
Joint Air Power Competence Centre
JAPCC
Transforming Joint Air Power
The Journal of the JAPCC
ANG
Edition 9

Verteidigung und Sicherheit

Diehl Defence steht für Dienstleistung, Innovation und Partnerschaft in Verteidigung und Innerer Sicherheit. Von A wie Aufklärung bis Z wie Zuverlässigkeit bieten wir Einsatzkräften die notwendige Ausrüstung und kompetente Unterstützung auf Missionen rund um den Globus. Für Flugkörper und Munition, Sensoren, Zünder, Instandsetzung, Kette und Schutz gibt es einen neuen Namen: Diehl Defence.

www.diehl-defence.de

DIEHL
Defence

Editorial

The Journal of the JAPCC welcomes unsolicited manuscripts of 1500 words in length. Please e-mail your manuscript as an electronic file in either MS Word or WordPerfect to: articles@japcc.de

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

Current and past JAPCC Journal issues can be downloaded from www.japcc.org

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

He who has not first laid his foundations may be able with great ability to lay them afterwards, but they will be laid with trouble to the architect and danger to the building.

It ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new. This coolness arises partly from fear of the opponents, who have the laws on their side, and partly from the incredulity of men, who do not readily believe in new things until they have had a long experience of them.

The one who adapts his policy to the times prospers, and likewise that the one whose policy clashes with the demands of the time does not.

Nicolo Machiavelli 1469–1527

I offer you 3 quotes in this editorial in an attempt to capture the impact of change, the need to be prepared for it and the inevitable difficulties of its implementation. Moreover, whilst these words were crafted half a millennium ago, they still encapsulate the essence of the issue.

They also nicely complement the JAPCC's working theme this year – NATO at 60: Future Challenges for Air and Space Power – which will also be the title of our Annual Conference in October. We intend to address such challenges in 4 areas: training and exercising; common air and space assets; assuring the air domain; and, separately, assuring our access to space. This Journal is geared to address the first two and Edition 10 the latter.

With that in mind, I am grateful to colleagues from the military, academia and industry, who have contributed to this edition, and hope you the reader will find articles that both challenge traditional thinking and confront us all to assure we are preparing for both current and future operations in an appropriate manner.

DCOM CC-Air Ramstein kicks the journal off by reminding us that opportunities to harness the collective power of our Air and Space assets are only limited by our imagination and energy. Other potential areas of common endeavour, from small satellites to air transport, are also placed in the spotlight. Elsewhere, we look at training and exercising from collective basic training opportunities through to emerging initiatives in the Live, Virtual and Constructive domains, which have the potential to change how we prepare from the unit/individual level to the highest reaches of command.

All in all, then, an extensive range of topics, which I hope will whet your appetite for our Annual Conference, details of which are also included herein.

Garfield Porter
Air Commodore, GBR AF
Assistant Director Transformation

Transforming Joint Air Power:
The Journal of the JAPCC

Director
Joint Air Power Competence Centre
Gen Roger A. Brady

Executive Director
Joint Air Power Competence Centre
Lt Gen Friedrich Wilhelm Ploeger

Editor
Air Cdre Garfield Porter

Deputy Editor
Maj Ron Peterson

Editorial Board
Col Roberto Sardo
Lt Col Mike Delorey
Lt Col Terje Fagerli
Lt Col Tom Single
Lt Col Denis Stengel
Maj Frank Weisskirchen
Maj Gert-Jan Wolkers
Maj David Heist
Sqn Ldr Bruce Hargrave
Lt (N) Rodolfo Calabró

Production Manager/
Promotion Manager
Mr. Simon Ingram

Sponsor Manager
Lt Col Lothar Pichler

Layout and Illustration
Mr. Sascha Kranefeld

Distribution
SMSgt Edgar Hersemeyer
SSgt Roshawn Burdett

The Journal of the JAPCC is the professional publication of NATO's Joint Air Power Competence Centre aiming to serve as a forum for the presentation and stimulation of innovative thinking on NATO Air Power related issues such as doctrine, strategy, force structure and readiness. The views and opinions expressed or implied in *The Journal of the JAPCC* are those of the authors and should not be construed as carrying the official sanction of NATO.

Transforming Joint Air Power
The Journal of the JAPCC

Transformation & Capabilities

Copyright: AVDD, Arief Rorimpandey

CONTENTS

View Points

Copyright: EADS

Copyright: Mark Postlethwaite, www.posart.com

Out of the Box

Copyright: USAF

Inside the JAPCC

Regulars

Copyright: USAF

M Denotes images digitally manipulated.

Leveraging NATO's Common Air Power

Air Marshal David Walker, CBE AFC RAF, Deputy Air Commander, CC-Air Ramstein

When considering the phrase 'NATO's common Air Power' you might well think of the NATO Airborne Early Warning & Control force at Geilenkirchen. Alternatively, you might consider the Strategic Airlift Capability for the C-17; a consortium of predominantly NATO nations, involved in a project closely tied to, if not wholly owned by NATO. If, however, you think in a slightly broader fashion, or perhaps ask the question 'What Air assets are common to NATO,' your thought process may lead you down a different path. If you were to overlay this question of commonality with one of requirement – particularly that of a shortfall against current operational requirement – you may come up with the Mi 8/17 'Hip' helicopter.

New Initiative

It is no secret that the coalition forces of ISAF have perennially suffered from a shortage of support helicopters; a problem that has been approached from many angles. The latest proposal to address this capability gap is that of the 'Hip' Helicopter Initiative. This initiative didn't actually spring from a commonality analysis, but like many a good idea, it has such simplicity and seems so obvious in so many ways that one is left wondering why no one thought of it before. In essence, the idea is to pool the capabilities of a number of the newer NATO nations. Whilst they may have smaller air forces, they operate a common type, but are unable to mount an enduring operational deployment on their own. Broadly speaking, one nation may be able to offer some platforms, another may have some crews, a third may offer some engineering capability and so on. Broader still, the deployment may just see a sharing of engineering facilities, tactical information and support aspects. Obviously, the greater the integration achievable, the greater the savings possible. Any such deployment would be underpinned by a commonality of aircraft and a commonality of desired end state – that of increased helicopter support to operations.

Right Platform?

Before considering this potential solution further, it would be appropriate to pause, undertake a sanity check, and ask ourselves

'The "Hip" is a capable and robust platform enjoying a great deal of commonality ...'

whether the 'Hip' is a realistic solution capable of producing a relevant contribution; or whether we are being swept along by the convenience and availability of that solution. The answer is, most emphatically, the former. The 'Hip' already serves with the Afghan National Army Air Corps (ANAAC); indeed, they now have one of the larger fleets in the world with circa 65 platforms. The aircraft in its original version (the MI-8) has a service ceiling of almost 15,000 ft; up-engined versions (such as the MI-17) see this increased further to nearly 20,000 ft. With the later MI-171 variant adding about 10% of extra power per engine this is definitely a platform well suited to the hot and high environs of Afghanistan. The aircraft's main selling point, however, is its simplicity. It was very much the work horse of the Warsaw Pact. An airborne Landrover of the battlefield built to take a fair degree of punishment and be readily and rapidly repaired should it suffer damage of any form. In sum, the 'Hip' is a capable and robust platform enjoying a great deal of commonality and is ideally suited to the Afghan theatre of operations.

