraft carrier, homeported in Yokosuka, Japan. He is currently serving as the Maritime Air (FW) including Carrier Operations SME at the Joint Air Power Competence Centre.

Institutionalizing Counter-Improvised Explosive Device Lessons Learned from Afghanistan

An Overview – Part 2

By Wing Commander Jez Parkinson, GBR AF, JAPCC

Introduction

As this is the conclusion of a two-part article, it is highly recommended to read, or re-read, Part 1 before reading this portion. As a reminder, this article represents the distillation of many hundreds of hours of work, including a JAPCC team conducting a number of 'fact finding' visits to the International Security Assistance Force (ISAF) over a period of years and C-IED (Counter-Improvised Explosive Device) capability development workshops supported at a variety of headquarters. The JAPCC used engagements with both the C-IED Task Force and the C-IED Centre of Excellence (COE) as vehicles to gather information. The primary method of obtaining data was through discussion with specialists across the spectrum of ranks. Military and civilian, national and Alliance perspectives were recorded and both industry and academia were consulted. As with all JAPCC work, feedback is encouraged, and whilst the author has not gone out of his way to be deliberately provocative, there were some challenging views gathered both in the operational theatre and in headquarters closer to home. These have subsequently been expressed in this article. It is suggested the critical question now is whether NATO could deploy and very quickly – if not immediately – be able to counter a significant IED threat? If the answer is 'yes', then the objective has been achieved. If, as is suggested, the answer is 'no', do we attempt to do something about this now or, wait and risk paying again with the same or greater 'blood and treasure' to re-learn what we should already know?

A soldier tentatively brushes away the dust from a suspect object beneath the surface of a dirt road near Garmsir, Afghanistan.

Courting Controversy Again – The Harsh Reality

Is It Already Too Late? Irrespective of whether the 'Lessons' listed here and in Part 1 are correct, it is suggested that both the impetus and structures to facilitate 'institutionalization' are already long-gone. The personnel and structures NATO had in the ISAF-era have dissipated back to Nations, into other appointments or have left the military. Equally, as an Alliance, NATO is now focussing on other issues and the IED no longer holds 'centre stage'. Simply put, current NATO structures may not have sufficient capacity to effectively manage the number of complex threat scenarios that exist today. Whilst predicting the future is difficult, one only need make a cursory search of open source material to see the frequency of IED use worldwide. Therefore, it is reasonable to state we will again face an IED threat and, potentially, that threat could be far more sophisticated than we have already encountered. As with the previous instalment, the 'challenges' presented here were included only if they were expressed on a number of occasions and/or across a number of locations.

The Next 11 Lessons

11. Campaign Continuity. An often repeated observation during interviews was there was a lack of 'Campaign Continuity'. The size of the operational area, the number of nations involved, and the incessant pace of troop rotations meant a lack of consistency in managing the threat of IEDs. Each troop rotation or change of staff in headquarters meant a new approach to the problem. Those serving on longer deployments expressed frustration at the number of changes during their tour. While they acknowledged a need for evolution, particularly in response to changes in enemy tactics, they often saw changes without any understanding of the effects of that change on the force, the civilian population, or indeed, on the adversary. There should be a C-IED Campaign Plan that all agree upon and adhere to across units. A vital element of this plan should be the early development of a Host Nation (HN) C-IED capability.

12. The Role of Culture. In the context of C-IED, we need to far better understand the culture in the midst of which we are operating and attempt to see our

activity from the perspective of that culture – a perspective likely to be very different from our own. What has been made clear is whilst many IED incidents can be classed as enemy action against ISAF forces; there were a considerable number of IED attacks conducted by or on behalf of the civilian population. These attacks were the result of other more complex cultural responses to our presence in a theatre of operation. Simply, more investment is required in the training and education of our personnel in order to better prepare them to operate in and amongst other cultures.

13. Communication and Knowledge Management. In conducting in-theatre research, the JAPCC team itself had an effect on units as it moved between locations by simply carrying information. The team led the same or similar discussions at multiple locations. Then, those on the ground at each location would seize on a point as being new, novel, different or even 'wrong'. The ensuing discussion and exchange of contacts was repeatedly commented on as being extremely useful and led to the development of the concept 'to defeat a network, you have to create a network'. Personnel in C-IED positions in-theatre were not in-post for sufficient time to allow them to establish, share, and record not just Situational Awareness (SA) but actual Situational Understanding. They were focussed on their task, at their level, for their tour. As with many challenges, the underlying issue was availability of resources. The JAPCC's activity would seem to indicate there is a need for a team to be continually moving around a theatre of operation, capturing, recording and subsequently sharing information; a second team would be required out-of-theatre to conduct further analysis. The information captured should be placed in a central database. These challenges are likely not unique to C-IED. Is it a step too far to consider whether it is time for the creation of a 'NATO Knowledge Management Agency' and/or the further development of the roles and responsibilities of the Joint Allied Lessons Learned Centre (JALLC)? The C-IED COE is the C-IED Lessons Learned Database Manager; however, they are not adequately resourced to actively capture data or to analyse data to develop proper lessons that feed the 'Capability Development' process. This must change if we are serious about learning, not just identifying lessons.

14. Strategic Communication. One Centre of Gravity, if not 'the' Centre of Gravity, for the Alliance is the concept of 'Alliance Cohesion'. Our adversaries know this and are well-versed in manipulating the media to their own ends to undermine public opinion, political will and as a result, Alliance Cohesion. In numerous instances, our adversary either filmed their own attacks for internet broadcast or has ensured that a 'news-hungry' media outlet has been conveniently present at the scene of an attack. In each case, the narrative has been set by our adversary. In many of the areas where we will operate in future, the cultural dimension of communication has to be considered. It is often the case that 'perception is truth' and whoever speaks first is often viewed as the one telling the truth.

15. Capability Development. Frequently, attempts to deliver enhanced capability to the warfighter brought further challenges. Rapid developments in response to an emerging threat are required, but to be effective, robust linkages between research and development personnel, equipment manufacturer and the end user need to be in place. In some cases,

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capability was delivered in what some described as either a 'hasty' or 'ill-conceived' manner. The concept of capability being developed along Lines of Development (LoD) has gained considerable traction in NATO and the Capability Development LoD[1] are often quoted. Where attempts to deliver capability enhancements have faltered, it has frequently been because all lines of development were not properly considered. The Capability Development process and the use of LoD has proven to work and prevents omissions and oversights; therefore, the process should be rigorously applied.

16. Risk Management. In the context of Alliance C-IED operations, discussions indicate well-understood national Risk Management constructs do not work. Commanders were regularly uneasy with the amount of risk they were expected to tolerate. However, the ability of the commander to transfer risk was mired in a multinational chain of command. Disagreement would centre on whether it was a NATO or national responsibility to resolve the issue. Put simply, there was evident in-theatre frustration to the out-of-theatre answer that nothing could be done because the answer lay with the nations. Without the ability to transfer the decision to the next level or the authority to terminate the mission, the commander was left with little option but to tolerate a level of risk he felt inappropriate. Any politically, or militarily-driven imperative to avoid loss of personnel and equipment at all costs is unrealistic. Countering the IED threat cannot in its self be considered a viable end-state. The Alliance approach to C-IED should always be based on minimizing the risk wherever and whenever possible but, not on risk elimination, as this approach is likely to have a negative impact on the accomplishment of the overall mission. Guidance needs to be provided on acceptable risk levels within the context of the campaign end-state. This guidance should be disseminated down the command chain, allowing risk to be managed at the appropriate level. It is essential commanders are given an assessment of the 'amount' of residual risk[2] they face and understand the effect their C-IED measures have in mitigating overall risk. From time to time incidents will happen, and senior leadership, both political and military need to understand this.

17. Measures of Effectiveness (MoE). Several commanders expressed uneasiness over the level of resource being expended with no real ability to understand what was being effective and why. As part of any drive to 'institutionalize' C-IED as a capability, there needs to be an analysis of what activity was undertaken and in what context to identify whether there is a reliable way to capture and/or measure the effectiveness of C-IED efforts. This would appear to be an ideal task for an external, specialist consultants, possibly from academia and/or industry? With the huge resource implications of maintaining an effective C-IED capability, understanding what works and why will become increasingly important.

18. Understanding Effects. The issue of correctly understanding effects is also linked to the issues of 'Campaign Continuity' and 'Culture'. When IED events were re-investigated it was shown that, in many cases, whilst there were obvious linkages between the event and ISAF activity, there were many other less obvious potential causational factors. More effort should be expended to understand second and third order effects and unintended consequences. Both now and in the foreseeable future, an ability to identify, track, and bring effects to bear on individual elements within a network, the network in its entirety, or indeed on a network of networks, brings with it an inherent need to look beyond just desired effects. Equally, not prosecuting a target may better support campaign or mission objectives because of the intelligence value of leaving a target to operate apparently unhindered and unobserved. For this to happen, greater synchronization is required between intelligence, planning and operations staffs. A better understanding of how our actions affect others from their perspective, not our own, is required. This in turn can be achieved by enhancing cultural training as already proposed elsewhere.

19. The Lessons Learned Process. It has become clear in the course of this work there is a lack of understanding of the 'Lessons' process and probably more worryingly, a general lack of 'faith' in the system. A significant number of personnel interviewed understood the basic concept of learning lessons in order to avoid repeating mistakes, but many were not aware of the formal NATO process. Where processes were discussed in detail, they were often unit or national processes and there was little understanding of the NATO mechanism. The issue of a lack of faith in systems was expressed as a result of the perception that inputs were made, but there was little, if any feedback. Further, a number of individuals expressed the view that the NATO process was cumbersome and required those with the 'observation' to do much of the analysis to identify the lesson themselves, as a result of a lack of dedicated NATO resources. It is recommended that resourcing to the JALCC is significantly increased.

'… the impetus and structures to facilitate "institutionalization" are already long-gone. The personnel and structures NATO had in the ISAF-era have dissipated back to Nations, into other appointments or have left the military.'

20. Increased Threat or Increased Footprint? A figure quoted by several sources was 70 % of activity in ISAF was self-sustainment related – logistics. New approaches to military operations, including use of renewable energy sources, will lessen the logistics footprint and reduce exposure to IEDs. In October 2005, there were 70 IED incidents in Afghanistan, whilst in Iraq there were 1,683[3]. However, by the middle of 2009, IED incidents in Afghanistan had reached similar levels[4] as those of Iraq in 2005. The 'Troop Surge' in Iraq took place during the period March 2007 to July 2008. In Afghanistan, the surge was between December 2009 and July 2011. In both cases, the mid-point of the surge saw the peak of IED incidents[5]. More boots on the ground equals more targets! Leaders must be educated to understand that a possible consequence of deciding to deploy significantly more personnel, will likely be more casualties.

21. Last But Not Least. There was a point in the ISAF campaign (at the peak of the troop surge) when it could have been argued the political desire to prevent

IED-making material found in a discovered weapons cache.

casualties from IEDs was in danger of becoming the focus of the mission. As has been said on numerous occasions, 'You can't fix stupid!' This point is not meant 'tongue in cheek'. The best way to expand this point is to ask: Why would personnel on numerous occasions enter high, Remote Controlled (RC) IED threat environments with their countermeasures switched off? Or: Why did a company commander collect IED components, construct his own viable IED and bury it on his base, without informing anyone, thinking that these actions would provide a realistic training opportunity (to include casualty management)? The point here, is that however effective a strategy is, in military operations things will inevitably go wrong. Trying to plan for every eventuality increases the risk of diverting or over-burdening already scarce resources. Leaders need to accept that military operations are inherently dangerous. All reasonable measures must be taken to reduce risk, but it cannot be eliminated.

Summary

This two-part article has sought to capture and briefly explain numerous Observations and/or Lessons Identified. There are still many more that have yet to be captured. Further, some of what has been presented will, quite correctly, be contradicted by others.

Current Political and Military 'generations' are short (perhaps less than ten years?). As highlighted above, there is already a shift towards future challenges and for some the challenges of Afghanistan are now seen as a thing of the past. Clearly, we do have to look to the future and there are numerous challenges ahead for NATO but, as ISAF drew to a close on 31 December 2014, the IED threat did not go away. The IED is both a current and future threat. Work must continue in order to prevent, in a few years' time, our successors being confronted with the issues that confronted this generation in terms of the Alliance and its Partners being able to effectively counter the IED threat. However, it is also about appropriate balance. We need to have an effective C-IED strategy backed by robust capability, but not at the expense of an ability to counter whatever our adversary conceives next.

1. Doctrine, Organisation, Training, Materiel, Leadership, Personnel, Facilities, Interoperability.
2. The amount of risk still being carried with all current available C-IED measures in place.
3. Figures from the Centre for Strategic and International Studies.
4. Figures from Joint IED Defeat Organisation (JIEDDO).
5. Iraq, May 2009 = 2,482. Afghanistan, May 2010 = 1,128.

Wing Commander Jez Parkinson

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


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AEGIS Ashore Missile Defence System in Deveselu, Romania.

Nimble Titan – Ballistic Missile Defence in a Regional, Cross-Regional and Global Environment

By Lieutenant Colonel Andreas Schmidt, DEU AF, JAPCC

Introduction and Background

Since the beginning of armed conflicts, weapons have been used to gain advantage on the battlefield. The chronological and developmental successor of arrows, catapults, and cannons, Ballistic Missiles (BM) entered the battlefield in 1944 and rapidly evolved into an instrument of global force projection, with the capability to deliver mass destruction over long distances with great accuracy. Considering the short flight times and therefore available reaction times, BM are a substantial threat for nations, regions and global organizations.

To be better prepared for a potential BM threat, nations with Ballistic Missile Defence (BMD) capabilities have undertaken numerous exercises, war games and studies. Based on a unilateral US BMD exercise executed by the US Joint Staff's Joint Theater Air and Missile Defense Organization (JTAMDO) in the late 1990s, Nimble Titan (NT) was created in 2002. In 2003, the United Kingdom entered as an observer and participated in 2004 and 2005, rendering NT a bilateral but still classified event. These early exercises considered themes such as interceptor shot doctrine, automated battle management aids, decision support tools, combined early warning, offence-defence integration,

weapons allocation and release authorities, and Command and Control (C2) structures, all of which represented challenges on a mainly tactical level.

In 2006, the NT program was transferred to US Strategic Command (USSTRATCOM), which tasked the Joint Functional Component Command for Integrated Missile Defense (JFCC IMD) to manage and execute the war game.[1] After NT 06, the focus shifted from tactical matters to multinational policy issues at the operational and strategic level. Furthermore, to allow for broader participation, NT became an unclassified event. Since then, NT has grown from a small bi-lateral event to include 26 participating NATO and Non-NATO nations and organisations. JAPCC became the latest NT member in November 2015 after being accepted by the NT Steering Committee. Due to NT's unique and complex composition, this article will highlight how a NT campaign is being planned and executed and why it plays such an important role in the global understanding of BMD. Furthermore, it should become clear that NT is constantly evolving and improving based on lessons learned from past campaigns.

In accordance with the NT Campaign Design Standing Operating Procedures[2], a regular campaign spans a time frame of two years, during which all planning, designing, execution and evaluation events take place. At the start of each campaign, participating countries offer to host single events, making NT truly a global endeavour.

Campaign Development, Design and Planning

Every NT campaign starts with a Campaign Concept Development Conference (CDC), at which all NT participants bring forward their key objectives for the upcoming campaign. All objectives and potential carry-overs from previous campaigns are evaluated and grouped into main and sub-objectives. NT 16 comprises four main objectives with a total of 22 enabling sub-objectives. Here is a sample of the NT 16 objectives[3]:

- Policy (POL)-1 Examine national and multinational BMD decision making processes and their effects on planning, design and execution;
  - POL-1.2 Identify conditions and factors for enabling effective cooperative action, including formal information exchange processes, between intra-, inter-, and non-organization partners;
  - POL-1.8 Examine the second order effects and implications of anticipatory self-defence;

- Planning (PLN)-1 Explore the effects of policy guidance on defence design;
  - PLN-1.3 Identify implications, gaps, potential risks and mitigation options in comparative defence designs;
  - PLN-1.6 Explore the benefits and limitations of BMD and non-BMD state contributions in planning and design of BMD architectures.

The developed list of objectives is then built into a suitable campaign construct. Some objectives are best evaluated in a dynamic war game, while others lend themselves more to a Table Top Exercise (TTX), Limited Objective Experiment (LOE), or Seminar. Due to the extensive NT participant list, there are, next to national territories, always four regional focus areas to be evaluated and stimulated. These are the NATO and non-NATO European Region, the Gulf Region, the Asia-Pacific Region, and the North American Region. Since NT 12, the campaign design has striven to create a global scenario as well. To maintain the experimental character of NT, the time scope is always ten years in the future, which allows for experimental national policies, weapon systems, C2 structures, constructs, and concepts. Traditionally, the main focus of all NT campaigns has been ballistic missile defence on a regional and global scale. However, the current objectives include Integrated Air and Missile Defence (IAMD) as well. This is because the community acknowledges an isolated view on BMD might not clearly identify potential problem areas where air defence and missile defence overlap. Due to the experimental character of NT itself, the participants can free themselves to a certain extent from their current national policies during the campaign events and try out new approaches to support the development of future policy or doctrinal documents.

The CDC determined the current NT 16 campaign will be made up of four major events, and the campaign will stay on the pol-mil strategic level with an operational background. Each main event has a Planning and Design Workshop prior to its execution, which involves the NT core team and representatives of the NT participant nations. Due to the highly professional input of the NT participants and the extensive historical NT knowledge, NT events steadily evolve and adapt to fulfil participant expectations. The use of outstanding tools, like skilfully-produced NT Television news clips, very capable simulation and visualization support by the US Missile Defense Agency (MDA) and experienced facilitators to stimulate NT injects during the various events, increases the professionalism and value of the NT game play.

Campaign Main Events

The first event during the NT 16 campaign was a LOE, which took place in Seattle, Washington. Participants were tasked with creating a working definition of IAMD for the NT environment to be used in subsequent NT events. Every nation, organisation and region had definitions for IAMD, so the challenge was to find a viable common denominator that could be utilized within NT game play. The LOE was executed as a facilitated seminar with a mainly global forum, but it also included some regional excursions. The player actions and interactions were observed by the Design, Analysis and Reporting Team (DART) for later analysis.

The results were used during the Planning Phase Event in Soesterberg, Netherlands. Here, military planners and policy players created defence designs against regional and global threats. These threats were designed mainly by the Wargame Control Group (WCG), which, in conjunction with the DART, creates the historical background of the crisis, the enemy order of battle and all needed injects to stimulate realistic and productive game play. The biggest challenge for the WCG is to define a scenario that stimulates all objectives and is realistic enough to be believable yet removed enough from reality to satisfy all participant caveats. Overall, the scenarios created by the WCG have been spot-on and have created some interesting discussions within the NT community. This demonstrates how important the player audience is to the execution events and it is of critical importance the appropriate audience also participates in the CDC and design workshops to obtain the optimal benefits from the campaign. Unclear objectives and desired injects that are not brought to the table cannot be played during the NT events.

Patriot PAC-3 Launcher.

In the design and planning event for the main war game, which was hosted by US Pacific Command (USPACOM) in San Diego, participants discussed how far possible scenarios should evolve in the war game. Is a crisis situation sufficient to stimulate necessary discussions or is a full-blown IAMD conflict scenario required to achieve the goal? Due to the uncertain development of the war game, they prepared for both eventualities. The main events provide very valuable opportunities for the training audience to get a thorough understanding of multinational, cross-regional and global BMD issues. However, equally as valuable are the design and planning events for the subject matter experts who define and develop the war games, since it is a unique platform to exchange thoughts, approaches, and current problems in the field of Ballistic Missile Defence.

The main war game itself was held in Suffolk, Virginia, at the Lockheed Martin Center for Innovation, also called 'The Lighthouse'. This outstanding facility once again hosted the 26 nations and organisations participating in the so-called hybrid war game. Since it is difficult to guarantee the achievability of all given objectives in a pure free-flowing war game, it used a partly facilitated format with mostly pre-written injects. The flexibility and dynamics in the game play was created by the interaction of the exercise audience and the white/red cell players in the WCG. Steady feedback from the DART allowed the WCG to steer the game play towards the objectives. The red and white cell players are experts in their fields, which makes the interaction during the game play very realistic for the participant audience and allows a certain degree of freedom in the scenario development for the WCG during the whole event. Also, in cases where discussions in regional or global consultation forums create much valuable input, the game play is flexible enough to allow for extended dwell-time on those specific topics.

Each NT Campaign is concluded with an NT Capstone Event, usually a war game as described above, which has traditionally had a distinguished visitor day. This allowed senior leaders, be they military flag officers or their foreign affairs civilian equivalents, to see NT in motion and experience the live war game. However, this option, with its high-level footprint, reduced the actual game time and denied the presentation of analysed results of the war game to those senior leaders. As a result, the June 2014 After Action Review Team recommended hosting a separate Senior Leadership Seminar (SLS) in June 2016. This will give the benefit of retaining the full use of all war game time as well as the possibility of presenting the thoroughly analysed conclusions of the entire NT 16 campaign.

This year's SLS, followed by an after action review of all events will conclude the NT 16 campaign and will also be used to obtain valuable senior leader guidance to aid in shaping the future of NT. All results of the NT events will be presented in the final NT campaign report and in the other subordinate event reports. Also, important individual findings will find their way into the NT Implementing Instrument, which is a collection of wisdom accrued over many

Attendees of the Nimble Titan 2016 War Game at the Lockheed Martin Center for Innovation.

NT campaigns. This document has, in the past, proven to be highly valuable and has contributed towards official national policy documents. The overall results of NT can then serve as a reference or foundation for the definition of new national or organisational documents.