Current State of Play

The initiative first blossomed in the latter half of 2008 following a series of visits to former Warsaw Pact States of Eastern Europe. These countries – now NATO members – were desperately keen to make an operational Air contribution to ISAF, but were limited in their capability to deploy or sustain any deployment. In visiting these nations, both their desire to contribute and their commonality of assets became evident – and thus the 'Hip' Helicopter Initiative was born. The simplicity and pragmatism – coupled with a growing belief in the achievability of the project – led to a remarkably rapid approval by the Executive Working Group at NATO HQ. The Initiative is currently under consideration by the North Atlantic Council. The Czech Republic has agreed to undertake

The 'Hip' initiative was born from former Warsaw Pact States' desire to contribute to ISAF.

the role of Lead Nation for the Task Force with the USA and UK looking to take on Mentoring roles.

Next Steps

So, where do we go from here? Well, as ever, there are plenty of obstacles if one wants to look for them. Will one country's engineers be allowed to work on another's aircraft? Or even, under the restrictions of current licensing agreements, will one country's spare part be allowed to be fitted to another's aircraft? For the obstructionalist, there are, as ever, a plethora of reasons to justify inactivity. On the other hand, one can take the 'glass half full' approach and say that whatever the potential problems with parts and engineering qualifications, it is fairly likely that two nations could share the same 'Hip' spanner, or equally the same operations facility or maintenance hangar. And this is the key; yes, there are problems that will need to be addressed. If, however, we can maintain momentum and deploy the first helicopters of the 'Hip' Helicopter Task Force (HTF) – under whatever auspices – then we will have taken the first steps toward realising the capability. With the project having already moved with unprecedented speed through the Executive Working Group and on to the North Atlantic Council, keeping the impetus is now paramount. Touting the deployment of the Czech Republic, planned for later this year, as Phase I of the 'Hip' HTF will be the next major milestone. This is not just an exercise in re-branding. The deployment will be undertaken with the help of Mentoring Nations, help that will ensure the deployment is sent forward with the right skill sets and knowledge to provide a sound basis for not only the Czech deployment, but also future deployments to come. Such a deployment will provide a real and tangible target for other nations to aim for, as well as establishing a usable and viable foothold for future expansion.

'... the initial aim will be to expand and bolster the deployed footprint as far as possible.'

The Future

The aims for the immediate future, therefore, are clear. In the longer term, there are obvious lines of development that can be followed both in terms, of this rotary initiative and in other spheres. In rotary terms, the initial aim will be to expand and bolster the deployed footprint as far as possible. As part of this process, there may well be an opportunity to 'reverse-engineer' a Community of Excellence, providing everything ranging from practical advice and lessons identified through to relevant hands-on pre-deployment training. Looking further ahead still, to a post-Afghanistan world, there may well be relevance for a NATO Helicopter Task Force as part of reaction forces such as the NATO Response Force. Extending the concept laterally, rather than temporally, one can see obvious potential synergies between the establishment of a 'Hip' task force to help meet the dearth of rotary lift and, say, an AN-26 task force to help address the shortfall in fixed wing lift availability.

'... the initiatives currently being developed for the "Hip" HTF may well prove to be a blueprint for the future, bringing together national capabilities to produce a collective effect greater than the sum of its parts.'

Conclusion

Coalition operations inevitably bring challenges in bringing together disparate forces, united by a common goal. Finding, and exploiting, other commonalities between partner nations may be a key tactic in leveraging common air power. If suitable momentum is maintained, the initiatives currently being developed for the 'Hip' HTF may well prove to be a blueprint for the future, bringing together national capabilities to produce a collective effect greater than the sum of its parts. ■

NATO's airborne warfare training provider

COBHAM

The most important thing we build is trust

Cobham provides a range of essential training for maritime, land and air forces around the world. Through innovative solutions developed in partnership with front-line operators, we play a key role in preparing agile, highly effective armed forces.

We offer flexibility and value; the UK Ministry of Defence ranked Cobham as its No.1 global supplier in 2008.

Our services include:

- Electronic attack - expert advice from countermeasures to multi-aircraft formations with embedded fast jet aggressors.
- Threat Simulation – a large range of threat platforms and weapon systems can be simulated through advanced EW pods.
- Air-Land Integration – providing battlefield intelligence for training purposes.

Cobham Aviation Services UK

Bournemouth International Airport
Christchurch
Dorset, BH23 6NE, England

T: +44 (0) 1202 409000

email: aviationservicesuk.marketing@cobham.com

www.cobham.com

Hitting Where it Hurts – Axiological Targeting

Dr. Anna Maria Brudenell, BA, Ph.D.

Does strategic attack work? How does it work? This article suggests a methodology for designing strategic attack. It is based on the simple idea that we should attack what the enemy leader values, and let him know what he has to do for the attacks to stop. By monitoring his behaviour, we can see if our attacks are having the desired effect. The more his behaviour changes, the more we are attacking what he values, and the more likely we will succeed in getting him to do what we want.

The process is called Axiological Targeting. Axiology is the combination of the Greek word *axios*, meaning 'worthy,' and *logos* meaning 'reason' or 'theory.' 'Axiology' is the study of values and validity.[1] The aim of axiological targeting is to focus on the overall enemy leader and engage, or threaten, what he or she most values.

In order to be effective at the strategic level, we first need to determine the enemy's Centre of Gravity (CoG). Secondly, we continue the CoG analysis[2] to discover the enemy's vulnerabilities; this allows us to ascertain what the enemy leader values most. Finally, we complete an attack algorithm, which outlines 'what to target,' 'how to target' and 'how to measure success.' What is described below is a methodology for targeting the enemy leadership. It is generic, and should be applied sensibly to each situation.

The aim of all military action should be to manipulate the enemy's will. We need to coerce the enemy to do something in accordance with our strategic objectives. That is: we want to change the enemy's behaviour. Colonel John Warden believed that the best target was the mind of the enemy leadership. Warden's theory of five concentric rings favours attacking the enemy's CoG, via 'that point where the enemy is most vulnerable and the point where an attack will have the best chance of being *decisive*."[3]

In order to achieve strategic effectiveness, we need to understand what the enemy's grand strategic CoG is, and how that can best be attacked. Dr. Joe Strange devised a method for determining strategic, operational and tactical CoGs.[4] According to Strange, the CoG has Critical Capabilities that enable it to function effectively. For instance, during the Kosovo conflict, NATO believed that President Milošević's retention of the Presidency of the Federal Republic of Yugoslavia was the grand strategic CoG.[5] Hence, the Critical Capability was his dictatorship. Critical Capabilities have essential Critical Requirements; in this case, things that keep the leader in power, such as Milošević's control over the military, the media, and the continuing support of his cronies. Critical Vulnerabilities are those Critical Requirements vulnerable to neutralisation, which would produce results disproportional to the resources applied to them. In the Kosovo conflict, they might have been the continued loyalty of Milošević's cronies, senior military leaders and the media, or Milošević's control over the organs of power. If NATO had made Milošević's cronies stop supporting him, or if NATO had reduced Milošević's control over the armed forces, the media or the black market, he may well have believed he would lose power. He would then have negotiated for peace. Consequently, CoG analysis suggests not only that the target should be Milošević, but also that the key vulnerability was his retention of power.

The concept of axiological targeting needs a broad model of human motivation, which includes most of the factors that influence motivation. Abraham Maslow's 'Hierarchy of Needs' is such a model. It has limitations, but is suitably broad.[6] Maslow outlined five major needs for human satisfaction: physiological, safety and security,

Milošević's retention of the Presidency was the grand strategic CoG.

love and belonging, esteem and status, and self-actualisation (self-fulfilment). A strict application of Maslow's model would insist that the lowest unfulfilled need would be predominant; however, here, all categories are treated as being equally important.

Maslow's areas of motivation can be considered as: security, sustenance, esteem and self-fulfilment. Furthermore, we can apply a targeting template to his 'Hierarchy of Needs'[7] in *Figure 1* below. For example, under 'belonging and social activity,' one of the entities to consider would be the loyalty of cronies. Under 'self-fulfilment' there might be bank accounts.

Because it is not possible to bomb a category, we should consider real entities (things) rather than ideas or concepts. What real entities does the enemy leader value? Three questions need to be considered: what to target, that is, which entities; how to attack those targets; and how to measure success against those targets? Psychologists, sociologists, anthropologists, and the intelligence staff should observe and analyse the behaviour of the enemy leader, thus providing a broad base to detect whether or not the leader's behaviour changes. In Operation ALLIED FORCE, it was presumed that the strategic CoG was Milošević's power-base and his retention of the Presidency. If psychological analyses had been carried out *before* ALLIED FORCE was launched, it would have been possible to detect when Milošević was beginning to lose control.

Figure 1: Source: Adapted from Lt. Colonel Peter W.W. Wijninga and Richard Szafranski, 'Beyond Utility Targeting: Toward Axiological Air Operations,' Aerospace Power Journal, Winter 2000

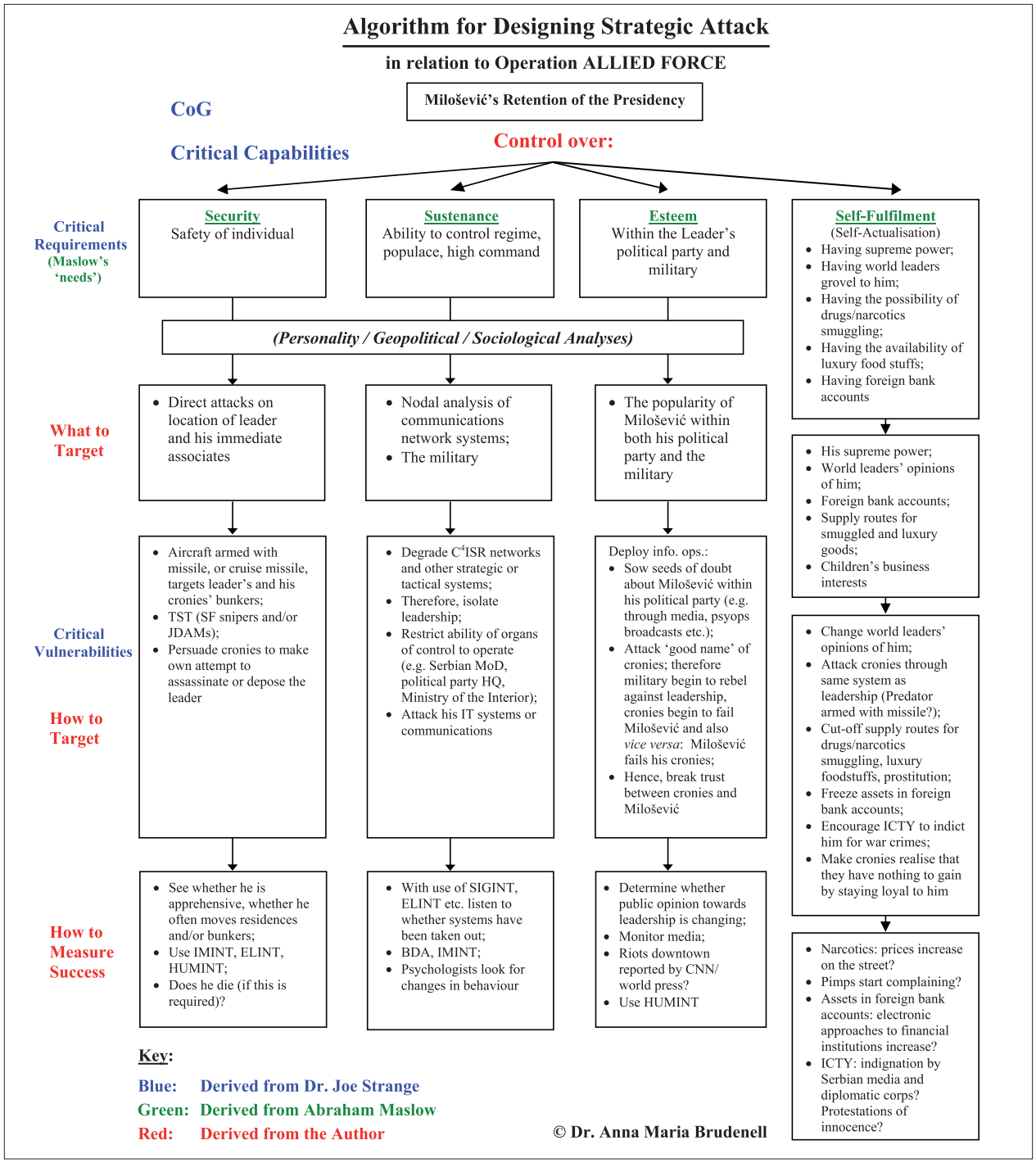


Figure 2

Axiological targeting uses a three-step process to move from categories to real entities, which can be attacked. The steps are: personality, geopolitical and sociological analyses.

Personality analysis looks at the personality of the strategic leader. Dictators may be strongly authoritarian. They are motivated by a desire to control, and tend to be bullies. Conversely, bullies are particularly vulnerable to being bullied themselves. Therefore, authoritarian leaders should be vulnerable to coercive force. For dictators, objectives under 'Esteem' and 'Self-Actualisation' might include the power structures that allow them to bully others; hence, removing that ability may be a highly effective form of attack.