Outlook and Summary

In September 2016, the CDC for NT 18, during which the next evolution of the NT series will be defined, will take place in Tokyo. Overall, NT provides a truly unique opportunity to learn about global approaches towards Ballistic Missile Defence and IAMD policy. No other campaign presents better grounds for international networking in the BMD arena on the political-military level. It is eye-opening to work with regions that have a more imminent threat and threat perception than central Europe. NT is the only BMD campaign with a strategic-level approach on a global scale, where political, legal and military challenges can be discussed equally.

The reality of ballistic missiles, especially in the realm of current and upcoming technology and means of physical and digital proliferation, can only be countered on a global scale. It is up to the participating nations to maximize their benefit from NT by ensuring that the appropriate players and experts participate in the individual events. The unique composition of nations, experts, and decision makers, along with the correct understanding of NT's experimental nature, makes NT a valuable tool in obtaining insight into factors that will impact the evolution of future BMD operations.

1. JFCC IMD, NT Compendium Report, Mar. 2015.
2. JFCC IMD, NT 16 Campaign Design Standard Operating Procedure (U), 10 Jun. 2015.
3. As defined in the CDC for NT 16 in Jun. 2014.

Lieutenant Colonel Andreas Schmidt

joined the German Air Force in 1993. After attending Officers School, he studied Computer Science at the German Armed Forces University in Munich. Since 1998 he built up an extensive background in Ground Based Air Defence, particularly the PATRIOT weapon system. He started as a Tactical Control Officer and subsequently held positions as Reconnaissance Officer, Battery Executive Officer and Battery Commander in various PATRIOT units. Furthermore, he had two non-consecutive assignments in Fort Bliss, Texas. The main task of his first assignment was to conduct bilateral USA-DEU studies of Weapon System behaviour on a tactical level for the German Patriot Office. During his second assignment he was the Subject Matter Expert (SME) on Integrated Air and Missile Defence at the German Air Force Air Defence Centre. In between he had an assignment as the A3C in the former Air Force Division. Currently, he is the Ballistic Missile Defence SME in the JAPCC.

Air Strikes Against Terrorist Leadership

Three Lessons from the US Air Force Special Operations Command

By Major Samuel G. McIntyre, US Air Command and Staff College

Introduction

Since the United States began worldwide military operations in response to the 11 September 2001 terrorist attacks, our military has been increasingly tasked to fight Violent Extremist Organizations (VEO).[1] Wars in Afghanistan and Iraq, characterized by large, conventional troop mobilizations and nation-building exercises, have been inconclusive. Recent hostilities in Mali, Yemen, Syria, and Libya have joined long-simmering conflicts in Somalia and Pakistan as VEO influence spreads.[2] As more countries became battlefields, US tactics shifted away from massive and costly deployments towards air strikes of key enemy personnel. Three factors have converged, creating an environment ripe for NATO Special Operations Forces (SOF) involvement in efforts similar to the US SOF High Value Individual (HVI) air strike campaign.

First, the continued refinement of the US find, fix, and finish targeting methodology has demonstrated VEO HVIs can be struck worldwide with minimal collateral damage.[3] Second, striking terrorist leadership remains politically palatable, and precision engagement of HVIs has proven politically popular.[4] Lastly, mass casualty attacks in Paris combined with public declarations by VEOs reaffirming their commitment to attack NATO countries increases political pressure to act. These factors create the potential for NATO SOF to augment ongoing US SOF operations targeting VEO HVIs. If that happens, three lessons from the US effort should be internalized by NATO leadership at the outset.

Manage Expectations

HVI air strikes alone will not defeat VEOs under most circumstances, and decapitation strategies will not

© US Air Force, Staff Sgt. Julianne M. Showalter

stop ideologies.[5] This does not mean air strikes are futile. It simply means SOF leadership must engage in critical rather than wishful thinking regarding benefits and limitations before advocating an HVI air strike campaign. 'Battles are dangerous affairs'[6] is the ancient acknowledgement that violence is inherently unpredictable, precipitating intended results but also unintended consequences. Although proficiency at HVI air strikes is better than ever, SOF leadership must manage political and military expectations about positive, negative, and unknown aspects of a HVI air strike approach to VEOs.

The US campaign, although indecisive against VEOs, has nevertheless produced successful aspects. Air strikes have denied the enemy sanctuary by forcing them to re-evaluate areas previously considered safe from US attack.[7] Since the opening salvos against Taliban targets during the early days of Operation ENDURING FREEDOM, airpower has been the asymmetric advantage of US SOF, depriving VEOs of safe havens.[8] Former US Secretary of Defence Leon Panetta even called this campaign 'the only game in town' in terms of directly confronting al-Qaeda.[9] Air strikes put VEOs on the defensive by keeping enemy HVIs occupied with force protection and evasion concerns. Alone, precision air strikes will not defeat VEOs, but strikes disrupt their offensive planning while buying space and time for other solutions. In Somalia, SOF air strikes combined with regional, conventional forces collapsed al Shabaab's hold on massive swaths of territory. While these positive outcomes were intentionally designed, commanders must be aware of potential undesired second order effects.

US SOF rapidly killed successive al-Qaeda in Iraq (AQI) leadership, creating an impression their organization was reeling. Unfortunately, the tactically successful killings failed strategically by enabling an exceptionally capable junior member to rapidly rise in authority and rejuvenate AQI. Abu Bakr al Baghdadi transformed AQI into the Islamic State of Iraq and al Sham (ISIS) and birthed a nightmare of regional conflagration.[10] The applicable lesson from ISIS is we should not presume our enemy is defeated when their leaders are killed, nor should we discount the danger of unintended consequences. Uncertainty will remain a combat variable no matter how modern our methods. NATO SOF leaders should approach any HVI campaign with clear expectations about benefits and limitations of this course of action along with a healthy respect for the unknown.

Share Information

The US has experienced mission-degrading bureaucratic friction during its SOF-led HVI air strike campaign. Coordination between disparate communities has been hampered by cultural, process, and personality differences. For precision HVI strikes to succeed, robust integration between operations and intelligence organizations is required. US military and intelligence agencies have shown a willingness to cooperate, but nonetheless challenges have surfaced.[11] Within the Joint SOF community, integration has not been seamless[12] and, even within the same service process, issues between operations, intelligence, and decision-makers have presented obstacles to mission success.[13] As US forces have worked through much of the friction over the past decade, NATO SOF can still learn from their growing pains.

One of the most difficult obstacles faced by US forces was enabling the timely sharing of relevant information across communities. Sensor operators, intelligence analysts, interagency partners, military commanders,

© Major Samuel G. McIntyre

and civilian leaders each see information relevant to others but regulations prohibit unrestricted sharing. These restrictions make sense; information compartmentalization remains an effective means of protecting secrets. The easiest answer is only sharing minimal amounts of information at the moment it is required; however, if everyone operates this way, the paradoxical impossibility of progress soon appears. After all, if organizations only share the minimum necessary, how do they judge what amount is necessary to share without knowing more about other organization than they allow them to know about themselves? The desire to protect sources, methods, and capabilities between US government agencies and branches will become exponentially more complex if the players are NATO states, each of which must share and protect information internally within their own systems.

US SOF has not resolved this problem entirely, but friction has been decreased by using liaison officers (LNO). If properly educated on both the parent and host organization capabilities and needs, LNOs can ensure the right information is punctually shared while simultaneously protecting it from unauthorized release. The US has expanded this concept with the Joint Interagency Task Force (JIATF) construct, which is partially designed to produce the LNO function on a macro scale. Like every bureaucratic function, the LNO and JIATF constructs must be constantly managed and will not produce the desired results merely by existing. However, these organizational solutions have made the US SOF HVI campaign more lethal and should be examined by NATO SOF.

Practise

The single most important factor that increased the success of SOF air strikes during the past decade was practise. The investment in realistic practise has been instrumental in increasing the lethality of the SOF HVI air strike campaign. Seemingly simple in concept, it took a high number of failed air strikes[14] to realize 'practise' applies not just to the tactical weapons release but is a rehearsal of the entire enterprise's ability to communicate and make decisions fast enough to exploit fleeting windows of HVI vulnerability. Often the strike assets were ready, but decisions could not be made quickly enough to approve a strike and the opportunity passed, leaving operators frustrated with the bureaucracy. Other times, the intelligence and decision-making processes were robust, but operators failed in simply keeping crosshairs on target, leaving headquarters frustrated with inadequacies in execution. Commanders overcame these challenges by encouraging the entire team to practise both together and separately. This is difficult in a joint environment and will be doubly difficult between countries, but there is no escaping the reality that only by practising what you expect to do can you become good at doing it.

Practise is time consuming and time spent practising is time not spent tracking and gathering intelligence. Striking the right balance between practice and intelligence collection is not a stagnant formula; commanders must assess each function of their joint team to determine the appropriate ratio given situation-specific peculiarities. Knowing such a ratio exists and will be deceptively difficult to ascertain is a relevant

US Navy, Mass Communication Specialist 2nd Class Brian T. Glunt

lesson NATO SOF should extract from the US SOF HVI campaign. Commanders should strive for intimate familiarity with every function contributing to the HVI air strike enterprise and then exercise those functions as often as possible.

Final Thoughts

US SOF will likely continue to utilize precision air strikes of HVIs as a primary tool against VEOs. Alone, this will not create victory, and we are losing across the board to our adversaries.[15] Nevertheless this tactic has proven politically popular and sustainable for US forces; until a winning strategy emerges, US SOF will continue to refine precision air strike methods. Consequently, examination of our techniques and polishing of best practices is the duty of officers knowledgeable about the enterprise. If NATO responds to VEO attacks by either assisting the US SOF expansion of our HVI hunt or mirroring similar practises, there are lessons learned NATO SOF members can derive from the US experience. Chief among these are expectation management regarding the efficacy and outcomes of air strikes, early streamlining of information sharing, and the importance of constant, realistic practise for the entire team. ●

1. I wish to thank Majors Casey, Slaughter, Mitchell, Keay and Loken for their thoughtful comments and suggestions. All errors found herein are my own.
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US Admiral Mike Mullen holds a shura with Afghan leaders in Marjah, Afghanistan, discussing their concerns (March 2010).

Knowledge Development vs. Intelligence in NATO

A Problematic Delineation and its Ramifications

By Lieutenant Colonel Martin Menzel, DEU A, JAPCC

Background

For too long, NATO and its member nations perceived Military Intelligence as the staff discipline providing information and assessments exclusively about weather, terrain, and most importantly, 'the enemy'. Typical defence planning and exercises during the Cold War decades restrained Intelligence staff organizations, procedures, leadership, and personnel to this very limited interpretation of what Intelligence should all be about.

In 2010, US Army Lieutenant General (ret.) Michael T. Flynn tellingly stated how this residual paradigm was negatively impacting modern age operations such as the International Security Assistance Force (ISAF) in Afghanistan: *'Eight years into the war in Afghanistan, the US intelligence community is only marginally relevant to the overall strategy. Having focused the overwhelming majority of its collection efforts and analytical brainpower on insurgent groups, the vast intelligence apparatus is unable to answer fundamental questions about the environment*

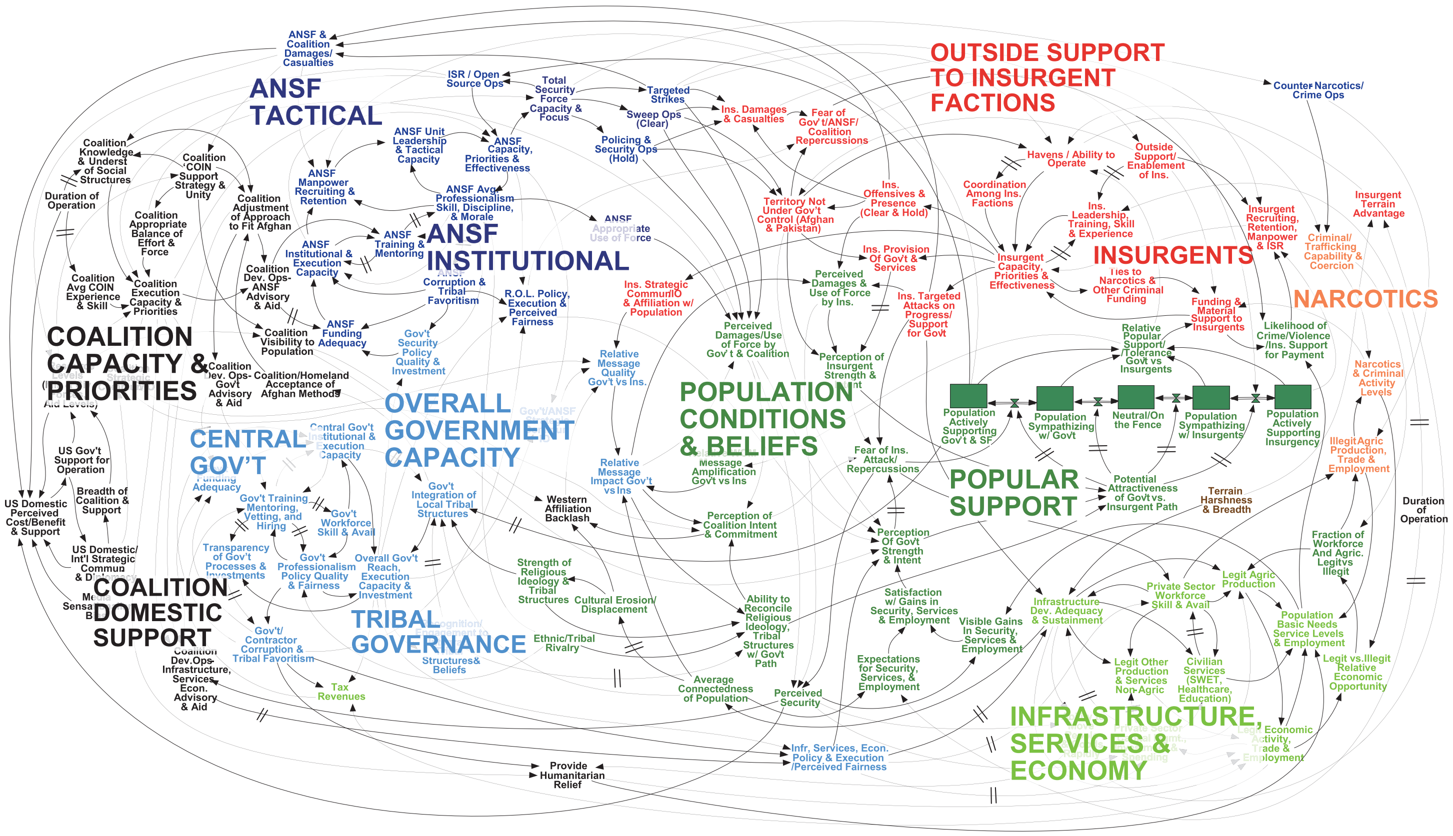

Figure 1: Afghanistan Stability Dynamic as an Influence Diagram.

in which U.S. and allied forces operate and the people they seek to persuade. Ignorant of local economics and landowners, hazy about who the powerbrokers are and how they might be influenced, incurious about the correlations between various development projects and the levels of co-operation among villagers, and disengaged from people in the best position to find answers – whether aid workers or Afghan soldiers – U.S. intelligence officers and analysts can do little but shrug in response to high level decision-makers seeking the knowledge, analysis, and information they need to wage a successful counterinsurgency.'[1]

While Coalition Forces in Afghanistan struggled with such deficiencies in their intelligence branch, the underlying problem in dealing with modern operations was not new to NATO. The emergence of new concepts such as the Effects-Based Approach to Operations (EBAO) as well as the Comprehensive Approach revealed the necessity of a more holistic understanding about the operational environment for both the military and its civilian partners. Contemporary Alliance operations require cooperation of the military with host nations, security organizations and agencies as well as International and Non-Governmental Organisations.

These operations usually occur in operational environments in which adversary elements, networks and threats are complex, multidimensional, and difficult to detect or analyse.[2] Furthermore, the complex nature of contemporary security environments presents a range of potential risks and threats to Alliance interests that cannot be resolved by military means alone. NATO's Comprehensive Approach recognizes a holistic appreciation of the operational environment is necessary to deal effectively with such complex security problems and doing so will likely require the integrated use of political, economic and civil instruments in concert with military means.

Emergence of the Knowledge Development Concept in NATO

Therefore, for roughly twelve years, the NATO Command Structure (NCS) has been developing and partly implementing the concept of 'Knowledge Development' (KD), which is intended to support operational planning, execution, and assessment by providing a holistic view of the engagement space.

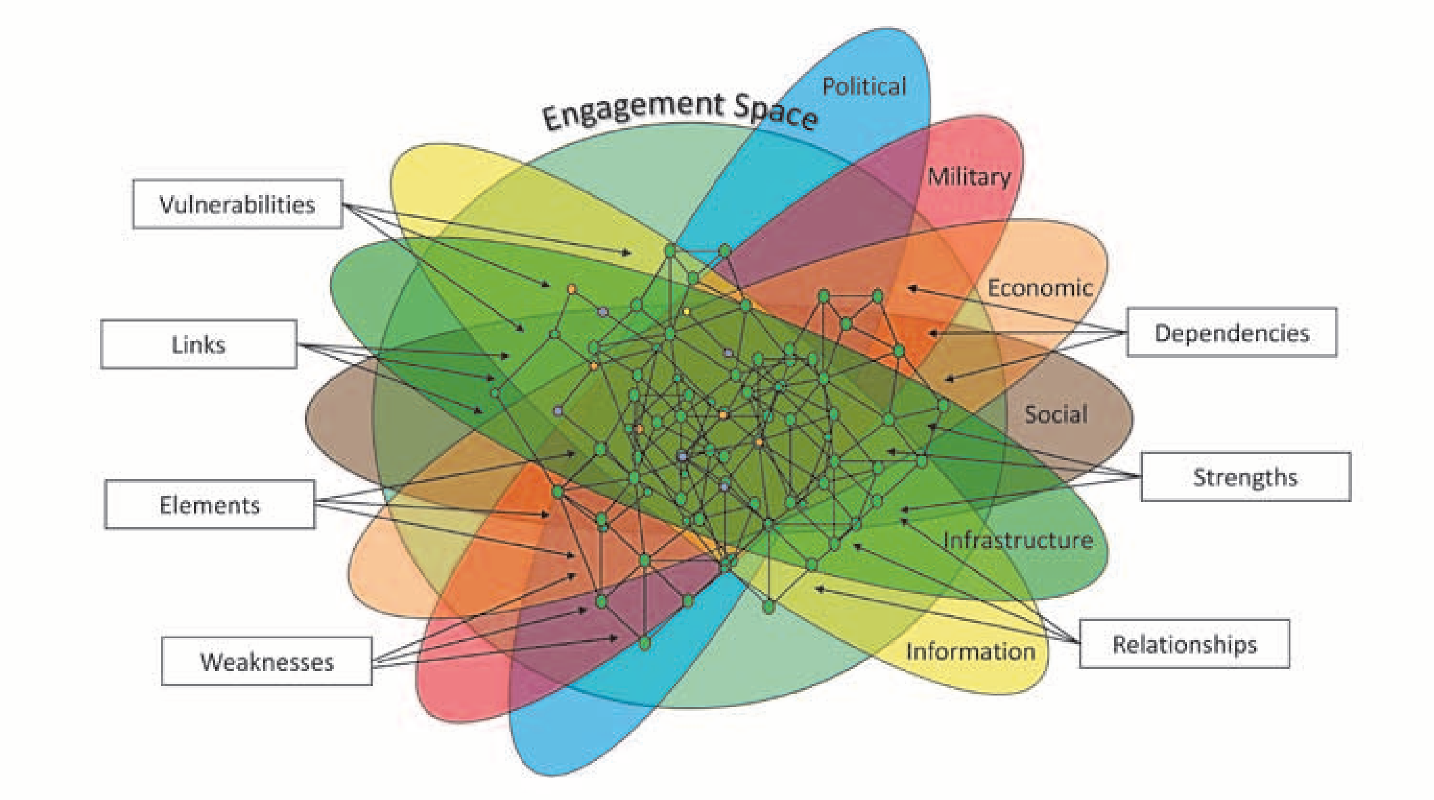

Figure 2: Depiction of PMESII Systems Analysis about the Engagement Space. © JFC Brunssum, 2011

Originally, KD developed as a research field within the business sciences. While general Information Management (IM) or Knowledge Management (KM) were the main academic focus, particular research looked for better models of decision making in complex environments under uncertain conditions, i.e. with incomplete information. The central idea was to describe the environment in terms of a system (of systems) by analysing relevant relationships between identified actors as well as evaluating probable influence mechanisms between those system elements. This developed knowledge would then be used to identify suitable leverage points as well as appropriate measures or actions that could achieve desired outcomes.[3]

NATO started to further develop this scientific KD approach for military purposes during the Multinational Experimentation (MNE) series[4], which included a Live Field Experiment on KD conducted at HQ KFOR in 2007.[5] In 2010, the Alliance abandoned EBAO as a future doctrine, but decided to stay aligned with the Comprehensive Approach and continue developing the KD Concept.[6] The two Strategic Commands (SCs) jointly developed an initial version and subsequently published multiple updates of the Bi-SC Pre-doctrinal KD Handbook (latest update in 2011)[7], which is designed to assist NATO's understanding and future integration of KD into its approach to operations. This formed the basis for a draft Military Committee policy document on KD (MC 0600)[8] as well as Chapter 2 of the Comprehensive Operational Planning Directive (COPD)[9].