Geopolitical analysis examines the government and people of a country. It considers which aspects support the leader's behaviour. Such aspects would not just be objects like the economy, but also important aspects of those objects, such as stable food prices. Because the enemy may be a leader of a sovereign state, it would be naïve not to consider his behaviour as leader of that state. Hence, the way that he interacts with his Ministers should be considered. Which organs of power is his position based on: is

it the Politburo; is it the Security Police; is it control of the media; or is it all of these?

Sociological analysis observes relationships. It considers how individuals are organised and how they interact with each other. For example, if the army is identified as being a critical target, it would seem obvious to target the army. However, what should be attacked is the relationship *between* the army and the leader; for example, its loyalty.

An initial personality analysis should be the first step, since it suggests what factors motivate the strategic leader. However, all three analyses should be conducted iteratively: they are inter-related, and objectives suggested by one analysis may have negative impacts on another. The analyses should also indicate what is *most likely* to influence the leader's behaviour. The resulting targets should be highly specific to the particular situation. For example, in ALLIED FORCE, the outcome of the analyses should have indicated precisely which factories to attack, and why – because of those factories' connections to Milošević's cronies.

Measuring Strategic Effectiveness

A simple calculation of sorties launched and weapons delivered does not equate to strategic success. We have recently seen many examples of tactical activity *not* leading to strategic achievement. Every attack needs to answer such questions as 'did hitting the intended target achieve the desired effect?' If so, 'did the desired effects meet the stated objective?'[8] For a particular scenario an algorithm would be produced, indicating: 'what to target,' 'how to target' those objects, and 'how to measure success' against those targets.

Once targets have been identified, it is fairly easy to decide *how* to attack them. *Figure 2,* opposite page, is an example of what might be produced. Strange's CoG analysis forms the basis for the Critical Capabilities, Requirements and Vulnerabilities. Maslow's 'Hierarchy of Needs' are discernible as the Critical Requirements. They relate to the enemy leader's need for control over the trappings of power. Warden, Strange, Maslow and the three-step analyses enable the four boxes of 'what to target' to be completed. The Critical Vulnerabilities indicate *how* those targets might be attacked.

How to measure whether we have achieved the desired effect appears in the bottom row. It would be reasonably straight forward to measure success, since in most cases, a real, physical object would have been identified under 'what to target.' For example, within the Esteem column in *Figure 2*, in the line 'what to target' there is 'the popularity of the leader within both his political party and the military.' In the line 'how to target' there is 'sow seeds of doubt about the leader within his political party.' This might be considered through diplomatic contacts, within the foreign media, or PSYOPS broadcasts. In the line 'how to measure,' there is 'determine whether public opinion towards the leader is changing.' For instance, we would look for signs that the leader's esteem is being undermined, possibly through parliamentary reports, domestic media, electronic eavesdropping and/or HUMINT; or we might observe changes in the leader's behaviour.

Consequently, it can be seen that measuring success should be relatively simple. Under 'what to target,' behaviour or a tangible item would be listed and it would be reasonably easy to observe whether changes to those items or behaviour are occurring. Normally, these would be called measures of performance. However, since they are obviously linked to the behaviour of the strategic leadership, what is written in the bottom row is a reasonable indicator of overall effectiveness. If we attack what the enemy leader values and his behaviour is seen to change, we are clearly hitting him where it hurts.

Conclusion

This article has proposed a methodology for designing strategic attack, incorporating a mechanism for measuring strategic effectiveness. It is based on the simple idea of attacking what the enemy leader values. This includes both kinetic and non-kinetic attack and often, the best way of mounting kinetic attacks on what the enemy leader values will be via air power. The methodology includes psychological, sociological and geopolitical analyses, which should be conducted iteratively. It develops a process for considering which entities to attack and why, how best to attack them, and how to measure success.

Such a methodology offers the prospect of better-focussed strategic attack. It is neither a 'wonder weapon' nor a 'silver bullet.' However, if conducted rigorously, it should focus intellectual effort and shape the application of the military and other instruments of state power. ■

1. Kan, Dr. Paul Rexton. 'What Should We Bomb?: Axiological Targeting and the Abiding Limits of Airpower Theory.' Air & Space Power Journal, Spring 2004.
2. Strange, Dr. Joe. Perspectives on Warfighting, Centers of Gravity & Critical Vulnerabilities. Marine Corps War College, Quantico, 1996.
3. Warden, Colonel John A.. USAF, The Air Campaign: Planning for Combat. Pergamon-Brassey's, Washington, 1989, p. 9.
4. Strange, op. cit.
5. Shea, Dr. Jamie, NATO Spokesman, personal communication, 19th November 2003.
6. Carr, Professor Karen, Professor of Human Systems, Cranfield University, personal communication, 20th December 2007.
7. The theory discussed here is based on that outlined by Lt. Colonel Peter W.W. Wijninga and Richard Szafranski. 'Beyond Utility Targeting: Toward Axiological Air Operations.' Aerospace Power Journal, Winter 2000.
8. Meilinger, Colonel Dr. Phillip S., personal communication, July 2004.

The Single European Sky – An Opportunity or Risk to Military Aviation Training?

Colonel Mihai Stir, ROU AF, MOD J3

SESAR – Single European Sky ATM Research – is a major modernisation programme for European Air Traffic Management (ATM). Regulations establishing the Single European Sky (SES) concept first became part of European Community (EC) Law in 2004 and, therefore, directly affect all EC member countries and, indirectly, all those who use their airspace. SES is not some grand idea that will conveniently go away. The programme will represent an eventual investment of some €34 billion; moreover, a key early conclusion of the definition phase of the project was 'Business as usual is not an option.' The military aviator cannot ignore the implications of SES – they will directly affect the way we do business – but, as with all evolutionary change, there will be both risks and opportunities. By increasing our awareness of the change implications now we, as military aviators, can work to ensure that the opportunities outweigh the risks.

SES Objectives

- To restructure European airspace in terms of air traffic flows, rather than according to national borders
- To create additional capacity
- To increase the overall efficiency of the ATM system

Military Aviation plays a vital role in security and defence and there is a fundamental requirement for nations to be able to train and operate their military forces. Modern aircraft and weapons require large volumes of training airspace to fully exploit their capabilities and airspace utilisation will need to be optimised to satisfy both military and civil needs. This can only be achieved with a new flexible approach to airspace design and airspace management. In turn, this requires planners to be aware of the operational needs of *all* airspace users.

The current airspace structure no longer satisfies all the requirements of civil and military users. Predictions of significant increases in civil air traffic, as well as environmental pressures, mean that future ATM capability can only be maintained if there is a fundamental rethink of how European airspace is used. Existing technology (e.g. mode S and differential satellite navigation systems), and technologies currently being developed (e.g. net-centric system

wide information management, or System Wide Information Management [SWIM]), can be harnessed so that airspace is used in an adaptive and, ultimately, smarter way.

However, this does not come without a cost – remember the large price ticket mentioned earlier (and that predicted costs have a habit of growing rapidly). Civil airspace users have an obvious mechanism for cost recovery – increased productivity means more customers and, therefore, more revenue. The same cannot be said of the military. Defence budgets are not limitless and savings measures are a constant pressure. The cost benefit of specifying ATM technology upgrades for future air systems will be extremely difficult to justify, but will be nothing compared to justifying the same for legacy military aircraft fleets that may only have a few years until their planned out of service dates.

However, close civil/military cooperation has been maintained from the earliest days of SESAR. Defence and security needs have been acknowledged and the priority will always be to dedicate 'sufficient airspace' for military purposes. What does this mean? *Sufficient airspace* will be based upon the following principles defined in the EUROCONTROL Airspace Strategy for the European Civil Aviation Conference (ECAC):[1]

- Freedom to operate at any time in all areas of ECAC airspace
- Special handling for priority flights, time-critical missions (e.g. air policing missions), and military aircraft whose equipment does not fully meet civil standards
- The ability to conduct uncontrolled VFR flights, including those in managed airspace, will be retained
- Temporary airspace reservations for low-level flying, in-flight refuelling, air combat training, high-energy flying and other activities incompatible with the normal application of the rules of the air will be as close as practicable to the respective airfield
- Airspace restrictions for activities not related to aviation, e.g. the protection of areas of national interest, air-to-ground firing ranges, air-to-air gunfire and missile firing areas, etc
- A more dynamic airspace allocation system with enhanced flexible use of airspace application

In other words, judicious use of these principles should ensure that airspace will be provided for military aviation to meet defence and security needs and maintain the appropriate standards for training effectiveness and flight safety.

Military Airspace Requirements in SES for Training

The airspace requirement for military training varies from the minimal to the very large. Additionally, there are different requirements regarding scheduling and availability as well as permeability for other traffic. The daily need for airspace is determined by a number of factors such as available equipment, available personnel and meteorological conditions. Sufficient airspace must, therefore, be available for training when conditions are favourable, and flexible use of this airspace would mean that, on those occasions when it is not being used by the military, it should be available to civilian air traffic. The location of airspace in relation to the intended users is also of vital importance, not only with regard to cost effectiveness but also the time needed for transit to remote areas. If too much time is used for transit, the time available for training will be inadequate – resulting in mission ineffectiveness, which in turn may require that mission to be re-flown. That said, the military's approach to airspace utilisation must also be flexible. International Civil Aviation Organisation rules, standards and recommendations should be followed, as long as substantial military requirements are not infringed. One oft-quoted phrase in civil/military ATM cooperation is 'As civilian as possible, as military as necessary.'

Just as in civil aviation, flight safety is paramount for all military operations. Air forces must 'train as they would fight,' and military VFR flights provide them with the necessary tactical freedom of operation for the development of collective war-fighting capabilities through realistic day-to-day

training and specific exercises. In missions where aircrew workload does not allow for sufficient attention to other traffic or in which aerial manoeuvres are not predictable for other traffic, adequate separation must be ensured. Because of this, the use of segregated airspace will still sometimes be required.

The high complexity of military missions and their wide variety means that quantifying military VFR activities for the entire ECAC region remains impracticable, although it is certainly desirable. On the other hand, the widespread use of segregated airspace just to accommodate VFR flights would seem unnecessarily wasteful of a precious resource. Set against this, for both training effectiveness and flight safety, the airspace structure and the regulations that govern it must be kept as simple as possible.

Recommendations to Enhance the Utilization of Airspace

To enhance the utilisation of airspace, Eurocontrol's Civil/Military Interface Standing Committee made the following recommendations in 2003:[2]

- Collaborative planning must be improved on the strategic level to increase the opportunities for airspace sharing, and to explore new methods in the management of airspace in order to increase efficiency and thus capacity.

- Air Navigation Service Providers must increase their efforts to make maximum joint use of finite airspace resources through appropriate civil/military coordination based on the principle that any necessary segregation of airspace is derived from real usage within a specified time period.

- New simulation systems have to be developed that reflect characteristic military airspace requirements.

- The use of common data formats between ATC and air defence units must be exploited.

The full implementation and further enhancement of the 'flexible use of airspace' concept is needed to optimise civil and military airspace usage. Moreover, this concept must ensure that military needs get priority when dictated by essential national security and defence interests.

The Real Challenge in Future ATM

The real challenge in future ATM is to propose procedures to integrate the operation of military aircraft in an oversaturated airspace. The ATM target in Europe is for a three-fold increase in capacity and the immediate task is to assess the feasibility of new operational solutions that do not jeopardise performance of the future ATM system or restrict the operational freedom of military aviation.

The key features of the SESAR's 2020 ATM Target Concept[3] are:

Business Trajectory – a 4D (position and time) description of the airspace users' preferred routing. Access to accurately predicted 4D information for each airspace user will be via a net-centric operation based on new data communications systems and increased reliance on airborne and ground-based automated support tools.

Trajectory Management – the focus will move from airspace management to trajectory management. Airspace user preferred routing will see the end of pre-defined routes and airways – other than in some terminal areas and below a designated altitude.

Collaborative Planning continuously reflected in the Network Operations Plan – layered planning undertaken at local, sub-regional and European level will balance capacity and demand, taking constraints into account. Efficient queue management will allow optimized access to constrained resources (mainly airports).

Integrated Airport Operations contributing to capacity gains – airports will become an integral part of the ATM system due to the extension of trajectory management. Increased throughput and reduced environmental impact (e.g. through turnaround management, reduction of the impact of low visibility conditions, etc.) is envisaged.

New separation modes – will minimise potential conflicts and controller interventions.

SWIM – by integrating all ATM related data, collaborative decision making processes will exploit the power of shared information.

Humans will be central in the future European ATM system as managers and decision makers – but they will be supported by an advanced level of automation.

Implications for Military Air

SESAR aims to link all air assets together via common data-exchange networks to form a moving, real-time Common Operational Picture of all assets at all times. Such a vast capability will enable civil aviation authorities to shorten en-route separation distances between aircraft, boosting efficiency by squeezing more aircraft into the same space. SESAR's proponents argue it will also benefit Europe's Military Aviation by allowing them to use airspace more flexibly without disrupting commercial air traffic.

'The real challenge in future ATM is to propose procedures to integrate the operation of military aircraft in an oversaturated airspace.'

SESAR's common digital air picture should also support the integration of military unmanned air systems into controlled airspace, allowing them to move autonomously across Europe's airspace en route to distant theatres. But will this somewhat utopian view become reality?

> 'Will the military be able to afford to buy, or justify buying, the technology that enables them to reap the benefits?'