In essence, these concepts and directives describe how KD shall support civil-military planning at the strategic and operational levels as well as providing commanders and their staff with a deeper situational understanding. According to the COPD, the KD process covers the acquisition, integration, analysis, and sharing of information and knowledge from relevant military and non-military sources. It includes analysis of the relationships and interactions between systems and actors taking into account the different Political, Military, Economic, Social, Infrastructure, and Information (PMESII) as well as environmental factors.[10]

Well-developed, capable IT solutions are currently available and applied within the NATO Command Structure (NCS) to facilitate KD, particularly the very sophisticated Systems Analysis Tool (SAT), which is part of the Tools for Operational Planning Functional Area Systems (TOPFAS) software suite. The SAT supports graphical depiction, analysis and ultimately simulation of complex relation and influence diagrams, allowing

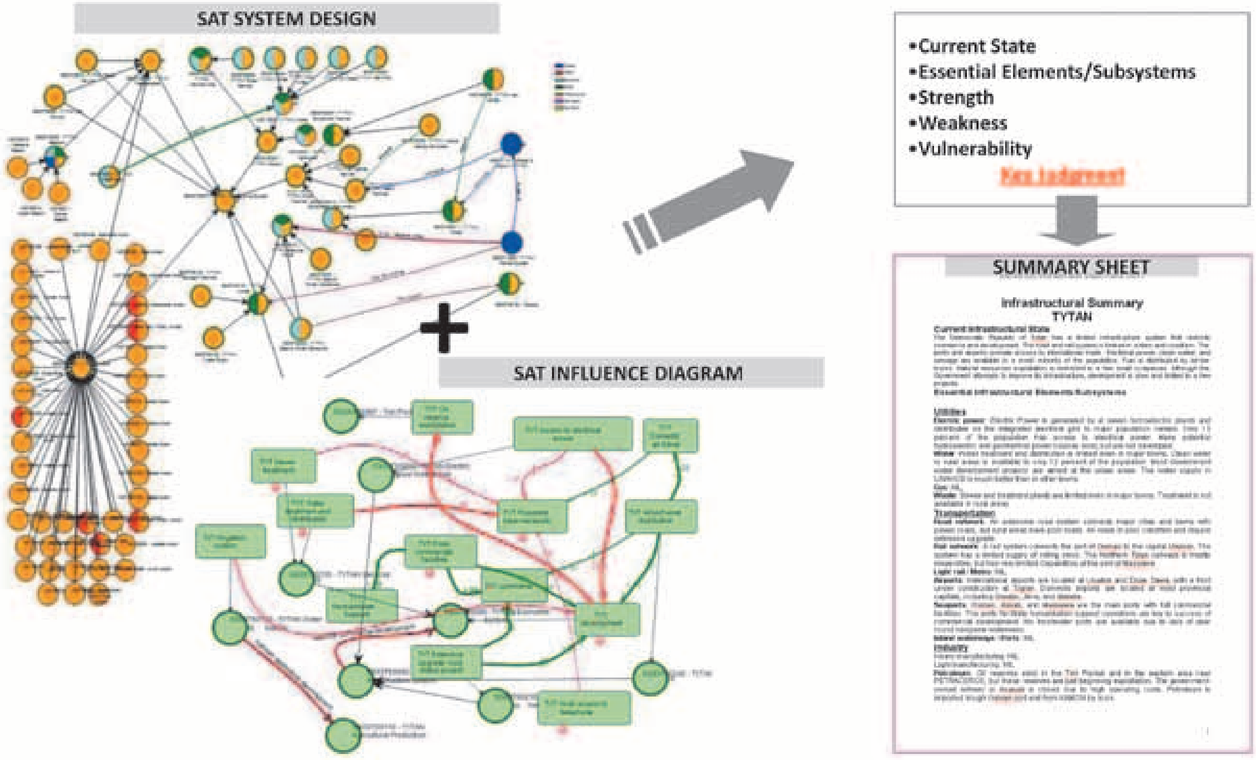

Figure 3: Depiction of the Systems Analysis methodology, using the TOPFAS SAT Module. © JFC Brunssum, 2011

the user to identify Centres of Gravity, achievable effects, and methods for their measurement.

KD and Intelligence – Truly Different?

With regard to the above purpose and scope of KD, as described in applicable NATO policy and concepts, common sense may demand the question: Why would KD be a different function than Intelligence, rather than its necessary evolution, or add-on? The 2011 (Pre-doctrinal) KD Handbook attempts to answer the question by delineating KD and Intelligence. However it is based on two obsolete assumptions: First it postulates that *'NATO and national intelligence activities are focused primarily on actual or potential adversaries within a specific country or region.'* Second, it states *'KD encompasses the deliberate use of non-military sources beyond the scope of military intelligence activities.'*[11] Conversely, the KD Handbook weakens its own argument by admitting *'today's Intelligence also addresses non-military sources and domains, and operational practice will demonstrate how the delineation between KD and Intelligence can be better defined.'*[12] This last statement discovers the major flaw incorporated in the concept: Restricting Intelligence to information about 'red' forces contradicts its own fundamental paradigm about complex environments, since it is required to observe the complete PMESII spectrum in order to understand the origin, nature, and probable further development of an adversary threat.

The KD Handbook assumption that Intelligence and KD should be separate also neglects that earlier versions of NATO Intelligence doctrine[13] (published well before the development of the KD Concept) stated the relevance of non-military factors in the operational environment, and they did not exclude the use of external non-military sources. Updated Intelligence doctrine, meanwhile, omits any enemy-centric notion. Allied Joint Publication (AJP)-2, promulgated in September 2014, states *'Intelligence develops knowledge about the environment and actors'*[14]. It furthermore stresses *'the complexity of modern operations produces a greater need for all-encompassing intelligence […] in order to enable comprehensive understanding about the environment'*[15] in an approach that *'should be sufficiently inclusive, flexible and adaptive to accommodate a wide range of experts, both within and external to the formal NATO structure'*[16]. In the same tone, the AJP-2 is permeated by the Comprehensive Approach methodology. Nonetheless, the doctrine still draws a line, stating that *'KD is not an Intelligence function'* whilst admitting in the same sentence that *'the Intelligence staffs make a significant contribution to KD.'*[17]


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A US Civil Military Operations Staff Officer meets with Afghan village elders in Kabul, Afghanistan.

Establishment of KD in the NATO Command Structure

At Supreme Headquarters Allied Powers Europe (SHAPE), the Comprehensive Approach concept is established through the Comprehensive Crisis and Operations Management Centre (CCOMC), of which the Crises Identification Group (CIG) is a subordinate staff element. The CIG consists of the two core elements Civil-Military Analysis (CMA) Branch and the J2 (Intelligence) Operations Branch, whose Chief is the CIG lead. The applicable Comprehensive Crisis and Operations Management Process (CCOMP) Handbook[18] tasks the CIG to provide 'fused intelligence and information', not mentioning the term 'KD' at all in that regard. Having said this, it is important to note that while SHAPE has not established any formal KD organization, the KD methodology (development of fused intelligence) is inherently implemented and applied by the CIG staff, which includes both military and civil analysts.

Also the two NATO Joint Force Commands (JFCs), Brunssum and Naples, have no formal KD organization. After the NCS reorganization in 2012–13, KD related tasks were placed back under J2, where the J2 Intelligence & Knowledge Assessment & Production (IKAP) Branch leads comprehensive systems analysis in collaboration with other staff divisions. Moreover, a small J2 Knowledge Management (KM) Branch remained, perhaps as a residual element resulting from past ideas that interpreted KD as a centralized staff function with intrinsic KM responsibilities. The continued existence of this branch has led to problems fully integrating the KD and Intelligence functions within the JFCs.

KD/Intelligence Delineation – Ramifications at the JFCs

While the J2 IKAP Branch at the JFCs had been established as the core KD/Intelligence capability with the comprehensive mind-set communicated to all its analysts and Subject Matter Experts, the J2 still struggles to demarcate the roles of the J2 KM Branch as opposed to J2 Information Acquisition (IAQ) Branch, the latter being traditionally responsible for Intelligence Requirements Management (IRM) and Collection Management (CM). Falling back to the idea of KD/Intelligence delineation, an internal directive was issued in 2012 that J2 IAQ shall collect intelligence about 'red', i.e. the adversary only, while information acquisition about other factors would be a task for the J2 KM Branch. Respective parallel procedures to answer formal Requests for Information (RFIs) and fill information gaps were subsequently established in order to manifest this directive:

RFI management. This doctrinally well-established and accepted intelligence procedure has been split into categories such as 'Red RFIs' (about opponents or potential opponents) and 'Green RFIs' (about neutral, independent, international or other actors)[19], which along that line are to be forwarded through different channels as opposed to the past.[20] Many examples demonstrated the logic pitfall built into this procedure, often to the effect that the distinct addressees requested to answer the RFI denied responsibility for answering the identical RFI, since neither side would accept the single issues of requested information as clearly RED or GREEN by their nature.

Identify knowledge / information gaps (as opposed intelligence requirements). While the traditional IRM&CM functions at J2 IAQ are doctrinally robust and best suited to identify, validate, prioritize, and manage the satisfaction of intelligence requirements, the KM Branch is persistently occupied with defining 'knowledge requirements' or 'gaps' as well as developing a 'Knowledge Acquisition Plan' to include the conduct of its own Working Groups and Boards.

Although the additional procedures established by J2 KM appear to be practically accepted, the challenge remains as to how to utilize them with meaningful substance because of the all-too-blurry border between 'Knowledge' and 'Intelligence'. In both cases, many opportunities to collect relevant information remain unexploited while analysts' articulated information requirements remain unsatisfied. The overall impression is one of unnecessary redundancy of processes and complexity maintained for the sake of justifying the existence of two different Branches, while the overall coherence of CM regarding intelligence, information, and knowledge requirements is at stake.

Conclusion

Past deficiencies, failure and irrelevance of Intelligence to cope with contemporary operational environments have paved the way for KD as a promising new concept. Its emergence has indeed brought many fresh and valuable ideas to NATO that have helped improve the organization in this regard. The application of systems analysis, staff-wide internal expert collaboration as well as cooperation and information exchange with external non-military experts (based on a cultural shift in information sharing from the 'need-to-know' principle towards the 'responsibility to share' tenet) are among the most valuable components of the concept.

KD and Intelligence are today obviously more aligned than delineated. Although the few arguments for a segregation of the two functions persist as a resilient mantra, they are weak and nearly obsolete. An explicit delineation, as advocated in the KD Handbook, creates practical difficulties and risks, particularly with regard to information acquisition functions and processes. Rather than developing separate doctrine as well as establishing additional staff elements and processes, the better solution is a simple relief of Intelligence staffs from traditional dogmatic barriers that have kept them enemy-focussed and compartmentalized in exaggerated secrecy. This would allow them to rely on well-established, robust intelligence procedures while integrating the beneficial ideas that the KD concept has brought. ●

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3. Allied Command Transformation, 'Final Analysis Report: The German Knowledge Development (KD) Life Field Experiment (LFE) at HQ KFOR', 17 Aug. 2007.
4. The Multinational Experiment (MNE) series is designed to develop and introduce new capabilities to enhance the coalition force's operational effectiveness in joint, interagency, multinational, and coalition operations. Initiated by the United States Joint Forces Command in 2001, it has been, since then, joined and supported by many Alliance Nations.
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7. Ibid. 2.
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10. Ibid., Par. 2–5.a.
11. Ibid. 2, Par. 1–12 and 1–13.
12. Ibid. 2, Par. 1–14.
13. NATO, 'AJP-2 Allied Joint Doctrine for Intelligence, Counter-Intelligence and Security', Jul. 2003.
14. NATO, 'AJP-2 Allied Joint Doctrine for Intelligence, Counter-Intelligence and Security (Edition A Version 1)', Sep. 2014, Par. 3.2.2.a.
15. Ibid., Par. 2.2.3.
16. Ibid., Par. 2.5.2.
17. Ibid., Par. 2.4.3.
18. Supreme Headquarters Allied Powers Europe, 'Comprehensive Crisis and Operations Management Process Handbook', 14 Jul. 2015.
19. Not to mention the 'Blue RFI' about capabilities and situation of own forces or NATO Nations supporting the mission.
20. JTF HQ SOI 208.02 'RFI Management System', Apr. 2014.

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began his military carrier in 1985, spending several years in the German Army Engineer branch including positions as Company Commander, and as Chief Instructor at the German Army NCO School. In 1999, he stepped over into the Military Intelligence branch. With a broad range of intelligence positions and functions held at Headquarters 1st German/Netherlands Corps, Joint Force Command Brunssum. SFOR, and ISAF, he became a highly experienced staff officer with regard to the conduct of military intelligence at the operational level in NATO or multinational staff environments. Since May 2014, Lieutenant Colonel Menzel has been the JAPCC's Subject Matter Expert for Research, Analysis and Intelligence Support as well as serving as Assistant Editor of this journal.

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Contracting Civilians for Remotely Piloted Aircraft System Operations

Blurring International Law's Principle of Distinction?

By Lieutenant Colonel André Haider, DEU A, JAPCC

Afghanistan, 21 February 2010, 5 a.m.: A convoy of three vehicles is travelling along dark mountain roads heading towards a special operations team tasked to capture insurgent forces suspected of operating in the area. A fully armed Predator Remotely Piloted Aircraft (RPA) is watching over them, cameras and sensors focussed on the suspicious convoy. Intelligence analysts and video screeners verify 21 military-aged males carrying what appear to be 'possible weapons'. As the Predator continues tracking the vehicles, cell phone calls in the area are intercepted and translated. According to linguists providing intelligence support, the phone calls indicate a Taliban unit is in the area and preparing for an attack. The ground force commander concludes he has the positive identification necessary to engage a hostile force and calls for an airstrike. The Predator unleashes two Hellfire missiles. They slam into the first and third vehicles, which burst into flames. Dead and wounded are everywhere. Very soon, the RPA crewmembers and video screeners realize something has gone horribly wrong. The investigation that soon followed would reveal that at least


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15 Afghan civilians had been killed, to include one woman and three children, and twelve wounded. They were travelling together as a group for safety through the insurgent stronghold region of Uruzgan Province. Some were businessmen, others students returning to school, and a few were simply travelling to visit family. No disciplinary action, however, was taken against the primary screener from Florida who provided imagery analysis that contributed to the decision to attack. There wasn't much that the military could do – she was a civilian contractor.[1]

This abbreviated narrative clearly demonstrates civilian contractors are deeply interwoven into present-day military operations. Remotely Piloted Aircraft Systems (RPAS) have opened the door even wider for such civilian participation, even becoming an integral part of the targeting process. A thin line separates civilian intelligence analysts from direct civilian participation in hostilities, which may violate domestic or international law. This article outlines the challenges arising from civilian involvement in RPAS operations, examines the extent to which civilians should or should not be contracted to perform RPAS tasks, and recommends good practices to ensure compliance with international law.

The Past and Present Role of Civilians in Combat

Throughout history, civilian populations have contributed to general war efforts. These contributions have included the production and supply of weapons, equipment, food, and shelter, or economic, administrative, and political support. However, such activities typically remained distant from the battlefield. Although nations have often employed civilian contractors to fulfil combat and combat support functions, their employment had been most prevalent in the technical and support categories. George Washington hired civilians to haul the Continental Army's equipment. Supply vendors followed the Union and Confederate armies during the Civil War. In the Vietnam War, technological innovation increasingly required the presence of contractors on the battlefield to maintain and repair sophisticated equipment. Ever greater reliance on contractors has come as a direct result of downsizing the military forces following the Cold War. Today, contractors are an integral part of complex weapons systems support and, to a large degree, they are responsible for functions once performed by uniformed personnel.[2,3,4]

The complexity of remotely piloted systems amplifies the reliance on contractor-provided technical field support. Most major RPAS manufacturers regularly deploy civilian teams to combat zones to support their military customers. This support typically includes 'traditional' repair and maintenance services. It also may include launch and recovery support as well as piloting the aircraft and operating its sensors. Quite a few nations currently contract civilian RPA pilots and operators to conduct unarmed Intelligence, Surveillance and Reconnaissance (ISR) missions with a very low probability of combat involvement.[5]

The Issue of Civilian Participation in Combat

The primary aim of International Humanitarian Law (IHL) is to 'protect the victims of an armed conflict by regulating and balancing the conduct of hostilities between military necessity and humanity.'[6] The principle of distinction lies at the heart of IHL. National armed forces participating in a conflict must be clearly distinguishable from civilians, who are presumed to not be taking part in combat operations and are therefore protected against direct attack. Outsourcing military functions to contractors increases the risk of blurring that principle.[7] Hence, careful consideration must be given as to what extent civilians should perform military tasks and where direct participation in combat begins. Furthermore, consequences of crossing that line should be considered not only for the contracting state, but also for the individual civilian.

RPAS Functions and their Direct Participation in Combat

As already mentioned, civilian contractors currently perform almost the entire spectrum of RPAS functions, with the exception of target designation and weapons employment, both of which would obviously be considered direct participation in combat. For other functions, such as battlefield repair and maintenance, configuring munitions, launch and recovery, piloting and operating sensors, intelligence analysis, or target identification, it is more difficult to conclude whether they qualify as direct participation in combat.

To determine whether an individual is 'directly participating in combat', the International Committee of the Red Cross (ICRC) issued the 'Interpretive Guidance on the Notion of Direct Participation in Hostilities under International Humanitarian Law'. It states 'direct participation in hostilities refers to specific hostile acts carried out by individuals […] and must be interpreted synonymously in situations of international and non-international armed conflict.' Simply put, it means participation in combat operations or activities to support one party by weakening the enemy's military capacity. The ICRC guidance delineates three elements which have to be met in conjunction to consider an individual act as direct participation in hostilities: the threshold of harm, direct causation, and belligerent nexus.

Threshold of Harm

'To reach the required threshold of harm, a specific act must be likely to adversely affect the military operations or military capacity of a party to an armed conflict or, alternatively, to inflict death, injury, or destruction on persons or objects protected against direct attack.'[8]

Hence, a specific RPAS function does not necessarily have to inflict actual death, injury, or destruction on

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A civilian contracted as RPAS operator.

persons or objects to reach the required threshold of harm. It is sufficient if the function can reasonably be expected to cause an adverse effect to the opposing party. Even unarmed activities, such as electronically disrupting communications would reach the required threshold of harm. An adverse effect to the opposing party may also be achieved in a causal chain by, for example, transmitting tactical targeting information for an attack.[9] However, for those causal effects of RPAS functions, the principle of direct causation has to be considered.

Direct Causation

'For the requirement of direct causation to be satisfied, there must be a direct causal link between a specific act and the harm likely to result either from that act, or from a coordinated military operation of which that act constitutes an integral part. […] Where a specific act does not on its own directly cause the required threshold of harm, the requirement of direct causation would still be fulfilled where the act constitutes an integral part of a concrete and coordinated tactical operation that directly causes such harm.'[10]

A standard RPAS mission typically consists of six principal steps: Find, Fix, Track, Target, Engage, and Assess (F2T2EA). These six steps represent the linear sequence of events used to engage targets. Operators and analysts constantly screen video feeds and images streamed from the RPA to find potential targets. Once identified, operators and analysts fix the target by determining its precise location, typically utilizing the RPA's advanced sensor suite. Once the target's location is established, operators and analysts continue to track the target. At this stage of the mission, the focus shifts from what might be considered passive surveillance to active coordination with ground troops, who will confront the target, or with the execution of kinetic air strikes against the target. Based on collected intelligence, mission commanders make their decisions and kinetic capabilities may be applied against the target while the RPAS loiters above to assess.[11] Therefore, any function within or attached to the RPAS directly related to the F2T2EA process can be considered to meet the requirements for direct causation.

Belligerent Nexus

'To meet the requirement of belligerent nexus, an act must be specifically designed to directly cause the required threshold of harm in support of a party to the conflict and to the detriment of another.'[12]

It can be assumed that military RPAS operations in international as well as in non-international armed conflict are typically conducted in support of friendly armed forces and to gain a military advantage over the opponent by utilizing the RPA's sensors and, possibly, weapons. Therefore, any function within the unmanned system can be qualified as meeting the requirement of belligerent nexus.

Consequences of Civilian Participation in Combat

IHL recognizes two categories of individuals during armed conflict: combatants and civilians. With few exceptions, combatants include only members of organized armed forces. As such, they are provided with so-called 'combatant privilege', i.e. the right to lawfully participate in combat and immunity from domestic prosecution for those acts as long as they are in accordance with IHL. Furthermore, combatants are considered prisoners of war if captured and are entitled to the protections of the Geneva Conventions and supplemental Protocols.

Civilians are described as individuals not participating in armed conflict and who enjoy immunity from attack 'unless and for such time as they take a direct part in hostilities'. IHL neither prohibits nor privileges civilian direct participation in hostilities. However, civilians directly participating in hostilities are not entitled to the combatant privilege, do not enjoy immunity from domestic prosecution for lawful acts of war, and will lose the protection against direct attack. Therefore, civilians, if captured, may be prosecuted and punished to the extent that their activities or the harm caused by them is penalized under national law.

Furthermore, civilians directly participating in hostilities can be expected to not carry arms openly (if at all) or otherwise distinguish themselves from the civilian population. This may lead to significant confusion and uncertainty during the implementation of the principle of distinction and entail erroneous or arbitrary targeting of the civilian population. This may also lead an adversary to believe that civilian RPAS personnel are entitled to protection against direct attack, which may amount to perfidy in violation of IHL.

Contracting States' Responsibilities and Good Practices

As discussed above, contracting civilians for operating RPAS, even if they participate in combat, is not explicitly prohibited by IHL. But it does entail some serious consequences for those individuals involved. Therefore, the ICRC's so-called 'Montreux Document' provides guidance on legal obligations and good practices if nations contract civilian personnel for military functions during armed conflict. Some recommendations from the Montreux Document which are applicable to RPAS personnel are listed below.[13]

- States retain their obligations under international law, even if they contract civilians to perform certain activities.
- States have an obligation to ensure respect for international humanitarian law by civilians they contract.
- States should determine which services may or may not be contracted out while taking into account whether a particular service could cause civilian personnel to become involved in direct participation in hostilities.
- States should allow for a clear distinction between contracted personnel and the civilian population.
- States should provide appropriate administrative mechanisms to ensure the proper execution of the contract and the accountability of contracted personnel for their improper and unlawful conduct.