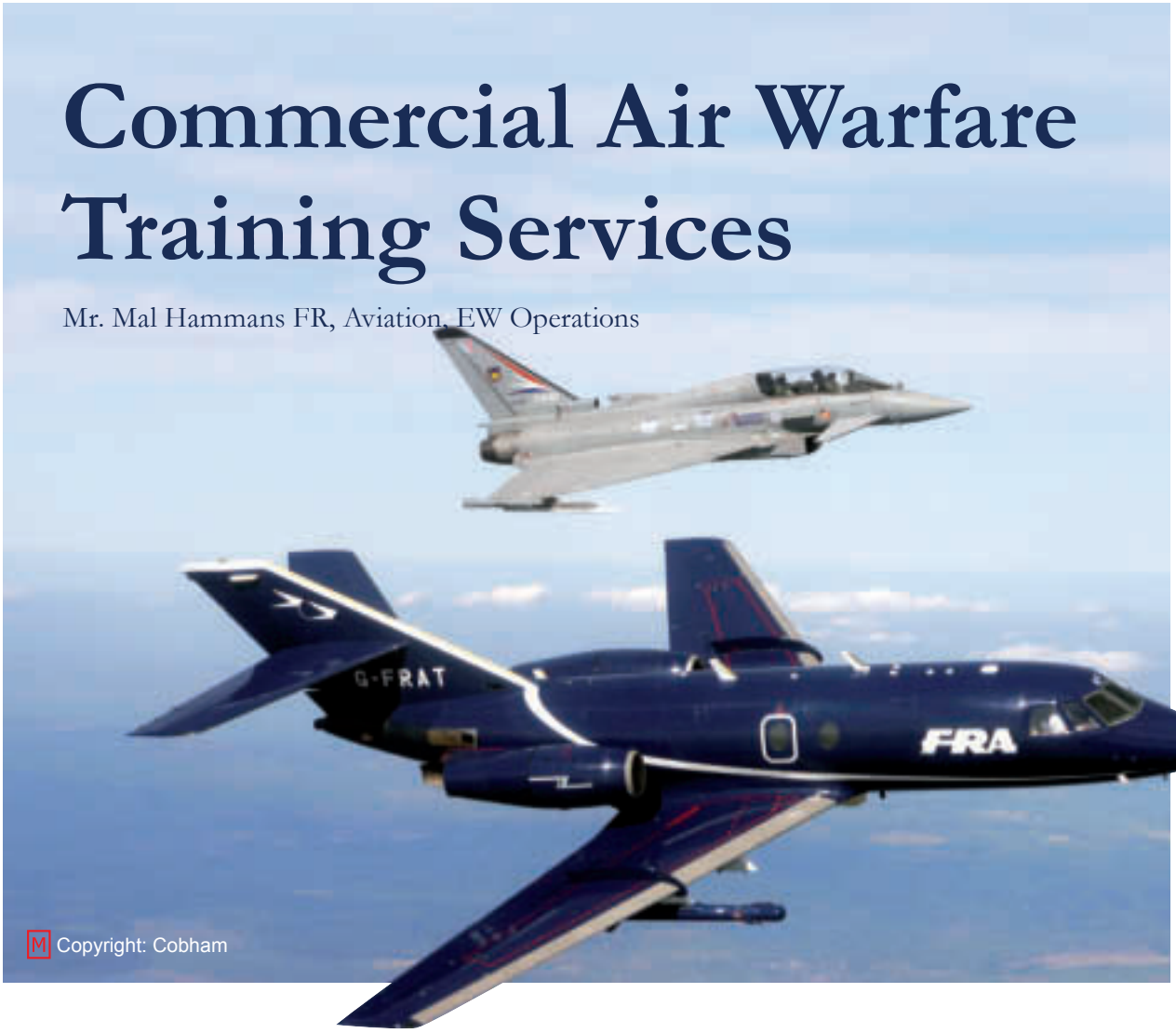
Risks to military aviation have been alluded to earlier in this article. Will the military be able to afford to buy, or justify buying, the technology that enables them to reap the benefits? Guarantees of access to airspace in times of crisis are not the same as the right to fly technology non-compliant aircraft through European airspace on their way to operations elsewhere, and scenarios where legacy military aircraft have to file for oceanic routes (with significant time and fuel penalties) to avoid European functional airspace blocks are not hard to imagine.

On the opportunity side, the net-centric SWIM envisaged for ATM has similarities to aspects of NATO's Network Enabled Capability (NNEC) and there may be benefits and synergies for the development of both systems where, for instance, the potential 'bugs' in the military system have already been addressed through the experience gained on the civil side. This might even represent a potential cost offset mechanism for the military. Although it is unlikely to show up as a discount in any future invoice, it may serve to 'de-risk' parts of a future military system. Finally, SESAR is not yet a 'done deal,' but it has the backing of industry and the European Commission. Currently, it's the only 'deal on the table' to solve Europe's increasingly congested skies. Operational airspace managers must continue to work together to ensure full cooperation between all stakeholders – both civilian and military. ■

1. EUROCONTROL, *EUROCONTROL Airspace Strategy for the ECAC States*, ASM.ET1.ST03.4000-EAS-01-00, Edition 1.0, January 2001, page 10.
2. EUROCONTROL, Civil/Military Interface Standing Committee, *Determining Future Military Airspace Requirements in Europe*, Annex B to C/CMIC's Report to PC/18, Final Version, April 2003, page 21.
3. SESAR Consortium, SESAR Definition Phase – Deliverable 3, *The ATM Target Concept – D3*, DLM-0612-001-02-00a, September 2007, pages 8–9.

Commercial Air Warfare Training Services

Mr. Mal Hammans FR, Aviation, EW Operations



Training support for Armed Forces around the world has increasingly been contracted out to private business. In the field of Air Warfare Training, a variety of solutions exist, ranging from contracted Aggressors using Gen II fighters (such as Skyhawks, Kfirs and Drakens), through to a medium altitude, medium speed service that delivers a variety of training 'effects.' The aim of this article is to outline the role, equipment, capability and essential training services provided by civilian aircraft in modern Warfare Training thus releasing valuable military assets to tasks of higher operational importance. The subject matter covered will include the types of aircraft employed, the equipment needed to conduct Target Tow and Electronic Warfare missions as well as the latest and most relevant provision of Full Motion Video (FMV) feeds to the ground, replicating that of modern unmanned aerial vehicles.

In the category of medium speed Warfare Training, the platform tends to be a business jet (usually either a Lear 35 or a Falcon 20). By comparison, the Lear tends to be fitted with 2 pylons, role inverters and a range of internal equipment, while the Falcon, which is larger and faster, has 4 pylons and an APU for airborne use allowing continuous use of its systems.

Role

Cobham Aviation Services (Cobham) is a major provider of Air Warfare Training, through its widely recognised trading entity FR Aviation Ltd. For over 20 years, it has provided training services to the UK's Navy and Air Force and, from 2008, it has been on contract to provide a service to NATO. This service allows NATO forces to conduct training with minimum use of military assets.

The company also provides a service to other nations' armed forces, either via a government to government initiative, or as a commercial contract. Through these arrangements, Cobham receives tasks from NATO nations as well as from the Middle and Far East. Traditionally, 2 activities have been provided: Target Towing and Electronic Warfare training, which are delivered using a fleet of 15 Dassault Falcon 20 aircraft.

Many navies have a requirement to test and evaluate their weapon systems; aircraft towing targets for warships is one method that is widely employed. While some target towing requirements are relatively straight forward (a banner or sleeve with miss distance indicator or real time scoring), the sophistication of modern weapon systems demands technically complex targets, towed within exacting parameters, and possibly including elements of Electronic Warfare training. The proliferation of weapons systems that take advantage of different elements of the Electro-Magnetic Spectrum demand a range of targets that are augmented to provide the necessary tracking data for weapon evaluation.

The main areas of augmentation include:

- Visual – enhanced by use of smoke, flares or bright lights
- Infra Red – enhanced by use of engine plumes, IR flares or hot plates
- Radar – enhanced Radar Cross Section by frequency dependent Luneberg lens

Height keeping targets are the most sophisticated, can sea-skim to replicate Anti-Ship Missiles and have full telemetry for laptop control and recording.

Equipment

Electronic Warfare training services include the Radio Frequency (RF) and the Infra-Red (IR) domains, but the primary focus is on the RF domain, since few usable training systems exist in the IR spectrum. The RF domain can be further sub-divided into radar jamming, communications jamming, threat simulation and threat emulation.

Radar jamming includes active jamming, as well as passive radar jamming through dispensing chaff. The radar jammers used in the commercial world are mostly of the ALQ-167V standard (NATO nomenclature for this type of pod), and are widely available. These pods can be carried by both military and civilian aircraft, and offer most electronic attack countermeasures. However, they are specifically designed to be narrowband instead of broadband so that they can be targeted against specific radars, or categories of radar. The pods have high power amplifiers and narrow beam widths but high gain antennas (whose polarity is matched against the victim radars to minimise any power loss), which results in the pods producing higher power levels than military self-protection systems. Such power levels are required to provide a stand-off jamming capability.

For many years, the provision of radar noise jamming met most training requirements, although in some bands, deception jamming was also used. A combination of radar noise and deception jamming (which would often be employed simultaneously) produces 3 types of effect; multiple false targets, break lock and aircraft masking. The introduction of Digital RF Memory (DRFM) techniques allows the jammer to take advantage of processing gain within the victim's radar and so requires much lower power levels. This has enormous effect against the most advanced radars, which would otherwise render non DRFM jamming ineffective. A single DRFM pod can produce thousands of false targets, creating different effects. These effects range from a single false target offset from the jammer aircraft to thousands of false targets that could overload the radar's processor and impose severe limitations on its performance.

Communications jamming systems normally cover both VHF and UHF, although, in training, jamming is targeted against military UHF communications. Varying power levels are available, but a minimum level of 700–800 Watts is required to deny effective communications between ships and aircraft. The systems that are available commercially are primarily aimed at voice communications, but have a capability in denying early generation data communications. Their effectiveness can often be overcome with frequency hopping radios. Many military systems have a greater capability, but the limitations imposed by the commercial communications jammers are normally acceptable for training as the process is designed to train front line personnel in procedures rather than technology.

Threat simulation involves using pods to transmit specific radar parameters so that Electronic Sensor Measures (ESM) and Radar Warning Receiver (RWR) systems identify them as particular threats, and therefore require tactics specific to that threat. Threat simulation pods fall into 2 categories:

- Magnetron-based pods that offer high power, but with duty cycle limitations (very limited in max PRF, single frequency and narrow pulse widths). The high power also means long-range detection.
- Travelling Wave Tube (TWT) based pods that offer high PRFs (up to 200 kHz), wide pulse widths, frequency agility, and Compressed High Intensity Radar Pulse, but are lower power and so offer much shorter range detection.

End users, however, want the best of both worlds and so we have developed a small number of pods, which use a larger diameter

Cobham Falcon 20 aircraft

shell (not ALQ-167(V)), TWT amplifier and higher gain antenna to almost match the performance of the magnetron pods, but with the enhanced capability of the TWT.

Capability

Threat emulation takes threat simulation one stage further, whereby specific tactics that match the radar emissions are used to emulate a nominated threat profile for training purposes. From the perspective of the fighter, this may require a 'spike' (radar lock-on before missile firing) at a particular range to change the fighter's actions and, from the maritime perspective, this may require a particular geometric approach to the ship(s), including flying specific heights and speeds, and with radar 'switch on' at nominated ranges/times.

Another aspect of Air Warfare Training that has grown in importance over the last few years is that involved in developing Air-Land Integration capabilities. The training of Forward Air Controllers/Joint Terminal Attack Controllers and the familiarisation of ground forces in the use of real-time ISTAR information down-linked from air platforms has become essential with the proliferation of UAV and the increased availability of targeting pods for non-traditional ISR. The employment of advanced targeting pods on commercial platforms offers the means to provide training when such front-line assets are unavailable due to operational commitments. In addition, EO/IR camera turrets fitted to commercial aircraft provide an essential ISTAR training role, particularly for replicating friendly UAVs. There is a range of aircraft, which can be used in the role of providing full motion video via data-link to the ground. However, medium speed business jets are not particularly suited to this role, leading to the use of twin-propeller aircraft, which are much more appropriate as the platform and can be equipped with a highly capable day/night turret designed to meet the task. This type of training is particularly relevant to today's theatres of operation, albeit their full capability and utility has yet to be exploited.

Training Services

While Cobham provides all the capabilities discussed above at an advanced level, we believe the 'service' provided demands much more than simply switching pods on and off, or towing a target around the sky. The service should also enable the customer to identify the strengths and weaknesses of their own doctrine, Tactics Techniques and Procedures (TTPs) and equipment (Radar, Radar Warning Receiver, etc), while at the same time measuring equipment serviceability and performance. It should also allows the customer to develop and rehearse their operational TTPs whilst training in a live and dynamic EW environment. Advanced training scenarios will enable the tactics to be validated using a scenario and specific threat based environment, provided by commercial training aircraft.

In order to provide such services, it is essential to employ the right quality people. A mix of ex-military and civilian personnel is needed to deliver a high quality service; moreover, our view is that if the service provider is to stay 'in tune' with a military customer whose capabilities, thinking and tactics are constantly evolving, it is essential to have a high percentage of former Qualified Weapons Instructors, Fighter Weapons Instructors, EW Instructors and Helicopter Weapons Instructors. Not only can these people produce high quality missions and meet the exacting professional standards of the Armed Forces, but they also have the deep understanding of

the military culture and ethos. As in any military organisation – our most important asset is our people who, through their knowledge of current tactics and procedures, together with a thorough understanding of modern weapons and their characteristics, allow us to add real value by creating core training techniques that can be adapted to meet the precise requirements of each customer.