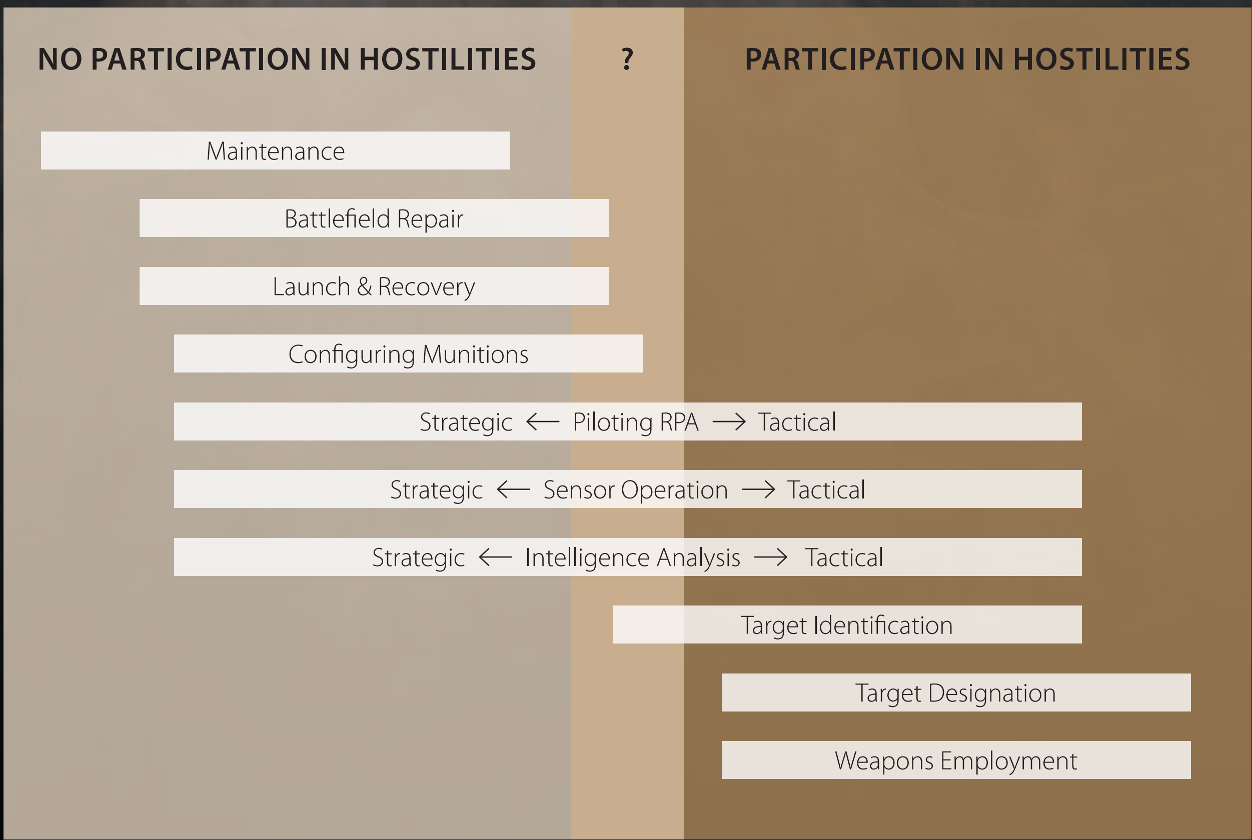

Figure 1: Attribution of RPAS Functions to Direct Participation in Hostilities.

The Principle of Distinction – What if one of these people would qualify as a lawful target?

Conclusions

The involvement of civilians in armed conflicts and the reliance on private entrepreneurs during war is nothing new. Indeed, the increased use of RPAS in modern warfare has opened the door for an even wider range of civilian participation in armed conflict. Contracting civilian personnel to operate RPAS or to perform functions within the F2T2EA process is not explicitly prohibited by IHL, but it considerably blurs its principle of distinction. If that line is crossed, contracted civilian individuals will lose their protection against direct attack, and might be exposed to domestic prosecution for their activities, potentially even by their own nation. Although remote operations from inside the home territory provide a decent level of protection against such consequences, states contracting civilians for RPAS should carefully consider their obligation to protect civilians from the effects of war and preserve the IHL principle of distinction.

Should nations determine that the use of civilians in RPAS operations is required, they should comply with the legal obligations and good practices outlined in the ICRC's Montreux Document, especially the ones listed in this article.

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Assessing Nations for NATO Partnerships

A Country Baseline Assessment Methodology

By Colonel Bernie 'Jeep' Willi, USA AF, JAPCC

Introduction/Background

In the NATO Strategic Concept, 'Active Engagement, Modern Defence', Cooperative Security is identified as one of the Alliance's three core tasks. The section addressing Cooperative Security states, 'the Alliance is affected by, and can affect, political and security developments beyond its borders. The Alliance will engage actively to enhance international security, through partnership with relevant countries and other international organizations.'[1] Partnership operations are widely recognized as an important tool in NATO's overall strategy. From NATO's perspective, strategic partnership requires a comprehensive analysis of the societal, economic, and political conditions within a potential partner nation. NATO must refrain from committing to providing assistance or cooperation when it is either impossible or imprudent to do so. Also, it is imperative NATO and the partner nation clearly define what each wants to accomplish through a strategic partnership.

Aim/Purpose

The JAPCC study 'Improving NATO Support to Future Air Advisor Operations', raised questions about the best way to prepare and execute an engagement operation with a partner nation. This article is based

on those questions. It looks primarily at the military aspects of establishing a partnership and presents a methodology to assess partnership development and implementation. As the political factors of strategic partnership are of prime importance, it also reflects on how these factors relate to the military phase of the operation.

A common misconception exists that strategic partnership is primarily a military endeavour. The military piece of a partnership is just one part of the relationship, but it is an important one. Strategic partnership must be based on political objectives that support both NATO and partner nation goals. Since NATO partnership efforts should include all aspects of political power (diplomatic, informational, military and economic), the NATO International Staff (IS) must provide clear guidance to the NATO International Military Staff (IMS) on the desired political objectives. The military objectives must be perfectly aligned with this political guidance and the execution adapted to the particular partnership scenario. Without clear guidance and support for these objectives from the start, any partnership effort is futile. Each partnership will be unique, based on the distinct political objectives of NATO and the partner nation. Is the main goal to improve the economic conditions within the nation, thus increasing national stability or is it simply to enhance relations between NATO and the nation? Is the goal to improve tactical integration between national and NATO forces to allow future participation in NATO-led military operations, such as what was done with the UAE and Jordan prior to OUP[2], or is it to create a new strategic military capability for the partner nation, such as what was sought through partnerships in support of OEF and OIF?[3] The level of training and effort associated with a partnership will be much different if the objectives are to enhance relations as compared to deterring active aggression or improving economic conditions.

Partnership Evaluation Methodology

Prior to engaging with a partner nation, NATO should perform a fundamental assessment of the nation. This should be done with the goal of increasing the efficiency of the military effort and improving the likelihood it will be effective in meeting the political objectives of both participants. Using a standardized methodology (or tool) would assist in this aim. The proposed 'Country Baseline Assessment Methodology for Partnership' outlined in the next paragraphs provides assessment considerations to greatly aid planners to thoroughly evaluate the general level of effort associated with a NATO partnership engagement. The proposed methodology employs the well-known Doctrine, Organisation, Training, Materiel, Leadership/Personnel, Facilities, Interoperability (DOTMLPFI) format and looks at factors for each of the DOTMLPFI areas NATO must consider prior to initiating partnership engagement.

Doctrine. NATO must consider how closely the nation's doctrine aligns with NATO's. If the nation's doctrine is based on one of the NATO members, this could provide a common baseline to foster the operational and tactical partnership and greatly improve success. If doctrinal alignment or pairing is not possible, then sharing technical standards and procedures such as NATO Standardization Agreements and Allied Joint and Tactical Publications must be pursued. The NATO assistance force can provide instruction on these doctrinal references to facilitate procedural interoperability. NATO must proceed with caution in this stage. Assuring the safeguard of sensitive, protected, or classified information must remain paramount when bringing in new nations into technical and informational interoperability standards. Related to doctrine, NATO must also review a partner nation's rules and regulations pertaining to a particular operation/activity (e.g. for air advisor operations, the partner nation's air-related rules or restrictions may negatively impact the conduct of training and must be considered in NATO's mission planning).

Organization. NATO must analyse the nation's organizational structure. This analysis would determine the organizational differences as compared to a similarly-sized NATO nation and the impact they will have on the methods employed and assets required. For example, a nation may have limited rotary wing assets organized in a single unit which conducts a myriad of missions. In contrast, many NATO nations employ rotary wing units for specific missions (i.e. logistics

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support, air assault or attack). The organizational analysis will help to ensure the proper assets and skill sets are available and offered to the training audience.

Training. NATO must consider the quantity and the type of instruction the partner military typically receives from its nation. If they receive only limited training annually compared to NATO forces, the instructors should (or may need to) adjust the training tempo and complexity. If the nation's education system primarily uses memorization as opposed to independent thought, it becomes an important consideration when determining training methodologies to provide instruction to the personnel. If the training audience does not speak English or French to a desired level, introductory or specific language training (such as English aviation terminology) may be required or advantageous.

Materiel. If the nation does not operate NATO-standard equipment, either training on the nation's equipment or bringing in NATO-owned equipment to conduct training is required. An associated consideration is NATO's desire and ability to operate and maintain the deployed training equipment. The economic conditions in the nation are also a critical factor; NATO must ensure that materiel-specific changes made as a result of the partnership are sustainable in the long-term, i.e. after NATO assistance forces depart. If not, it is highly likely the nation will revert back to its previous state and NATO's intervention/assistance mission becomes a true failure. (This may also be true of other DOTMLPFI changes made as a result of the partnership.)

Leadership and Personnel. These are both considerations when establishing partnerships. NATO must consider whether the nation is a 'Western-based' military culture. If not, leaders must determine how this will affect the ability of the combined force to meet mission objectives. In particular, religious considerations must be assessed for potential impact to training delivery. Other relevant considerations to assess include:

- The nation's military composition. (Are they a voluntary versus conscripted forces or some mix?)
- Is the military culture influenced by religion or the political system?

- The roles of the Non-commissioned and Junior Officers. (e.g. Is command decision-making retained at the senior officer level? How strict is rank differentiation maintained? Could the NCO corps be considered professional?)
- Does NATO have an existing exchange program with a NATO nation which can be used as a conduit for initiating a more extensive partnership program?
- NATO trainers must be aware of the level of popular support for NATO forces in the nation. This may provide a rough gauge for force protection requirements and the partner nation's force's enthusiasm to work with the assistance force.

Facilities. The facilities the partner nation intends to provide the NATO force must be considered, particularly for the level of force protection potential. Regarding force protection for the assistance force, a balance must be struck to ensure an adequate level of security is provided without appearing to be an occupying force to the local populace. Access to medical facilities, messing facilities, embassies and evacuation locations must also be considered. Related to facilities, the nation's quality, range, and level of infrastructure must be examined. This must be done to determine transportation and other logistical requirements for the NATO assistance forces. For example, tactical airlift may be needed to conduct the operation if surface vehicles are inadequate.

Interoperability. Finally, doctrinal and technical interoperability with the nation is important in NATO military partnership efforts. Both must be addressed prior to initiation of training events. Doctrinal interoperability has already been discussed. Technical interoperability may require NATO forces to bring additional hardware (such as radios or other communication equipment) to ensure operations are not impeded due to interoperability issues.

Summary

When considering partnerships, it must be stressed that the military partnership operations are being executed for only one reason – meeting NATO's and the partner nation's stated political objectives. These objectives can range from improving regional stability, creating an environment for economic growth or even to deter or defeat aggression. Using the proposed Country Baseline Assessment Methodology for Partnership to analyse the military element of the operations would help to ensure scarce assets are used efficiently and effectively. If partnerships are properly developed and executed, they can enhance conditions for lasting stability which in turn can reduce or eliminate NATO contingency response requirements. This will result in a significant return on the investment made towards developing a robust NATO partnership capability. ●

1. The November 2010 Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization (2010 NATO Strategic Concept), 9–10 Nov. 2010, p. 8, Para C.
2. Improving NATO Support to Future Air Advisor Operations, Apr. 2014, p. 19, Para 3.2.9.
3. Ibid.

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What's Past is Prologue

Why the Golden Age of Rapid Air Superiority Is at an End

By Commander (ret.) Jay Ballard, USA N

The Nightmare Scenario – The Near Future

Social media explodes with overnight reports of 'Little Green Men'[1] swarming through majority Russian speaking regions that had declared autonomy the day prior in Latvia, Estonia, and Lithuania. Ground reports indicate large numbers of Russian transport aircraft landed at airfields in those rebel held areas. SA-21[2] Surface to Air Missile (SAM) sites in Kaliningrad and Belarus are actively transmitting along with a number of SA-20s in both countries. Fighter air activity in Kaliningrad and Russian Baltic Fleet sorties are well above normal. Two of the three Kaliningrad infantry brigades moved out of garrison overnight and satellite imagery last saw them en route to the 'Suwalki Gap'.[3] The Kremlin and Moscow vigorously deny there are any Russian troops on the ground in the Baltics and claim any increase in air or naval activity in the region is simply the result of a minor, five-day exercise. The Baltic States ask for immediate consultations with other NATO nations with the intent of invoking NATO's collective defence clause.[4] Planners throughout NATO immediately recognize Russia is severing Western access to the Baltic States by

The Northrop Grumman X-47B is a Low Observable (LO) developmental unmanned platform, much like the BAE Taranis and the Dassault Neuron. Once these systems become operational they will be much more expensive than current Medium and High Altitude, Long Endurance Remotely Piloted Aircraft (RPA), but they will be a crucial capability should we go to war against an opponent who possesses modern integrated air defences.

'We will never go to war again without air superiority.'

A statement uttered by numerous military leaders since 1991.

activating an anti-access/area denial (A2/AD) environment over the region. This is going to be a nasty fight.

This scenario and ones like it have played out in various exercises over the last few years and illustrate how an A2/AD environment affects air operations. This paper is the result of personal observations during several exercises and discussions with training experts in NATO member countries. The focus of this article is how an A2/AD environment drives air operations to a peer-on-peer fight, which becomes intolerant of errors in planning, sequencing, and execution. There are many A2/AD considerations for the other components, but they will not be covered in this article unless they touch on joint employment.

Lessons Learned From the Cold War

During the Cold War, NATO assumed any hostilities with the Warsaw pact would be violent, short, and costly in personnel and equipment. A primary operational objective for both sides was to achieve the upper hand in the air battle, even though neither side was expected to rapidly achieve air superiority. The most efficient way to do that was to attack your opponent's bases, hindering their ability to generate sorties and providing the attacking force with immediate local air superiority.[5] Runway cratering would hold aircraft on the deck at that base or cause those already airborne to divert to other bases. A longer term impact was gained by destroying aircraft on the ground, which was difficult due to airfield dispersal and hardened revetments. Any damage to your opponent's fuel and weapons stocks affected all aircraft at that base and were particularly valuable targets. Both sides' targeteers considered the other's air bases to be High Payoff Targets (HPT)[6] even if they didn't use that term at the time.

Conducting air operations under fire was a major part of NATO defensive planning, which included Ground Based Air Defence (GBAD) to protect the airfield, rapid airfield repair, hardened aircraft bunkers, support and sustainment redundancy along with Camouflage, Concealment and Deception (CC&D) of critical equipment.

This is a photo of the Nizhny-Novogorod Research Institute (NNIIRT) 55Zh6ME radar system that can be coupled with the SA-20 or SA-21 SAM system. The multi-band (VHF, L-band and S-band), Active, Electronically Scanned Array (AESA) radars are all part of an integrated system. This system was designed to be jamming resistant and counter LO in order to deny airspace to opposing forces and presents a significant denial capability against Western air forces.

The Golden Age of Air Power

The fall of the Berlin Wall and the ostentatious display of air dominance during OPERATION DESERT STORM in 1991 ushered in a new way of fighting wars, which was to rapidly roll back the enemy's Integrated Air Defence System (IADS) to achieve air dominance over the battle space and attack targets at a time and place of your choosing. As a concept, this went away from the Cold War doctrine of Air-Land Battle, which was a simultaneous ground and air force blitz attack against Warsaw Pact forces, and shifted to a sequential affair with the achievement of air supremacy first, followed by the land maneuver forces invading once the enemy had been bombed into combat ineffectiveness. This concept worked well twice in Iraq against an inept opponent, but less so in Kosovo against a smart Serbian adversary who was adept at using CC&D along with mobile SAM hide, shoot and scoot tactics. NATO air operations in Afghanistan and Libya were largely permissive in nature other than the threat from man portable air defence systems (MANPADS), which are a persistent threat to helicopters and aircraft operating at low altitudes.

There are three notable impacts to air operations that have come from the West's ability to achieve rapid air dominance:

1. Rise of the Machines. The use of Unmanned Air Systems (UAS) has grown rapidly over the last 20 years. They are cheaper to operate than manned fighters and do not carry the political risk of a prisoner of war should they crash in enemy territory. Since these systems are operating in a permissive environment, it has been fairly cheap and easy to design the current crop of UAS. Incorporating Low Observability (LO) or stealth for a contested environment greatly increases the cost and development time of airframes, and recent conflicts have not highlighted this capability as an operational requirement.[7]

2. Mandating 'Certainty'. A permissive air environment has driven changes to planning, intelligence gathering, Rules of Engagement (ROE) and targeting in an effort to remove uncertainty. Simply put, the unfettered ability of UAS to loiter over enemy territory has made it possible for political and military leadership to mandate increasingly higher levels of confidence before acting. Targeting, in particular, has had layers of process and restrictions placed on target development and servicing in an attempt to reduce unintended civilian casualties. Many of these processes require a significant amount of Intelligence, Surveillance and Reconnaissance (ISR) collection time prior to attack, which is possible in a threat free environment, but might not be possible in one that is contested.

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The General Atomics MQ-9 Reaper is a very cost effective way to gather intelligence over a permissive battlefield and strike time sensitive targets with a mixed load of Hellfire Missiles and guided bombs. However, in a contested environment it is visible, slow and has no self protection capability which means it can be shot out of the sky with little enemy effort.

3. Efficiency of Force Concentration. It has been more efficient (and cheaper) to concentrate air forces, especially the big wing aircraft (tankers, AWACS and other enabling platforms) at a few air bases since they become free from air attack once air supremacy is established. This concentration of force, while easier to direct and sustain, has become an irresistible target for an aggressive adversary with a long range, precision strike capability.

The Push Back

Potential adversaries have been paying attention to how the West fights wars. They have chosen to develop capabilities that directly exploit Western weaknesses in an asymmetric way, by pitting strength (theirs) against weakness (ours). Russian SAM system designers took note of how effective the low observable F-117 was during OPERATION DESERT STORM and rushed to counter that.[8] Countries with coastlines have established anti-access corridors along their economic exclusion zones with anti-ship missiles and diesel submarine patrols. These developments have major implications for NATO power projection in general and air power in particular.

Why A2/AD Is So Disruptive

NATO has not planned to face a peer opponent since the collapse of the Soviet Union, but it cannot be dismissed as 'unlikely' given the current world situation. During the last few years, scenarios like the one in the introduction have featured peer versus peer air challenges, which have revealed several operational issues:

1. 'Certainty' is removed. Current UAS cannot survive in a modern SAM Missile Engagement Zone

(MEZ) and are sitting ducks against fighters because they are slow, not stealthy, and have no self-protection capability. Targeteers will not be able to assess patterns of life and evaluate target importance through a long-term ISR *soak,* and commanders will have to accept the potential for higher collateral damage, since they will have less information on the target. This will require changes to the ROE along with relaxed approvals in the targeting evaluation process.[9] LO UAS are a potential solution, but few nations have these *silver bullets* since they are more expensive to build and operate than conventional UAS and the countries that do have them only have a few.[10] With new LO UAS developmental timelines going into the 2030s[11] this loss of certainty will be a long-term challenge so it would be prudent to re-evaluate ROE and targeting so operations can continue with less target information. Platforms that can deliver persistent ISR coverage in a contested environment, while few in number, should be identified during operational planning and asked for in the force generation process.

2. Target development and sequencing become critically important. Rapidly achieving air dominance in a relatively benign air environment makes errors in target selection and sequencing unnoticeable since the enemy cannot capitalize on those errors. In a robust A2/AD environment, it may not be possible for Alliance forces to strike deeply or broadly in the early stages of the air campaign. Target selection and sequencing should be focused on creating freedom of movement inside a portion of the enemy's A2/AD coverage to be further exploited. Errors in sequencing and selection against a peer air force can be catastrophic, since friendly forces may be under a much greater threat than assessed or prepared for (which has played out in many recent exercises with enemy barracks and communications facilities being struck before early warning systems, modern SAMS or airfields). Incorporating targeteers into the early stages of the operational planning process and plan development can better help sequence the desired flow of effects to achieve operational objectives.

3. Finding and killing modern A2/AD SAM systems with current NATO sensors and bombs is the equivalent of jousting blindfolded with a toothpick. If NATO were to go to war tomorrow, it would do so with a predominantly 4th generation air force. This force was designed in the 1970s, 80s and early 90s to counter MiG-29s and SA-6s but is now showing its age when compared against modern equipment. In particular, recent advances in Russian and Chinese SAM systems now strongly challenge friendly air forces. The development of SAMs with multi-band, Active Electronically Scanned Array (AESA) radars coupled with passive receivers have greatly increased those systems' capabilities against LO aircraft and cruise missiles.[12] When tied to MEZ ranges of hundreds of kilometres, such as those associated with the Russian SA-21 and Chinese HQ-9 systems, they present a formidable operational challenge. Most of the air-to-ground weapons available to a NATO air force would have to be launched well inside the missile impact range of these systems.

© US Air Force

The A-10 Thunderbolt II has been a devastatingly effective close air support aircraft during recent conflicts. Its strengths are that it can carry a lot of ordnance and it can stay airborne longer than almost any other manned strike platform, which means that friendly ground forces love it. Unfortunately, an A2/AD environment would render the Warthog ineffective or ground it until the enemy SAM threat could be pushed back.

Thus, the 'workhorse' bombs that have been used so successfully for the last 20 years, such as the Joint Direct Attack Munition (JDAM) or laser-guided munitions, would have to be almost 'hand delivered' against these sites. Even the High speed Anti-Radiation Missile (HARM), which is used as a bedrock SEAD missile, has a launch range that would require an aircraft to deeply penetrate those MEZs before firing the missile. The attacking aircraft will have to either rely on stealth (plus jamming in most cases) to survive to JDAM drop range or launch a standoff missile from outside the engagement envelope (with modern systems pushing this range further out all the time). Any standoff cruise missile strike would have to rely on a volley of multiples, either LO (fewer) or conventional (a lot) to saturate and overwhelm the targeted system. Either way, it would be an expensive endeavour, with most standoff missiles costing more than $ 1 million US dollars apiece, and getting approval from the contributing nation to use them in large volleys for each SAM kill, might be difficult.[13]

Unfortunately, the challenge of destroying these systems is more straightforward than finding them since they are highly mobile and employ hide, shoot, and scoot tactics. The manufacturers claim a 15-minute cycle to unfold the radars and shoot with foldup and scoot probably less than that.[14] When coupled with CC&D and a lack of friendly ISR persistence due to conventional UAS vulnerability, this cycle speed makes them very hard to find. ISR and EW force generation numbers will have to be much higher than in previous operations and daily apportionment will have to be closely aligned with targeting to achieve success. Additionally, long-range, standoff weapons and low observable platforms will have to be part of the Alliance's air force in any peer vs. peer scenario to destroy these SAMs when found.

4. Jamming and cyber attacks will target the electromagnetic spectrum in a future JOA. The West relies on airborne early warning to feed information into the Command and Control (C2) system's net-

Western air forces tend to think of aircraft jamming as only coming from other airborne platforms. The Krasukha-1, built by the Russian firm Kret, is a truck based jammer that has been designed to blind the E-3 AWACS. This situational awareness denial weapon, combined with an opposing force OCA SWEEP mission could complicate intercepts at particularly inopportune times.

worked common operating picture. Therefore, disrupting EW and cyber have been given outsized importance by potential adversaries, with particular emphasis on injecting confusion into the decision cycle by disrupting friendly Situational Awareness (SA). Expect GPS jammers and airborne jamming pods to be ubiquitous within the JOA, but nothing highlights the attack on SA better than the new E-3 AWACS jammer by Kret. This ground-based system, named Krasukha-1, was unveiled during the 2015 MAKS air show near Moscow and features a 300-kW engine driving a robust generator. The Russian designers claim this system can blind the AWACS and fry the electronics on the E-3 when operating at full capacity.[15] Now whether or not it can cook silicon from a distance, it can likely cause a significant delay in passing information. If friendly fighters are in the middle of intercepting bogeys with closure rates in excess of 30 nautical miles per minute, any delay in target identification or maneuvers can be disastrous. We can expect any electronic attacks to be backed up by cyber, which Russia effectively employed during the Crimean invasion and the 2008 attack on Georgia.[16] All of this indicates the requirement to plan for operations in an aggressively contested EW environment.

'In a future conflict, we may not have the option of going to war with air superiority.'

5. Air bases are now threatened by standoff precision strike capabilities in the form of Theatre Ballistic Missiles (TBMs) and cruise missiles. NATO expeditionary basing options are usually limited due to political realities and host nation infrastructure challenges, which produce some force concentration. There is also the economy of effort that was mentioned earlier, which results in a further concentration of aircraft at few bases. Current Western air defence systems have been modernized to provide an intercept capability against an inbound TBM, however, proliferation has made the targeting challenge of several, simultaneously inbound missiles an unwelcome reality. With potential threat nations continuing to improve TBM and cruise missile precision strike capabilities, there is no longer a sanctuary from enemy air attack even if you have air superiority over your bases. This point is backed up by a recent RAND Corporation study on the vulnerability of air bases, which noted:[17]

- Air base attacks have been a recurring feature in the last 100 years of warfare.
- Air base defence has included CC&D, hardening, aircraft dispersal and post attack recovery.
- There will be no rear area sanctuary in the future; therefore, air bases, which our adversaries consider to be HPTs, will be threatened and we will have to incorporate this into planning and force composition.

Drawing from Cold War lessons learned, NATO should increase its focus on air base defence beyond force protection from enemy ground attacks and MANPADS, to include the continuity of operations while under fire and consequence management post-strike.

Conclusion

In a future conflict, which could happen as quickly as tomorrow's headlines and look a lot like the opening scenario, we may not have the option of going to war with air superiority. We will have to consider air operations against a peer opponent wielding modern air denial technology to asymmetrically target our weaknesses. This will have wide ranging impacts, which if not planned for and trained for, can result in a failed operation and significant losses to NATO personnel and equipment. Using the Cold War past as a guide to future operations may help show the way to avoid this. ●

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The Changing Arctic and its Impact to NATO Joint Air Power

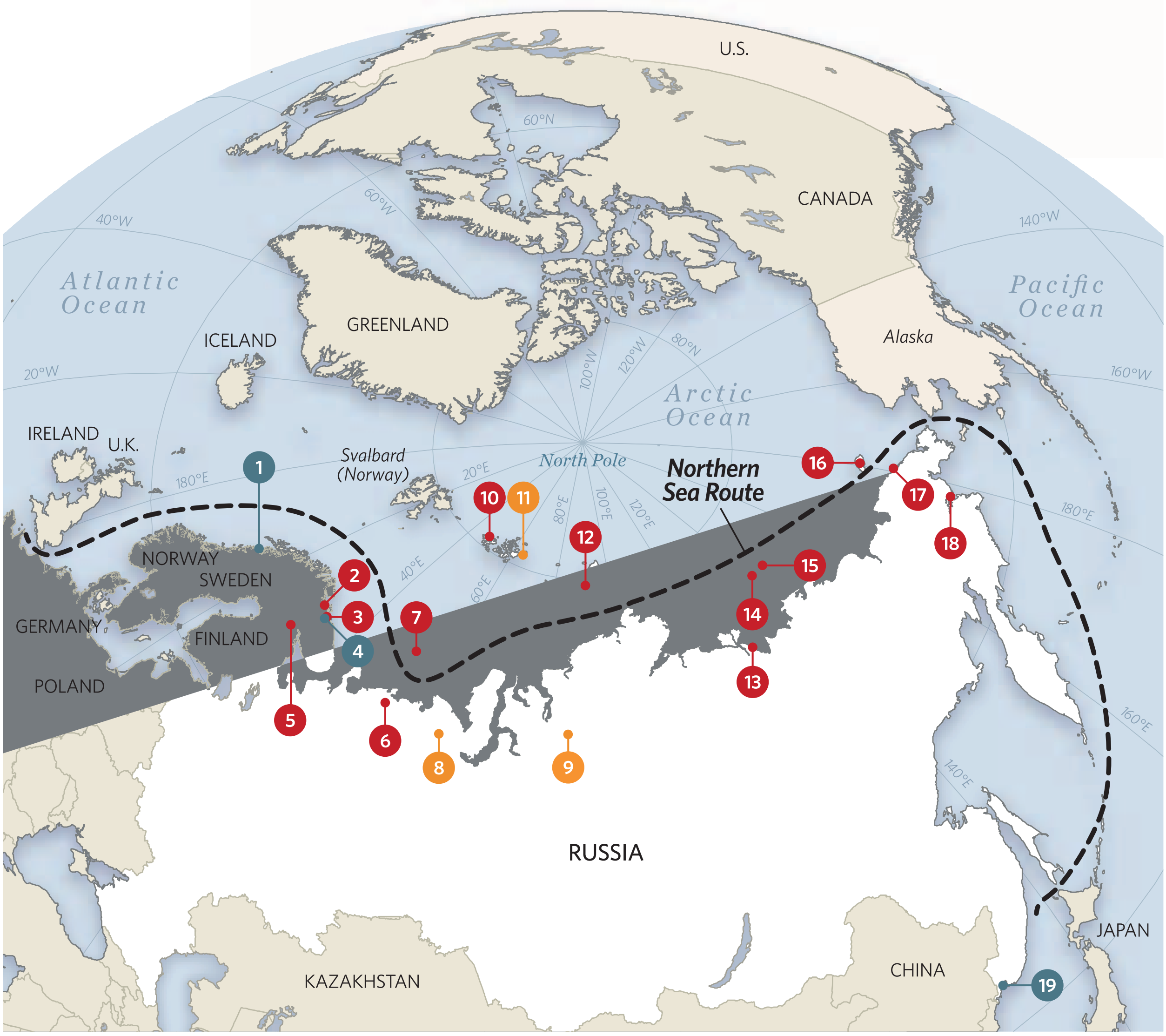
By Major Erik Carlson, USA AF

Once a tense underwater battleground and strategic corridor for nuclear-armed bombers, the Arctic has lost much of its significance to NATO since the fall of the Soviet Union. However, Russia is now militarizing the Arctic and the world is beginning to understand why. Allowing one nation to militarize a region unopposed is ill-advised, especially if the goal is to limit military and strategic activity in the Arctic, as stated by the former Supreme Allied Commander of Europe, Admiral (ret.) James Stavridis.[1] While shaping the Arctic security environment to resemble the Antarctic might be ideal, it fails to consider actions taken by the Russian Federation. NATO may find itself as the preferred military actor to enforce the United Nations Convention on the Law of the Seas (UNCLOS) in this region.

While the majority of the Arctic is considered High Seas, the environment is highly challenging to maritime traffic due to current levels of sea ice. Since NATO has limited ice-breaker capability, if there were ever a need to project power into this region, NATO naval forces might only be able to assume a supporting

Russia Fortifying Bases in Arctic Region

Key regional headquarters | Confirmed bases Russia is building/upgrading | Bases Russia may upgrade



1. Bodø, Norway's National Joint Headquarters
2. Sputnik Base, Pechenga
3. Gadzhiyevo Naval Base
4. Severomorsk, home of Russia's Northern Fleet
5. Alakurtti
6. Naryan-Mar
7. Rogachevo
8. Vorkuta Air Base
9. Alykel
10. Nagurskoye
11. Graham Bell Island
12. Sredny Ostrov
13. Tiksi
14. Temp-Kotelny Island
15. New Siberian Islands
16. Wrangel Island
17. Mys Shmidta
18. Anadyr-Ugolny
19. Vladivostok, home of Russia's Pacific Fleet

Figure 1: Russian Arctic Bases.[2]

© Heritage Foundation research (heritage.org) role. While an ice-free Arctic would be lucrative to commercial maritime traffic, the combination of the Russian Northern Fleet and its large fleet of nuclear-powered icebreakers is more than sufficient to ensure firm Russian control of the region's seas. Therefore, if NATO were forced into a conflict in the Arctic, Allied Air Command could likely be the supported command. Despite the desire to limit military activity, I will argue that, if Russia continues its current military expansion in the Arctic, NATO must prepare a counter. This will be accomplished through an exploratory analysis of three hypothetical future scenarios:

- Russia denies access to an ice-free Northern Sea Route;
- Competition over currently disputed maritime boundaries escalates; and,
- Russia takes possession of the Svalbard archipelago and seeks to renegotiate the Svalbard Treaty.

Security Environment

Arctic sea ice is receding and some predictions say it is likely to disappear during the summer months in the near future. The Intergovernmental Panel on Climate Change (IPCC) forecasts the Northern Sea Route (NSR) – the sea lane connecting the Atlantic and Pacific oceans along the northern coast of Russia – will be navigable by open water vessels for over 100 days per year by 2040.[3] Other forecasts go even further and predict Arctic summers will be ice-free within the next 25 years.[4] Assuming these forecasts are correct, major changes in the security environment will result. For example, some analysis purports nearly 10 percent of all container shipping from Asia to Europe could transit north of Russia by mid-century.[5]

The opening of a new, economically advantageous Sea Line of Communication (SLOC) could cause a major geopolitical shift. In regards to the NSR, Margaret Blunden, Emeritus Professor of the University of Westminster in London, remarked 'Historically, alterations in transport routes have been associated with radical shifts in the balance of economic and political power.'[6] Further complicating matters, Russia uses Article 234 of UNCLOS, which gives coastal states the ability to regulate ice-covered areas within their Exclusive Economic Zone and the search and rescue area of responsibility ascribed by the Arctic Council, to extend sea control beyond its territorial waters. Moreover, the Russian Federation views the Northern Sea Route as a national asset, a 'unified national transportation link', and the presence of foreign naval vessels would be perceived as an act of aggression.[7] In 2012, Dmitry Rogozin, former Russian Ambassador to NATO and current Deputy Prime Minister of Russia, 'insinuated that NATO warships operating along the ice-free Northern Sea Route would lead to conflict' and Russian Admiral Nikolai Kudinov 'opined in 2012 that his country is "doomed to geopolitical confrontation with NATO in the Arctic"'.[8]

Russia has significant military strength in the Arctic. They have recently opened six military bases, bringing their regional total to sixteen deep water ports, thirteen airfields, and ten air defence radar stations (see Figure 1). They have also deployed two S-400 Surface to Air Missile (SAM) regiments to Novaya Zemlaya.[9][10] Combining all this with their maritime capabilities provides the Russian Federation an effective Anti-Access/Area Denial (A2/AD) capability throughout much of the Arctic. They have both the stated intent and capability to prevent warships' movement through the NSR. Normally, naval forces would conduct Freedom of Navigation (FON) operations in order to defend commercial access and reaffirm international law. However, in the Arctic, these operations would prove challenging for three reasons. First, the still existing sea ice naturally denies access to the region and NATO lacks a significant ice-breaking capability. Next, the political stance Russia has taken in regards to the sovereignty of the Northern Sea Route makes FON operations in this part of the Arctic troublesome. Finally, the Barents Sea, which connects the European Arctic to the NSR, is the home of Russia's Northern Fleet. Therefore, the responsibility may fall on NATO's Joint Air Power to ensure access if the Russian Federation seeks to leverage its A2/AD capabilities to restrict trade or other access to the commonly accepted international waters of the region. Unfortunately, joint air power requires a much higher level of effort to maintain the same presence a naval vessel would during prolonged FON operations, especially at the great ranges of the Arctic.

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Anti-Access in the Arctic

In this first scenario, the NSR has become seasonally ice free and has proved highly lucrative to the shipping industry. Large container ships are able to transit north of Russia without the aid of an icebreaker escort. This new route shortens shipping times between Asia and Europe by roughly six days compared to the Suez Canal. However, the Russian Federation was prepared for this change and has exerted control over the entire region. The Northern Sea Route Administration imposes impossibly high tariffs on all non-Russian commercial ships, which pushes nearly all shipping towards Russian corporations. Furthermore, the Russian Federation has persisted in its stance that foreign warships would be perceived as an act of aggression. Bottlenecks in the sea ice allow the Russian Northern Fleet to quite often deny access. Thus, making FON operations extremely high risk. In this situation, NATO joint air power may be required.

Joint air power operations in the Arctic will be complex and challenging. First, to ensure its ability to act in the interest of regional stability, NATO must have situational awareness about operations in this region, which will require beyond-the-horizon air surveillance radars to increase the coverage of the recognized air picture (RAP) and space-based assets to provide complimentary maritime surveillance. The radars should be configured to give maximal coverage of the European Arctic. Additionally, a consolidated Arctic RAP, enabled by data-sharing between NATO and the North American Aerospace Defense Command (NORAD), should be pursued. A consolidated RAP would provide

Figure 2: Recent Russian maritime claim submitted to the United Nations.[11] © 2015 RFE/RL Graphics

NATO with enhanced situational awareness, indicators and warnings, extending its protective umbrella into the Arctic. Should operations to guarantee FON within the Artic become necessary, air and maritime Intelligence, Surveillance, and Reconnaissance (ISR), Command and Control (C2) at range, and other capabilities will be required in addition to those required during times of stability.

If large-scale air operations do become necessary, range will be a major planning factor due to the vast distance along the NSR, meaning assets must be based as far north as possible to minimize airborne fuel requirements. The aerial refuelling requirement alone for an air operation at these distances severely limits the size of the force. In this scenario, there is only a temporary requirement to operate in this region, and aerial refuelling can be employed to minimize operational impact of the environment. Operating large numbers of aircraft from Arctic bases, such as Bodo, Norway, or Barrow, Alaska, in the United States, requires extensive training and equipment. However, to prepare, NATO must plan, train, and exercise long-range operations from inhospitable regions.

Unresolved Territorial Disputes

The warming Arctic has become a 'fiefdom of competing claims',[12] with many unresolved disputes, including maritime boundaries, oil and natural gas reserves, fisheries, and search and rescue responsibilities. The dispute over energy rights alone is significant geopolitically considering the Arctic holds an estimated 30 per cent of the world's undiscovered natural gas and 13 per cent of its undiscovered oil.[13] In the past, these reserves were completely inaccessible, but that is beginning to change.

Most maritime boundaries are established and respected, but there are still some areas of disagreement. Canada, Denmark, and Russia have been issuing competing claims for the Lomonosov Ridge (see Figure 2), and as of this writing, the issue is still unsettled. On 9 February 2016, the Russian Federation again submitted a claim to the United Nations for this seabed. Recognition of the Lomonosov Ridge as an extension of one nation's continental shelf will give that nation resource rights beyond its current 200 nautical mile Exclusive Economic Zone (EEZ).

'Providing assurance to a threatened member state would put a large demand on airlift and airdrop operations.'

In this scenario, the UN has recognized either the Danish or Canadian claim, which is strongly opposed by Russia. The Russian Federation quickly increases military activity in the region to include large airdrop operations onto the ice and icebreaker escorted warships patrolling within the disputed territory. NATO will be needed to provide assurance and/or deterrence near the North Pole to protect Canadian or Danish interests in this scenario. Because the Russians did not attack territory, islands, forces, vessels, or aircraft of any NATO member, these actions do not constitute an armed attack and would most likely not invoke an Article 5 response. While such action would require support from the entire joint force, joint air power would obviously be deeply involved in all phases of the operation.

The first responsibility of NATO's air assets would be detecting the indications and warnings of any aggressive actions in the region. This would require a strong ISR presence from both air- and space-based assets. If a hostile military presence is detected, a land and/or maritime counterforce could be required to provide assurance to a threatened member state. This would put a large demand on airlift and airdrop operations. Additionally, NATO would need to effectively deter hostilities in the region and, should deterrence fail, be prepared to defeat any aggressor. To do this, all recommendations from the previous scenario would be necessary in addition to a substantial airlift and airdrop capability to position forces.

Svalbard Archipelago

Norway and Russia have a long history of competing claims over the Svalbard Archipelago (see Figure 3). In 1920, the countries signed the Svalbard Treaty. It made

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Svalbard part of the Kingdom of Norway, but Norway must not 'allow the establishment of any naval bases … and not construct any fortification in the said territories, which may never be used for warlike purposes.'[14] Additionally, the treaty did little to clarify the administration of the surrounding waters and the resources contained therein. Major M. N. Behrens, Royal Danish Air Force, in his 2014 award winning research paper from USAF Air Command and Staff College, presented this issue well when he stated 'a failing and assertive Russia could choose to seize the Svalbard archipelago militarily, to claim the territory and adjacent waters directly or to improve their position in post-conflict settlement of the status of Svalbard and adjacent waters.'[15]

If Russia were to seek to control Svalbard through military intervention, it would qualify as an Article 5 violation and require NATO to defend the territory of Norway. While it would not be in the interest of either side to escalate hostilities outside the immediate Svalbard region, spill over into other theatres could be possible. Since this would be a limited conflict and neither deterrence nor de-escalation would be the main aim, it is likely both sides would be motivated to stay well below any nuclear threshold, but that does not preclude armed combat.

Unlike the previous two scenarios, range is not the overwhelming obstacle. However, Svalbard is still over 1,000 kilometres from Bodo, Norway, and the RAP

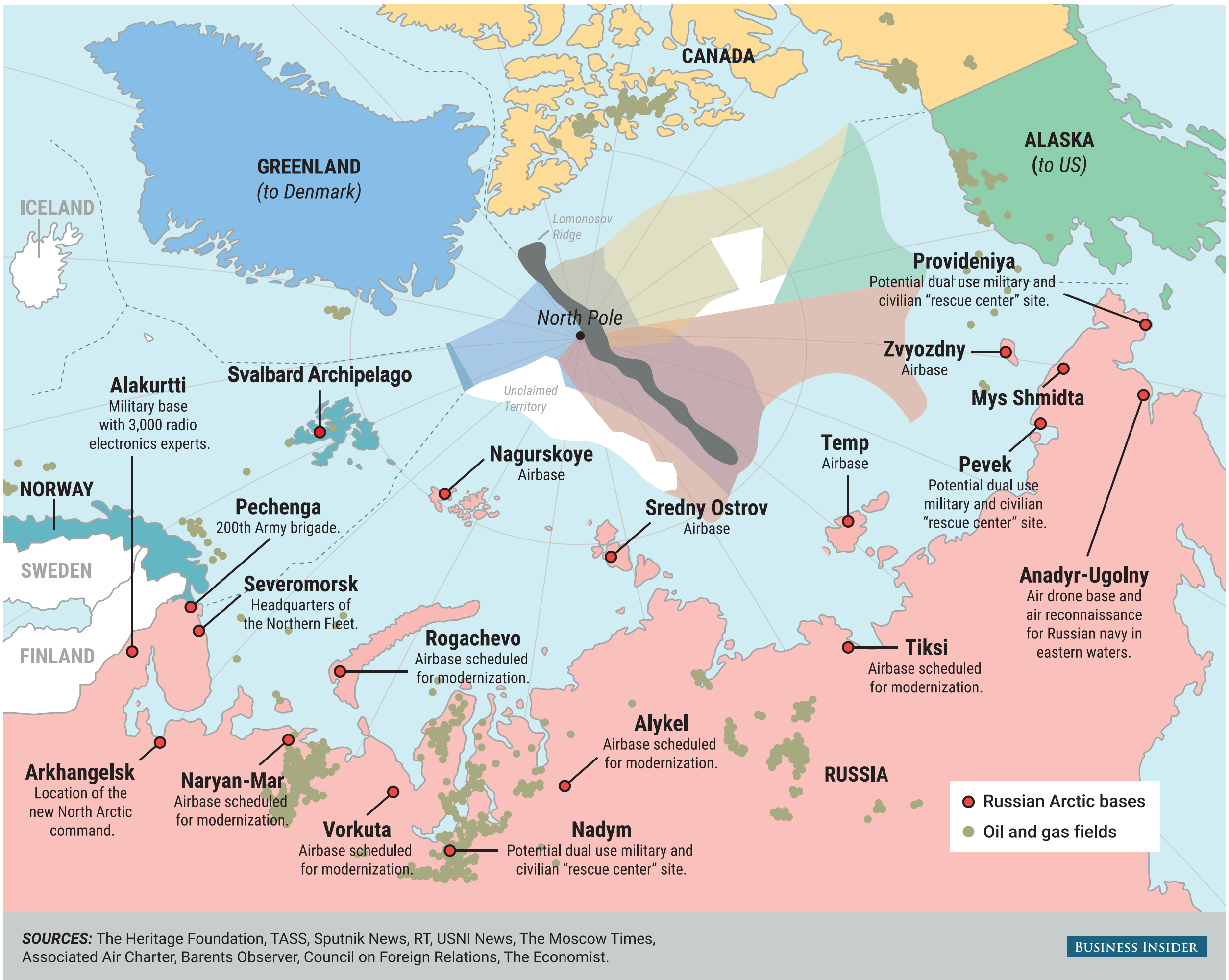

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Figure 3: Russia's Militarization of the Artic.[16]

must extend to cover this region. Air operations would face the same difficulties as in the first scenario, only to a lesser extent.

A conflict over Svalbard would likely be drawn out, due to both the climate and to Russia's desire to play to their strength. Its military has far more experience operating in the arctic conditions than NATO. Russia would not have to forward-deploy many of its units due to its bases on the Kola Peninsula, Novaya Zemlya, and Franz Josef Land, whereas NATO would need to place numerous units across northern Norway. To conduct an extended campaign to defend or retake Svalbard, NATO must be prepared to operate from Arctic bases for long periods of time. This would require NATO to provide comprehensive air and maritime ISR, forward-basing, C2, aerial refuelling, and air transport in the Arctic for an extended timeframe.

Conclusion

The polar ice cap has historically prevented the Arctic Ocean from routine use, rendering the region largely free from competition. As the sea ice continues to recede, the Arctic will become more accessible to fishermen, cruise ships, oil companies, cargo vessels, and even navies. As an Alliance, we must consider the possibility of conflict. Through this brief exploratory analysis, it is evident situational awareness through air and maritime ISR in this emerging global common

[M] © US Air Force, Staff Sgt. Christopher Boitz

'NATO must plan, train and exercise the forward/basing of forces in order to prepare for an Arctic contingency.'

would prove vitally important in any conflict situation. Additionally, C2, strike, and air transport missions at the long ranges seen in the Arctic will have a heavy aerial refuelling demand. Finally, NATO must plan, train and exercise the forward-basing of forces in hostile environments across the spectrum of conflict in order to prepare for an Arctic contingency. Currently, NATO and the majority of its member states are unprepared to conduct the operations discussed above. While, of course, it is preferable to limit military activity in the Arctic, it would be imprudent to dismiss the possibility of hostilities in this increasingly accessible global common. ●

The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of the Air Force, Department of Defense, US Government, or NATO.

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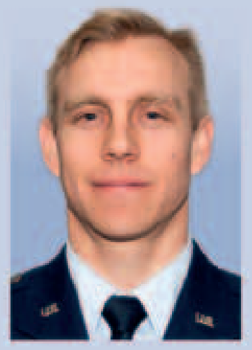

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Laser-Based Space Debris Removal

An Approach for Protecting the Critical Infrastructure Space

By Dr. rer. nat. Hans-Albert Eckel, DEU, Head Studies & Concepts, Institute of Technical Physics, German Aerospace Center (DLR)
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Introduction

Critical infrastructures are organizations and institutions whose failure or impairment would cause sustained shortage of supplies, significant disruption of public security, or other dramatic consequences for the state or community they support.[1] A similar definition is given by the US Department of Homeland Security: 'Critical infrastructures are systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.'[2]

Following the classification in the German National Strategy for Critical Infrastructure protection (CIP)[3], critical infrastructures can be divided by their technical, structural, and functional characteristics into essential technical basic infrastructures or essential social and economic service infrastructures. The technical basic infrastructures include power supply, information and communication technologies of transport, traffic as well as drinking water supply and sewage disposal. Health systems, food chains, emergency and rescue services, civil protection, government infrastructure (including the legislative, executive, and judicial branches), financial services and media all belong to the socio-economic service infrastructure. Space is not explicitly listed, although the basic technical infrastructure as well as the essential socio-economic

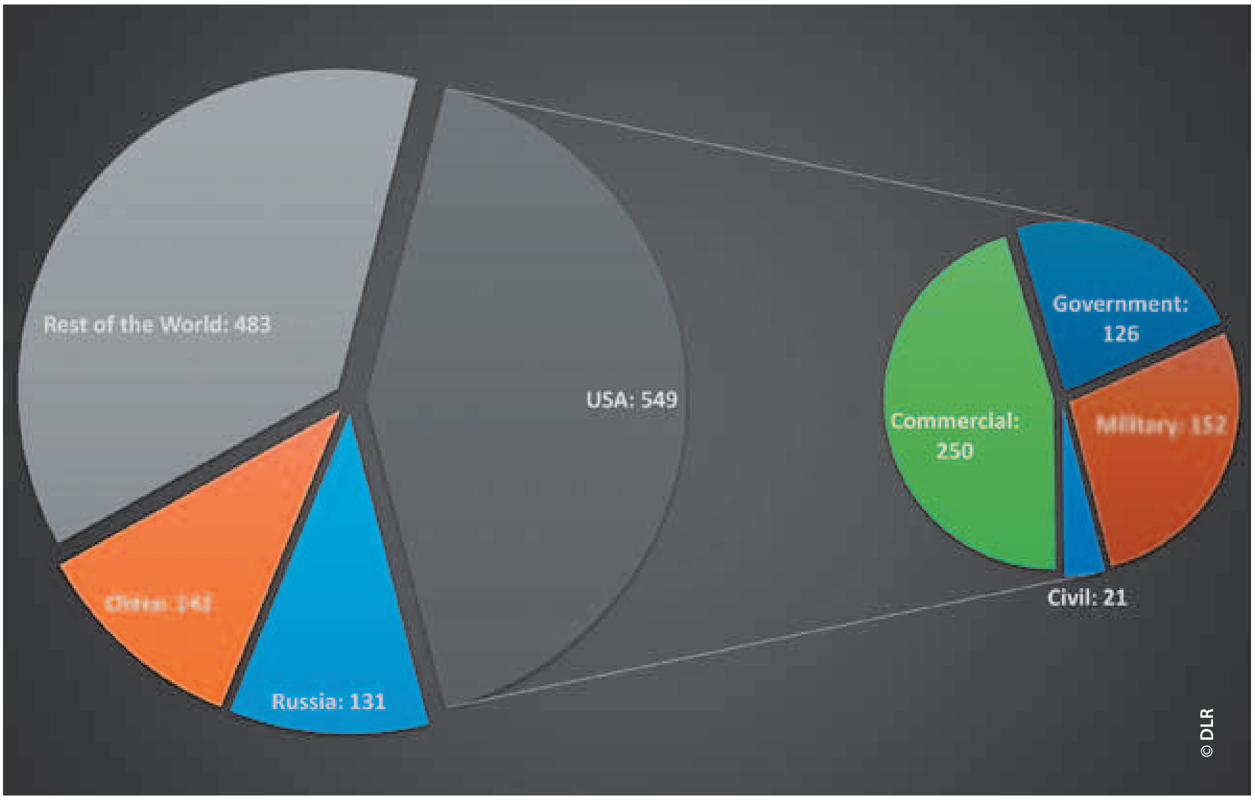

Figure 1: Space assets in use by the major world powers (includes launches through 31 August 2015).[5]

service infrastructures depend on space or at least are irreversibly linked to space capabilities.[4] This is true for the military as well. Almost all of today's military operations rely on capabilities enabled by space-based systems. Consequently, space assets have become a critical infrastructure not only for the civilian sector but also for the military world, as demonstrated by the numbers depicted in Figure 1.

Military Dependency on the Critical Infrastructure Space

Space systems remain an integral part of national security. The importance of space capabilities rose during the cold war, when the United States and the Soviet Union strove to observe the other's strategic weapon arsenal.[6] From today's point of view, this helped provide a stable nuclear deterrence strategy. Space-based surveillance and reconnaissance systems have developed further since the cold war and provide crucial information for today's military operations. The resolution of optical and radar systems has greatly improved over recent decades. Command and Control (C2) of operational military forces by land, sea, and air would be inconceivable without military communication satellites. The dual-use nature of military satellites has driven reliance by the civil sector. Global Positioning System (GPS) satellites, which were originally designed to enhance military navigational and targeting requirements, have driven multibillion dollar civil industries. In addition, weather satellites, which were originally launched by the military, have been nearly replaced by the civilian sector.

A science adviser to US President Ronald Reagan stated in 1987 that 'even in a very limited war, we would have an absolutely critical dependence on space today'.[7] This prediction was clearly confirmed in more recent US and Alliance operations such as in the Persian Gulf region, Afghanistan, and Libya, where the military uses of space greatly enhanced the Alliance's

Figure 2: Small space debris objects hitting and destroying a satellite.

effectiveness. Space systems provided support for navigation, weather, missile defence, communications, reconnaissance and surveillance, as well as target acquisition. As we face increasing global responsibilities with smaller forces, our ability to accomplish military missions will depend even more on such force-enhancing support from space.[8] The dependency of NATO Forces on space systems reveals a major vulnerability due to a variety of threats.

Threats to the Critical Infrastructure Space

Understanding and defining existing and future threats that can damage or even destroy critical space infrastructure is a requirement for the development of needed and appropriate means of protection. The ground segments of space assets (control centres, ground stations, and space launch facilities) are mainly vulnerable to security risks such as cyber and physical attacks, whereas safety is the major concern with regard to the technical operation of launcher systems. Both require respective defensive measures or safeguards that are not further addressed in this article. The further focus will be threats towards on-orbit space systems.

On orbit space systems are exposed to a number of highly probable risks, which, according to a study of the German Aerospace Center (DLR),[9] could be classified as:

- **Intentional threats.** Risks related to possibilities of an attack include disruption ('jamming'), manipulation ('hacking'), corruption ('spoofing') or destruction of satellites by anti-satellite weapons. The use of microwave and radio frequency weapons as well as 'killer satellites' are assigned to the same category.
- **Natural threats.** These include risks arising from the space environment itself, for example collision with a solid object with cosmic origin (meteor), high-energy particle radiation, magnetic storms (solar storms), or strong temperature fluctuations.

- **Artificial threats.** Threats posed by space debris include decommissioned satellites, rocket stages and their parts, or other artificial space objects. Additionally, design or development errors are allocated to the category of artificial threats.

In particular, the continuing growth of space debris poses an increasing threat to operational satellites. Today, the total amount of debris exceeds 200 million objects with diameters above 1 mm, accounting for a total mass of 6,500 tons. Of that, 77 per cent is concentrated in low Earth orbit (LEO), with higher concentration at 900 and 1,400 km. Studies show that the amount of debris in LEO is growing exponentially despite future debris release mitigation measures being considered. In the short and medium-terms, collisions will likely become a much larger contributor to debris generation in LEO, which may cause an exponential growth of further catastrophic collisions. Since even small objects can cause a total loss of the space system, space debris is already a major threat to satellite systems (Figure 2). With an estimated growth rate of about 5 per cent per year, the collision probability increases steadily.

Protection Measures Against Space Debris

An intact space infrastructure depends on technologies still in need of investigation and development. One of the main tasks of German Aerospace Center defence research is to provide an independent analysis and evaluation capability for the Federal Ministry of Defence (MoD). In that capacity, the DLR has conducted a comprehensive evaluation comparing the probability and impact of threats against potential space asset protection measures that could be realized with reasonable cost and effort.[10] The results showed very low efficiency in shielding assets from the exponentially increasing space debris population, because measures could only be realized in the long-term and with high monetary investments in research and development programs. However, promising concepts for space debris removal are currently being investigated by the DLR in order face the further evolving challenge.

Thus far, several protection measures and collision risk mitigation concepts have been proposed, though the technology might not yet be completely available.

The different approaches depend strongly on the size and the dynamic regime of the debris.

- Small size debris (less than 1 cm). Robust satellite architectures or armor are recommended in order to shield against debris impacts. These protection measures have to be incorporated before launch and are the cheapest by comparison with others.
- Large size debris (size more than 10 cm in size). Since this debris is usually tracked by ground stations and listed in orbital data catalogues, collision avoidance maneuvers are state of the art. More innovative is the idea of in-orbit protection vehicles to de-orbit debris surrounding space assets.
- Medium size debris (between 1 cm and 10 cm). This class of debris presents the greatest threat to operational satellites. It is too big to be countered by shielding technologies and still too small to be monitored and catalogued for collision avoidance with currently available technologies.

Laser-Based Debris Removal

A promising approach based on optical methods and laser technology will tackle this challenge. Optical tracking of space debris has already been demonstrated with unprecedented accuracy.[11] In a further development, Laser Debris Removal (LDR) by ground-based lasers is intended to clean the Low Earth Orbits (LEO) from hazardous small and medium size debris.

The LDR concept uses a beam of closely directed laser energy projected from the ground to modify the trajectory of debris objects in low earth orbits (Figure 3). When the pulsed laser beam hits the object, it ablates and vaporizes a thin layer of material, and then it creates plasma and an exhaust plume, which leaves the debris surface at such high velocities it generates enough force to push the object into a new orbit or to cause debris to re-enter the atmosphere (Figure 4).

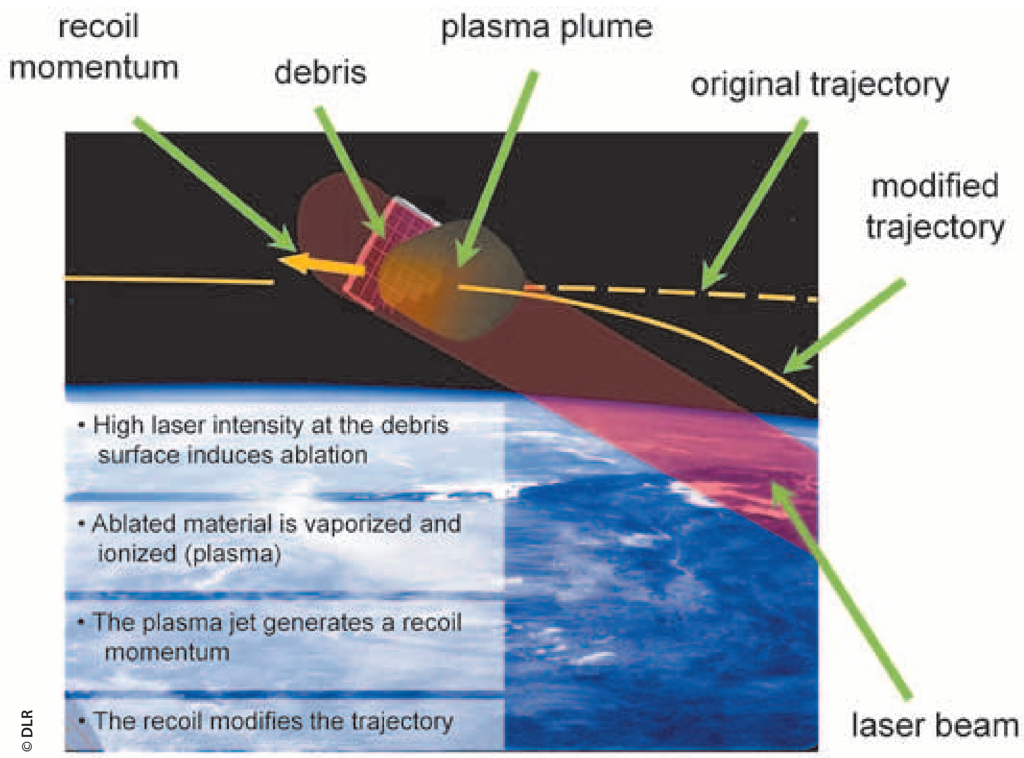

Figure 3: Ground-based laser beam modifying debris trajectory.

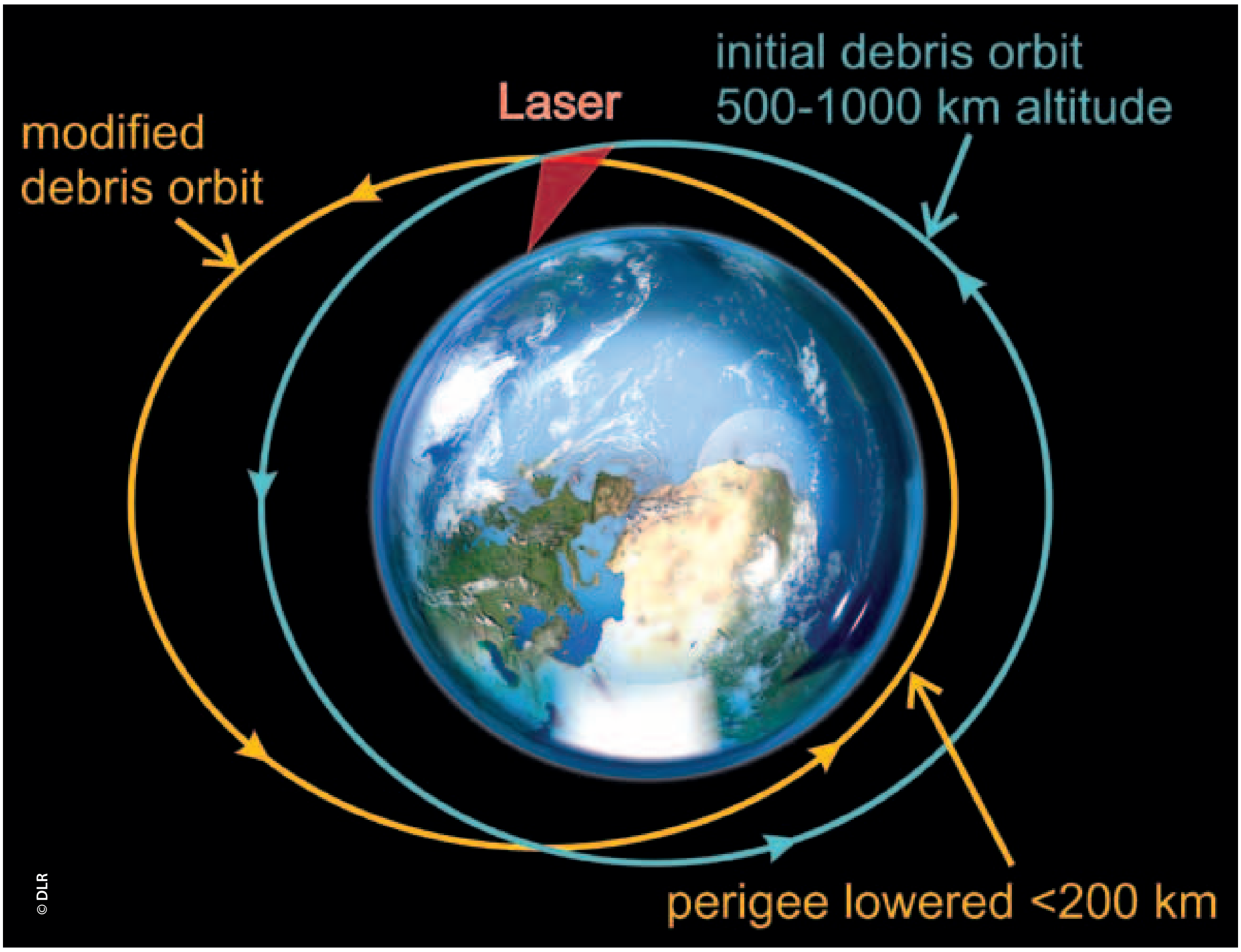

Figure 4: Perigee lowering by laser induced momentum transfer.

The overall requirements for a future LDR system have been investigated by a European consortium within the CLEANSPACE project funded by the European Commission.[12] The study comprises the concept of an innovative, ground-based laser station network, which allows for the protection of space assets from orbit collisions with medium-size debris. Research and technology developments in lasers, system dimensioning, trajectory simulation, and 'policy, ethical, and societal' implication activities have been taken into account, as well as state of the art situational awareness and space debris population surveillance. Within the framework of the CLEANSPACE project, the concept of a ground-based laser system has been validated and a preliminary architecture has been proposed, including crucial points like laser safety and the necessity to have international authority to ensure safe operations. One can envision the realization such an innovative ground-based laser station to deal with medium size debris within the next decade.

Of great importance for the detailed layout of a LDR concept is the efficiency of the laser-matter-interaction process, since it has a direct impact on the required laser power and hence the overall system specifications. The ratio of the thrust exerted to the debris object to the average laser power, which is commonly known as the impulse coupling coefficient c_m, is a material-specific figure of merit. However, in general, the laser-induced thrust is not proportional to the average laser

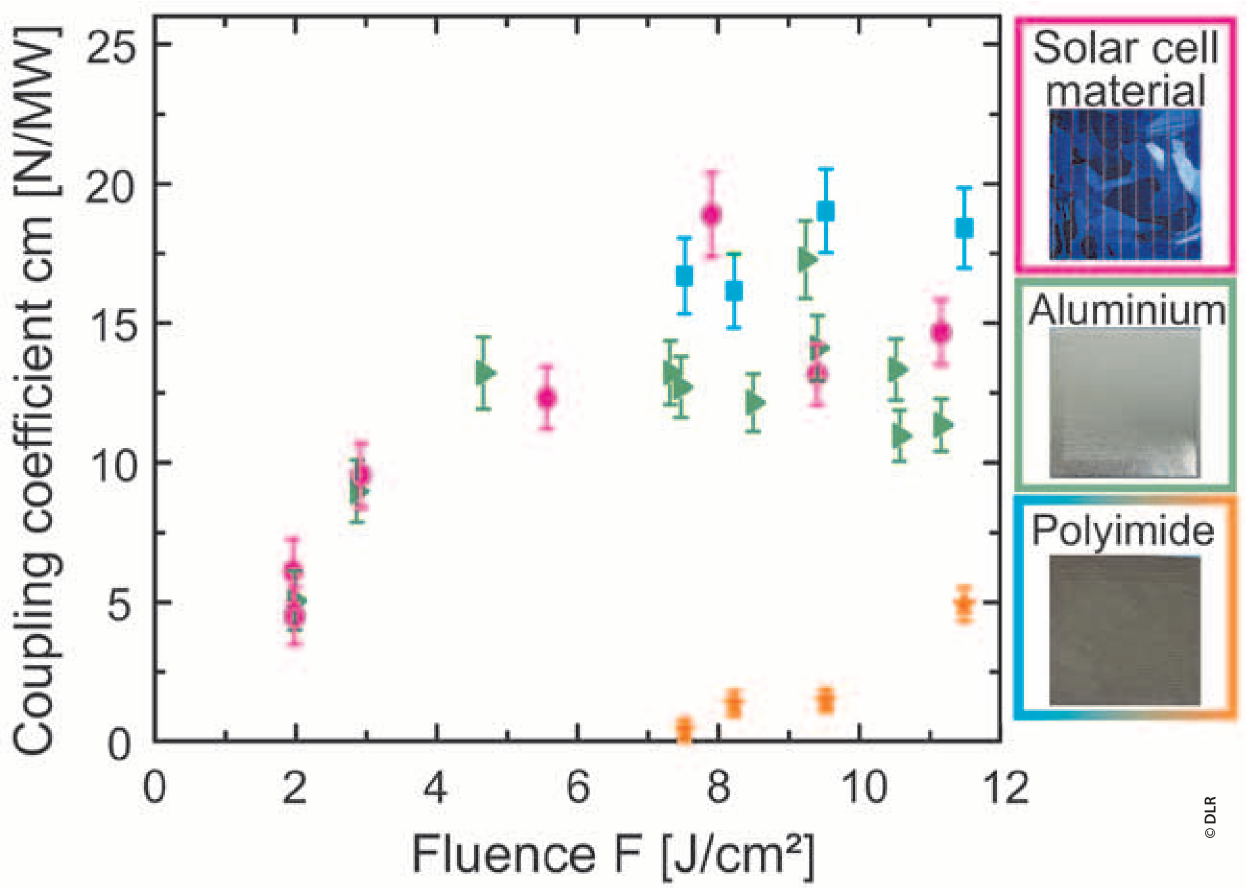

Figure 5: Experimental data on momentum coupling for space debris relevant materials.

power in a simple way. In fact, c_m depends mainly on the laser pulse fluence Φ at the debris target exhibiting a threshold fluence Φ_{th} for the onset of ablation and an optimum fluence Φ_{opt} where c_m shows a maximum.

The Institute of Technical Physics of the German Aerospace Center has been dealing with the characteristics and prospects of laser ablation propulsion for many years. The special challenges concerning laser-matter interaction with respect to a LDR concept have been addressed by experimental as well a modelling and simulation activities.

At first, the work concentrated on the dependency of the impulse coupling on the laser fluence for space-debris relevant materials. Aluminium, polyimide (both as a bulk material and a thin film material on an aluminium substrate), solar cell material and gold have been analysed by means of experiments with a torsional thrust balance and hydrodynamic simulations based on a two-temperature-model. Depending on the irradiated material, the experiments found the threshold fluence spans a range from 2 J/cm^2 to 8 J/cm^2 whereas optimum fluences are mainly located beyond 7 J/cm^2 yielding impulse coupling coefficients of up to 30 N/MW (Figure 5).

The modelling and simulation of laser-matter interaction is a difficult task, since there exists a variety of numerical approaches. The validity of those approaches

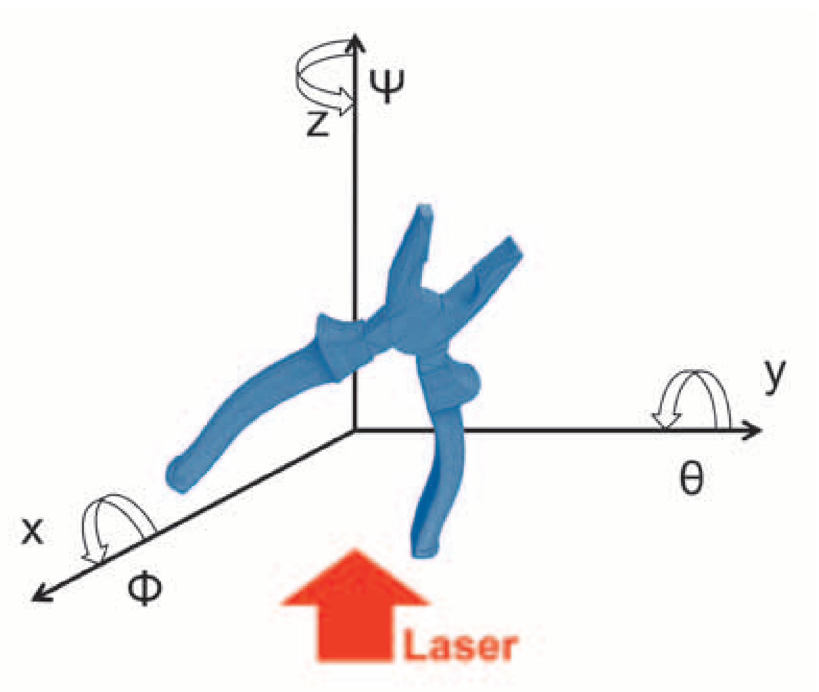

Figure 6: 3-D model of plier (space debris).

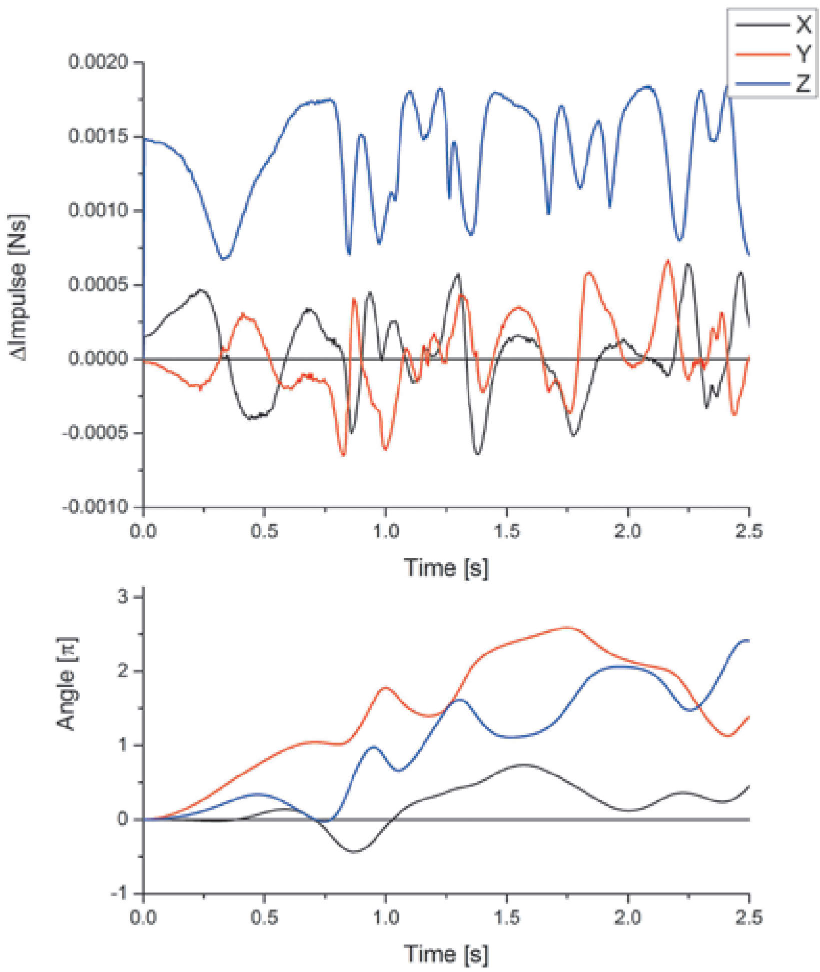

Figure 7: Impulse transfer and orientation impact.

depends on the included parameters and particularly on the investigated timescale given by the laser pulse length and the corresponding temporal and spatial regime of the ablation process. Nevertheless, the final model calculations are in good agreement with the experimental data and allow for the analysis of laser-debris-interaction in an extended parameter field.

Further, the effects caused by complex shapes and varying orientation of a debris object on the thrust vector have to be taken into account. A software tool, EXPEDIT (Examination Program for irregularly shaped Debris Targets), was developed to calculate the impulse transferred by laser ablation, taking into account variation of the fluence, self-shadowing and complex geometries. This tool allows for dynamic parameter studies to characterize the thrust vector and the involved uncertainties for a complete LDR procedure.

A case study undertaken in order to investigate the behaviour of a single debris object was done using a 3-D model of a set of pliers (Figure 6). The exact shape of the pliers is not as important as the general information, which can be gleaned from the results. The calculation assumed a Gaussian laser beam profile and a pulse repetition rate of 200 Hz. Figure 7 shows the impulse transfer and the evolution of the orientation as shown by the three angles of rotation. As expected the impulse in z-direction is consistently larger than the impulses in the other directions.

Conclusions

Space must clearly be considered as a critical infrastructure. Space-based assets have become indispensable for our economy and security. The dependency of the military on these systems will not only remain but will rise and is irreversible at the same time. Consequently, the protection of space assets against threats and attacks is an essential task for the future. A variety of threats need to be considered. Although a single concept will never result in 'zero' risk, it can reduce the risk of losing capabilities enabled by space. Laser-based debris removal represents an innovative concept to reduce the risk of collisions with space debris objects. The required technology is currently being investigated by DLR scientists and engineers with the potential to integrate these in future operational systems. ●

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is head of the department 'Studies & Concepts' at the Institute of Technical Physics of the German Aerospace Center (DLR). He started his career in 1996 as a Research Scientist in the field of solid state laser development and extended his expertise to experimental and theoretical concept and system studies of specific, mainly defense related, applications of high power laser sources. This includes a broad knowledge on different types of high power lasers, laser beam guidance and control technologies, target imaging and tracking, the effects of laser beam propagation under different atmospheric conditions, directed energy weapon target effects, as well as beamed energy propulsion and laser debris removal. Since 2010 Dr. Eckel is in charge of the program 'Impact, Protection and Materials' within the defence research of DLR.

Dr.-Ing. Dennis Göge

started his career at the German Aerospace Center (DLR) in 2000 as Research Scientist. In 2005 he became Deputy Department Head and Head of a Research Group at DLR in Göttingen, Germany. After having worked from 2005 to 2007 in this position he then joined the Science and Technology Organisation (STO) of NATO in Neuilly-sur-Seine, France, as Executive Officer. In 2010, Dr. Göge has been appointed Executive Board Representative and Program Coordinator Defence and Security Research at DLR in Cologne, Germany. Actually, Dr. Göge is representing DLR in various national and international supervisory bodies, advisory councils and committees. He is Member of the Science and Technology Board (STB) and former Chairman of the AVT Panel of NATO's Science and Technology Organization (STO). In addition, he is an advisor to the Federal Ministry of Defence and to the Federal Ministry for Economic Affairs and Energy, Germany.

Dr.-Ing. Dirk Zimper

joined the German Air Force in 2004 and graduated from the German Air Force Officer School in 2005. He holds a doctoral degree in Aerospace Engineering from the German Armed Forces University Munich. Following the completion of his professional training as an Ammunition Specialist, Dr.-Ing. Zimper worked as Head of Unit being responsible for the maintenance of air-to-air and air-to-ground missile systems as well as all pyrotechnic ammunitions for German aircrafts. Additionally, he managed the process implementation of SAP in a German ammunition depot. Dr.-Ing. Zimper was honored with the honor cross of the German Armed Forces for his service. Besides his officers' service he worked as Research Scientist in defense related projects of the German Aerospace Center (DLR). He currently works as Executive Officer at the NATO Science and Technology Organization (STO) being in charge of the Applied Vehicle Technology Panel (AVT).

Breaking Integrated Air Defence with Unmanned Aerial Vehicle Swarms

Developing and Testing the US Employment Concept

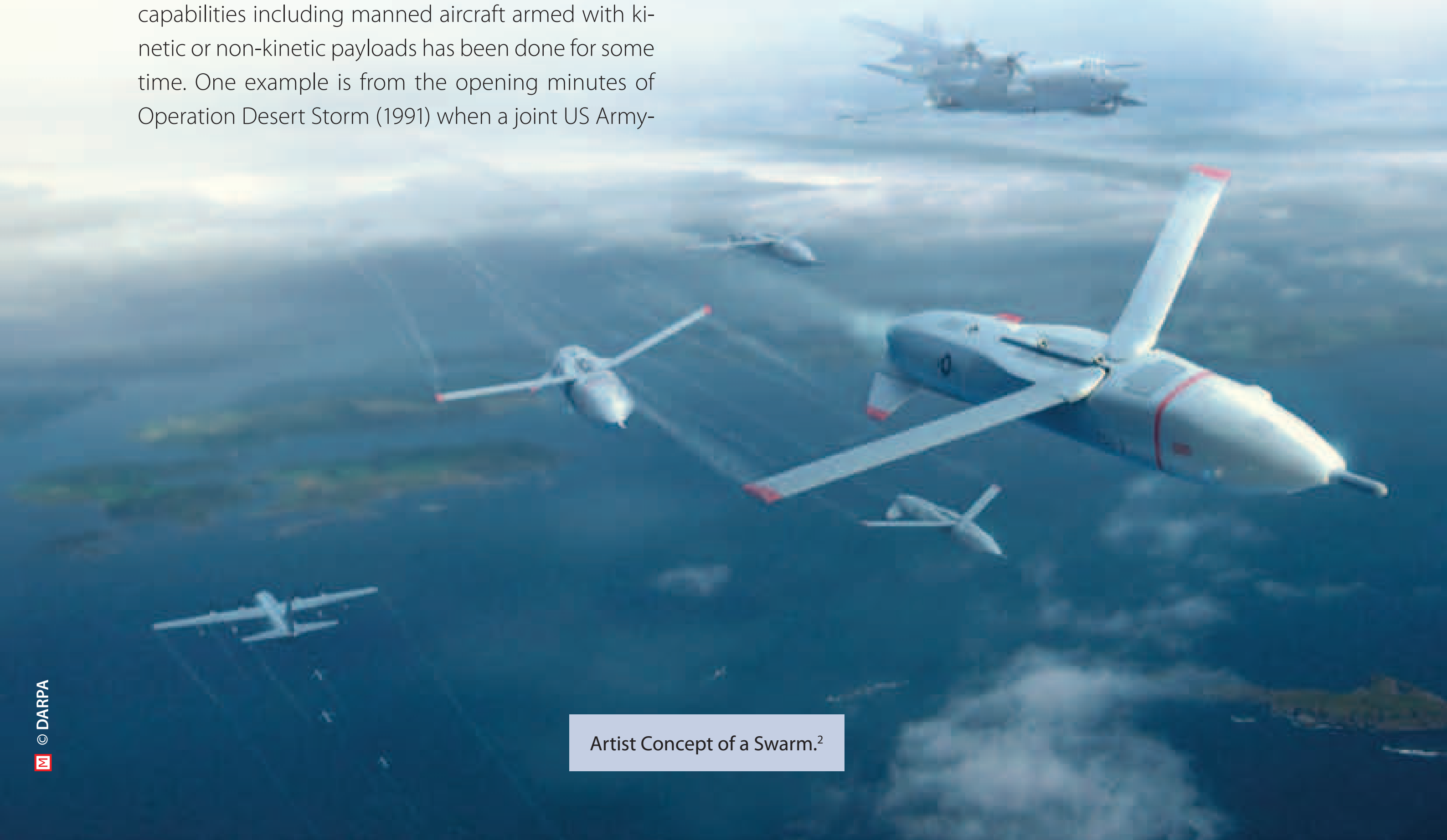
By Mr F. Patrick Filbert, JUSI QRT, Major (ret.), USA A

Introduction

As technology improves, so does the capacity to expand defensive perimeters to ever increasing ranges both horizontally and vertically. This enables an adversary to keep friendly advanced systems outside his sphere of influence, or more specifically, to deny access to specific areas of operation. In the current vernacular, this is called an Anti-Access/Area Denial (A2/AD) environment which has, as its backbone, advanced Integrated Air Defence Systems (IADS). Identifying ways to penetrate this perimeter with air assets and capabilities that do not require ever more expensive solutions is imperative for any nation's or alliance's air force, and thus demands creative use of current and emerging advanced technologies.

Attacking adversary air defence with 'layered' offensive capabilities including manned aircraft armed with kinetic or non-kinetic payloads has been done for some time. One example is from the opening minutes of Operation Desert Storm (1991) when a joint US Army-Air Force helicopter team (Task Force Normandy) penetrated Iraqi IADS. After US Air Force (USAF) helicopters (PAVE LOW III) delivered Electronic Attack (EA), blinding Iraqi early warning radars, US Army helicopters (APACHE) subsequently destroyed the radars with kinetic strikes. Resulting gaps in the Iraqi IADS permitted USAF follow-on air strikes on high-value targets deep inside the country.[1]

Similarly, in the future, advanced Unmanned Aircraft Systems (UAS) equipped with Electronic Warfare (EW) payloads could lead a subsequent wave of attacking aircraft to enter and counter a potential adversary's A2/AD environment.



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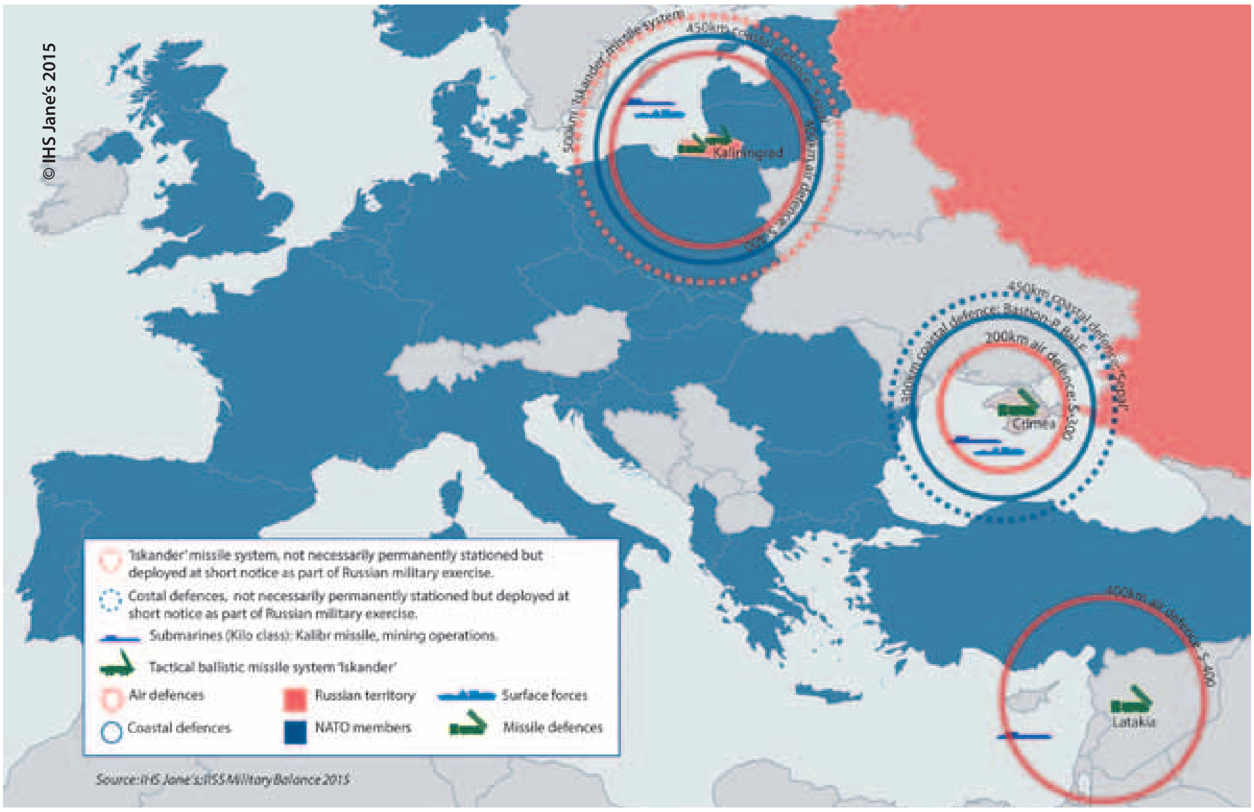


Russia's regional A2AD bastions, including Integrated Air and Missile Defence, at its Eastern and South-eastern flank.

US Concept Evolution – Employing Unmanned Aerial Vehicle Swarms

While emerging EW payload testing on UAS is occurring, mating Electronic Attack (EA) payloads onto a coordinated semi- or fully-autonomous swarm of smaller unmanned aircraft (UA) is still an emergent test environment effort. However, once such capabilities mature, employing them will require a foundational concept be in place. To address such a foundational approach, the Joint Unmanned Aerial Vehicle (UAV) Swarming Integration (JUSI) Quick Reaction Test (QRT) was established under the US Director of Operational Test and Evaluation's Joint Test and Evaluation Program in July 2015. It is co-located with US Pacific Command's J8 Resources and Assessment Directorate, at Camp H.M. Smith, Oahu, Hawaii.

The JUSI QRT will develop, test, and validate a Concept of Employment (CONEMP) for the integration and synchronization of swarming UA performing EA in support of the joint force against an advanced IADS. The JUSI QRT effort is focused on a 2015–2020 timeframe to research and identify previous and ongoing swarm-related efforts while building a swarming UA community of interest, concurrent with CONEMP development.

Advanced Integrated Air Defences and How to Address Them – The Problem

Modern Surface-To-Air Missile (SAM) systems are an integral part of advanced IADS. These IADS are, in turn, integral parts of a potential adversary's networked A2/AD environment. For the purpose of the JUSI QRT effort, IADS refers to a networked system of adversary capabilities (e.g., a series of detection and tracking radars coupled with SAMs) and not to one specific platform (i.e., an IADS on a warship by itself or a specific individual SAM such as an SA-20).

Miniature Air Launched Decoys (MALD) mounted underneath a military cargo aircraft. MALD is a system of programmable unmanned air-launched vehicles that accurately duplicate flight profiles and signatures of Allied aircraft. The MALD-J is a jammer variant.[3]

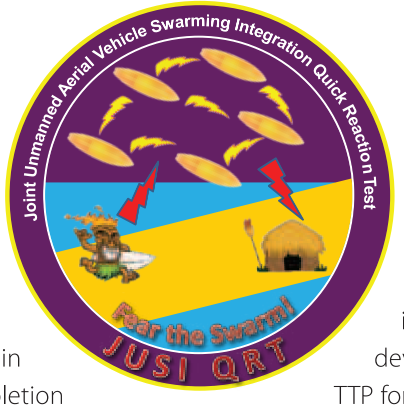
The US joint force is currently over-reliant on Standoff Weapons (SOW) and fourth/fifth generation strike platforms to address the A2/AD challenge. UA swarms represent a potential additional approach, complementing existing platforms and weapons systems. Despite rapid technical advances in UA swarming development and demonstrations, the US joint force lacks a CONEMP for UA swarm effects delivery, in particular with regard to operations against adversary advanced IADS protecting potential targets with SAM arrays. The lack of a CONEMP or other supporting documentation hinders requirements development and A2/AD countering as well as precluding integration and synchronization with the rest of the joint force.

The Approach – Addressing the Problem

Combat capable and survivable UA with the capability to perform swarming functions are a new but quickly growing aspect of modern warfare. The JUSI QRT will take the first step with its CONEMP to enable a joint force of other weapons and platforms (i.e., various types of SOWs, decoys, jammers, and fourth/fifth generation platforms) support to counter an adversary IADS in an A2/AD environment. With the short lifespan of the JUSI QRT – one year – the effort will focus on CONEMP development supported by a series of modelling and simulation (M&S) runs over the course of three test events.

Johns Hopkins University's Applied Physics Laboratory's (JHU/APL) experienced M&S personnel will support each of the test events enabling the QRT to collect data for the equivalent of hundreds of swarm flights. Their help will provide a cost saving aspect concurrent with data analysis to support CONEMP development. JHU/APL will provide M&S and analysis of the execution of UA with EA payloads against scenarios developed to test the UA's ability to deliver desired effects against an advanced IADS as part of an A2/AD environment.

S-400 Triumf (SA-21 Growler): Russia's next generation surface-to-air missile system capable of destroying enemy aircraft at extremely long ranges.



The resulting qualitative and empirical data will enable the JUSI QRT Team to assess findings, conclusions, and recommendations to revise the CONEMP between each test event starting with JUSI QRT's first test event, which wrapped up 20 November 2015 and the last test, which ends in late May 2016. Additionally, upon completion of each test event, a Joint Warfighter Advisory Group (JWAG) will be convened to receive test event results – the first JUSI QRT JWAG occurred in December 2015 and the last JWAG will occur in June 2016. As the QRT process continues, it will lead to development of a finalized swarming UA CONEMP to provide the link to requirements development and capability integration for the joint force to have a distributed approach to complement existing solutions focusing on fourth/fifth generation strike platforms and SOW.

The Way Ahead

At the end of the JUSI QRT, the resulting CONEMP will provide an effective operational context to inform requirements development, roadmaps, and eventually, Tactics, Techniques, and Procedures (TTP) in several areas, including communication, automation, UA, and EA to deliver intended effects. The CONEMP will also serve to help focus future Department of Defense and industry investment. Future considerations related to swarming UA with EA payloads may include development, testing, and validation of TTP for UA with EA payloads. Such TTP would further reinforce the use of swarming UA by empowering the commander to develop standards in the areas of manning, equipping, training, and planning in the joint force. In the interim, the JUSI QRT developed CONEMP will provide planners, trainers, and their supporters with a starting point for employment of this capability. ●

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JAPCC as the Department Head 'Space Support to Operations'

On 24th May 2016 Air Commodore Madelein Spit signed the Appointment Letter that officially confirms the designation of the JAPCC as the Department Head (DH) for 'Space Support to NATO Operations'.

The NATO Global Programming sets the framework for a standardized and long-term solution to E&T for every training category, the 'disciplines'. For each discipline, a Requirement Authority (RA) identifies the present and future E&T requirements deriving from operational needs, while the DH coordinates finding and developing solutions for these requirements. The supervision of this process is executed by JFT (E&T division Joint Force Trainer from SACT). SHAPE ACOS J3 is currently the RA for the 'Space Support to NATO Operations' discipline.

With this additional task, the JAPCC continues to play a leading role in the future development of E&T in the domain of Space Support to Operations.

JAPCC Journal Ed. 23 will publish an article on this topic.

Air Warfare Communication in a Networked Environment

The evolution of digital technology integrated into fourth and fifth generation aircraft has resulted in a dramatic increase of information directly available to the pilot or aircrew, both from on- and off-board sensors. Improving the manner in which this information is shared amongst the section, division, flight, and Air Operations Centres has demonstrated a dramatic impact on mission effectiveness ranging from the friendly force to adversary kill ratio to efficient target intelligence and the refinement of the detect to engage sequence. Heavily reliant on numerous, and sometimes dissimilar, data information links, this information exchange is the key foundation for the way NATO exerts Air Power.

The JAPCC has therefore initiated a project to explore the potential improvement to network-generated situational awareness through dynamic distribution and effective interaction of the Air Power capabilities throughout the joint battle space. The study will analyse the latest air systems evolution regarding interoperability through data transfer, focusing especially on fourth and fifth Generation systems, both manned and unmanned; ground, sea and air based; as well as existing and potential future nets and protocols.

This project will also examine the different Air Power packages that will be formed in the future by combining legacy, actual & future platforms (Air Power Clusters) through data transfer. The Tactical Leadership Programme Kill Ratio statistics and mission configuration under Battlefield Operations Support System (BOSS) comprising LINK-16 connectivity will serve as a cyber laboratory to gain perspective on the latest evolutionary trends in fighter-to-fighter connectivity and its impact in different tactical situations.

The overall objective is to develop a basic concept for further advances in Air & Space Power evolution through improved data transfer based on dynamic composition of capability clusters operating in continuous and deconflicted airspace. After considering potential vulnerabilities to future networks, a model based on real-time airspace synchronization will be proposed. ●

Future Alliance Maritime Anti-Submarine Warfare Capability

In the decades following the conclusion of the Cold War, non-NATO submarines virtually ceased operations in the European theatre. That fact, coupled with the Maritime Patrol Aircraft (MPA) growth into mission areas beyond Anti-Submarine Warfare (ASW), has resulted in a perceived dearth in ASW capability across NATO's MPA and ASW Helicopter force, most notably represented by a dramatic reduction in MPA inventory across the Alliance in the past 15 years. Recent trends toward increased deep water submarine patrols by many nations continue (notably Russia, India, and China), and the Alliance is slowly coming to terms with what might be considered 'a new normal' for submarine operations. As emerging technologies are developed and replacement aircraft for aged MPA and helicopters are explored, budgets and other factors continue to hamper the development of the future ASW force structure. Unless NATO retains an ASW competency, there is growing risk the Alliance will find itself unprepared to capably respond to a potential increase in future non-NATO submarine operations.

The JAPCC, by specific request of Allied Maritime Command, is, therefore, developing a document that defines the current challenges in ASW experienced by air platforms in both today's operational environment and a range of possible future environments. The document will assess whether the Alliance Maritime Air ASW platforms have a capability shortfall in this mission area. This will involve a review of environmental challenges, oceanography, and a brief review of NATO's Maritime Air history, focusing on this mission, to set the stage for detailed discussions about the current and future challenges in the ASW domain. Then, the research will examine current and projected non-NATO submarine capability, to include a review of national intent and a discussion about the use of submarines as an element of sea power. The project will review NATO and Partner Nations' current MPA and ASW helicopter force and future force structure/procurement plan against the future ASW challenges, including the potential integration of Unmanned Aerial Vehicles (UAVs) and Unmanned Underwater Vehicles (UUV) into this domain. The study will review NATO's ASW doctrine and current C2 structure for conducting large-area, multinational submarine prosecutions in times other than crisis. Finally, the study will provide a forecast of the maritime environment circa 2025–2030 and identify 'possible futures' and 'Wild Card events' which may shape NATO's maritime planning efforts.

NATO/EU Air Transport, Training, Exercises and Interoperability

Introduction

The JAPCC, with support from NATO nations, conducted a study in 2011 examining NATO's then-existing Air Transport (AT) Capability. This study identified many training deficiencies and interoperability issues. It also offered possible solutions to overcome these ever-present challenges and promote the enhancement of this important capability.

Many of these deficiencies in NATO AT Capability are being addressed by groups such as the European Defence Agency (EDA) and European Air Transport Command (EATC). However, many issues remain unresolved at the NATO level. There is still work needed in the areas of training, exercises, and interoperability to harmonize the initiatives started by Allied nations and other Non-NATO organizations. Closer cooperation and coordination between NATO and organizations like the EDA and EATC will significantly enhance NATO's current AT capability and allow Alliance members and partner nations to achieve a higher level of interoperability.

Aim

This project is a follow-on and update to our 2011 study. In the previous study, we had an overview of the Air Transport capability. The majority of the multinational Initiatives, especially in Europe, was at an early stage of development. In this study, we first intend to report which of our solutions/initiatives have been initiated or completed. Then, we will re-examine the feasibility of the remaining proposed solutions, identify any additional critical problems, and ultimately, attempt to stimulate NATO to adopt the best multinational initiatives to improve the standardization and interoperability of AT among NATO nations. This study will primarily focus on training, exercises and interoperability.

This project will analyse the current state of AT training, standardization and interoperability and attempt to determine the appropriate spectrum of AT training nations are willing to collectively support. Common AT training initiatives under the NATO/EU 'umbrella' could fill existing gaps and improve courses that are currently deteriorating. The study will analyse how these initiatives can serve as the cornerstone and/or impetus for NATO AT standardization and interoperability improvement while avoiding duplication of effort. ●


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JAPCC Think Tank Forum 2016.

Enhancing Synergy within the Air and Space Power Community

Joint Air and Space Power Think Tank Forum and the Network Meeting

As part of the mission, JAPCC Subject Matter Experts conduct collaborative research into Air and Space (A&S) Power subjects and areas by leveraging their independent thought and a global network of experts that reach across the military, academic and industrial spheres. In support of these efforts, the JAPCC has developed an engagement strategy reaching out to the Alliance, the Nations, and EU organizations, which includes offering opportunities for cooperative and synergetic investment in better research and analysis. This includes two annual collaborative meetings, the Joint Air and Space Power Think Tank Forum and the Air and Space Power Network Meeting.

Joint Air and Space Power Think Tank Forum

The main purpose of the Think Tank Forum (TTF) is to exchange information regarding the composition and responsibilities of Think Tanks, Air Warfare Centres, Air Force HQs, and Military Academies of the NATO Nations sponsoring the JAPCC. Issues covered include creating mutual awareness regarding focus areas, coordinating programmes of work, discussing solutions to common challenges as well as establishing objectives for follow-on collaboration.

Joint Air and Space Power Network Meeting, 2015.

The JAPCC has hosted two TTF meetings thus far, in 2014 and 2015, with a remarkable level of participation from the Sponsoring Nations. The consensus at the 2015 TTF was that it is a valuable forum for identifying vectors for mutual cooperation and outlining ways for more efficient coordination of the various institutions' projects. The third TTF was conducted in Madrid, from 5–7 April 2016.

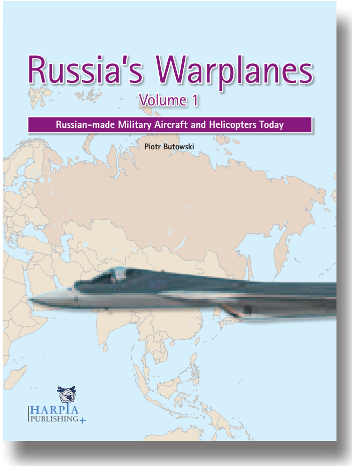
Joint Air and Space Power Network Meeting

While dealing with the same topics as the Think Tank Forum, the Joint A&S Power Network Meeting is targeted at participants from multinational NATO and European organizations critical to advancing A&S power, such as the NATO Headquarters' Armament and Aerospace Capabilities Directorate, Headquarters Allied Air Command (AIRCOM), European Union Military Staff (EUMS), European Defence Agency (EDA), European Air Group (EAG), European Air Transport Command (EATC), Competence Centre for Surface-Based Air and Missile Defence (CC SBAMD) and The Analysis and Simulation Centre for Air Operations (CASPOA).

At the second meeting in 2015, strong consensus was achieved that information sharing and the discussions held were most fruitful for the participants and that the meeting should be continued. Additional organizations that might bring more value to the discussion were identified and will be invited for the next time. The third meeting will take place from 8–9 November 2016, at the JAPCC in Kalkar.

Organizations interested in one or both of the meetings, please visit the JAPCC website at www.japcc.org for more information, or contact us by email at: ace@japcc.org.

'Russia's Airplanes – Volume 1'



By Piotr Butowski, Houston, TX, Harpia Publishing L.L.C., 2015

Reviewed by:
Lt Col Ralf Korus, DEU A, JAPCC

Recent geopolitical developments at NATO's Eastern and South-Eastern flanks, not least Russia's annexation of the Crimean Peninsula as well as its military intervention in Syria, led to the resurgence of Western analysts' interest in Russia's current military capabilities. Amongst these capabilities the Russian Federation's Air Force plays an important role. Since 2008, it has been significantly modernized with increasing budgets that had become available due to Russia's booming oil and gas exports.

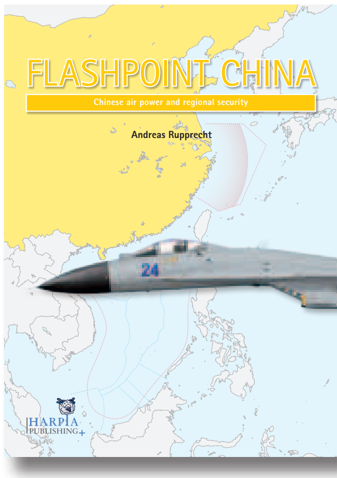
Piotr Butowski is a well-known expert who has outstanding connections within the Russian aerospace industry. In 'Russia's Airplanes – Volume 1', the author presents a complete overview of Russia's military aircraft inventory, encompassing tactical combat aircraft, attack, and transport helicopters, reconnaissance, and surveillance aircraft and special mission aircraft. Divided into four chapters, the book details the history and status of current Russian aircraft as well as the development of their prospective generations. Despite the fact Russia's currently declining economy will impact the sustainment of such ambitious military modernization efforts, with some of the described projects being cancelled or delayed, the value of this book cannot be disputed. It is an excellent overview of all current and future likely types of Russian military aircraft including their features. The book is not only directed at military analysts and subject matter experts but is valuable for anyone interested in Russian airplanes.

'Flashpoint China – Chinese Air Power and Regional Security'

'Flashpoint China – Chinese Air Power and Regional Security' offers an overview of potential military conflicts along the borders of the People's Republic of China. In contrast to most other publications which merely list current equipment and new acquisitions of the Chinese military, this book provides a short historic introduction of each of the regional 'powder kegs' in question to help the reader understand when, where and why the People's Republic of China decided to wage military conflicts in the past. The book further summarizes the Chinese Air Power related orders of battle in the relevant geographical areas.

The book is divided into chapters according to the Chinese regional Theatre Commands with dedicated sections for every adjacent country in the respective region. Thus, providing the historical and current geopolitical background as well as an assessment of the Chinese capabilities and intentions in that area. The respective chapters further provide imagery and figures of the region's military aircraft, political maps with the locations of Chinese Air Force and Navy bases and the regional countries' Air Defence Interdiction Zones as well as satellite imagery of the disputed islands in the South China Sea.

Although the book contains only 80 pages, the author managed to distil the very essence of the relevant information and to provide a comprehensive overview of Chinese Air Power and Regional Security such as stated in the books title. A very good and digestible read to gain insight and understanding of the complex political and military situation regarding the Chinese sphere of influence and interest.



By Piotr Butowski, Houston, TX, Harpia Publishing L.L.C., 2016

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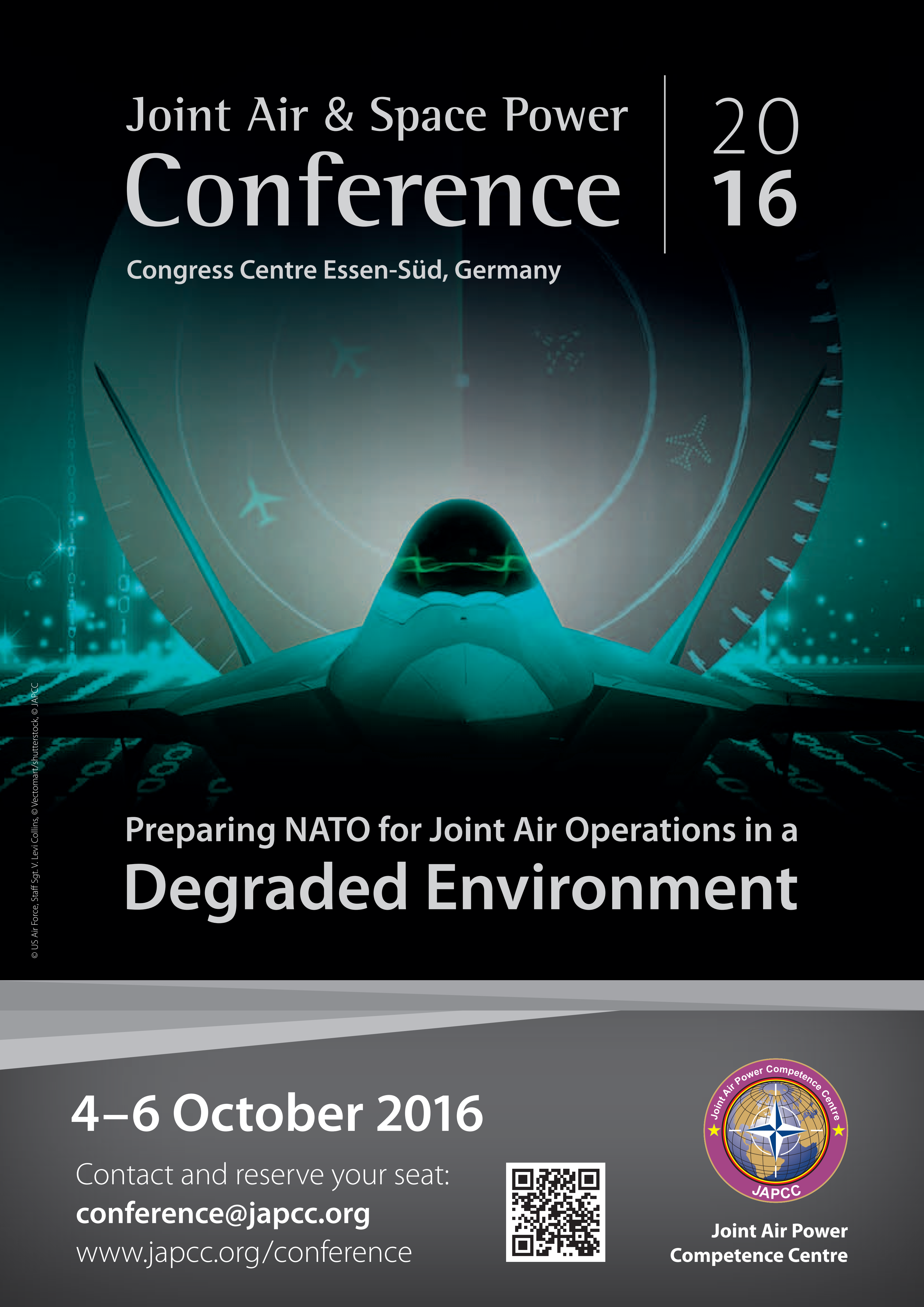

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Conference
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Preparing NATO for Joint Air Operations in a
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