In the UK, this type of service has changed dramatically over the last 5 years and the missions flown now fall more into the category of 'tactical' (rather than procedural) training. These missions generate training scenarios, which are relevant to the UK Forces' potential live operations. NATO conducts a large number of exercises each year and Cobham provides assets that can and do conduct EW, Target Tow, re-role to operate a targeting pod and also provide a data-linked picture from an FMV equipped platform. This breadth of capability is unequalled in Europe and, most importantly, offers great growth potential as NATO seeks to match its on-going operational posture with its concomitant Joint training needs.

ACT's Snow Leopard Programme

'Train as you will fight'

Lieutenant Colonel Michael Kentsch, DEU Army, HQ SACT

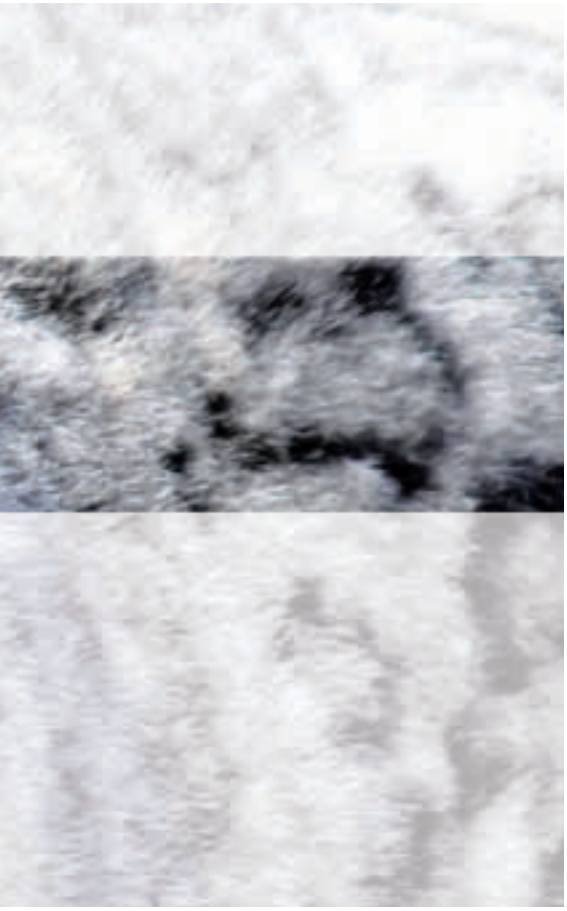
In its effort to transform Alliance capabilities, NATO is positioning itself to take advantage of emerging technologies and to improve operational and tactical effectiveness through improved future training methods. NATO's education, training, exercise and evaluation review has identified training and education challenges for NATO's command structure, Nations and Partners. NATO's new Peacetime Establishment, the reorganization of the NATO Response Force (NRF) and Allied Command Transformation's (ACT) Multiple Futures Project will have an impact on future training requirements. NATO member Nations are moving ahead with ambitious distributed simulation projects providing air, ground and maritime component training. A key element will be the interaction between NATO command centres and national assets within a common NATO training framework that reflects future Alliance missions. The lessons learned from past and current NATO operations, the emergent asymmetrical threats to the Alliance and foreseeable future NATO operations demand higher interoperability between the NATO Command Structure (NCS) and the NATO Force Structure (NFS) from the operational to tactical level. A shared situational awareness, near-real time data dissemination, a common operational picture and common understanding for both NCS and national units are widely perceived as high priorities, especially in an NRF and Combined Joint Task Force (CJTF) context.

> 'Snow Leopard will deliver to NATO and Nations the capability by which NATO can conduct exercises ...'

There is a stringent need for a common training environment where NCS, NFS and NATO Nations and Partners will be able to 'Train as you will fight.' Future developments could involve assets, including civil organisations, in the framework of an Effects Based Approach to Operations (EBAO).

ACT, as the most appropriate organisation in NATO for the development and implementation of simulated training, initiated the Snow Leopard project.

Snow Leopard will deliver to NATO and Nations the capability by which NATO can conduct exercises using constructive simulations to provide Computer Generated Forces (CGF). The CGFs can interact with human-in-the-loop virtual simulators under NATO and national Command and Control (C2) systems, allowing actors to train under near real mission conditions. In the future,



to complete the training picture, connections to troops in the field will be part of the program.

It is worth defining a few terms, and their use in the context of Snow Leopard:

Live *involves real people operating real systems. Systems include C2 systems used by the training audience.*

Virtual *involves real people operating simulated systems. It injects human-in-the-loop by including simulators and command centres where planning, decision-making and communication skills are tested.*

Constructive *involves simulated people operating simulated systems. Real people provide input, but are not involved in determining outcomes.*

Snow Leopard will deliver a capability where participating staff in their computer-aided exercises will be confronted with the war-fighter's reaction. The staff immediately receives the results of their actions and will then have to base their courses of action on human behaviour in a multinational, joint environment. An increase in reality, throughout all levels of command, will lead to an improvement in the decision-making process. The war-fighter will be able to see the impact of his actions. Today's technology offers real-world scenarios without environmental restrictions.

Future Training

The objective of Snow Leopard is to create a networked education and training capability, which will integrate and enhance existing national capabilities. It focuses on the education and training of NATO and Nations' headquarters staffs and forces preparing to execute NRF, CJTF, and Deployable Joint Staff Element (DJSE) missions.

'NATO Snow Leopard ... allow(s) multi-national staffs and forces to exercise together and achieve better interoperability of NATO forces.'

Snow Leopard will boost standardisation and interoperability, at the same time reducing duplication of effort and enhancing the efficient use of resources. A number of parallel initiatives have converged within the NATO Modelling & Simulation (M&S) community. Most of these initiatives will support the Snow Leopard objective defined above. The four projects under Snow Leopard are NATO Training Federation (NTF), NATO Live, Virtual and Constructive (NLVC), Advanced Distributed Learning (ADL), and Shared Scenarios.

NTF

The NTF project is an initiative especially related to operational-level training and associated exercises within a distributed simulation environment. NTF will provide a simulation toolbox with which to conduct multi-level, multi-resolution, and high-quality distributed Computer Assisted Exercises in support of war-fighter training objectives. These objectives will be consistent with the Comprehensive Approach and allow for the inclusion of Partners, Coalition Allies, Non-Governmental Organisations and International Organisations. The hub of NTF is at the NATO Joint Warfare Centre (JWC). While designed to support the STEADFAST series of exercises, this toolbox should have utility across the spectrum of NATO training, particularly in the era of stabilisation operations; such as International Security Assistance Force and Kosovo Forces. Nations will be able to join the federation via a set of NATO simulation standards.

NLVC

The NLVC project will deliver a distributed (over a network) training capability to the Alliance and its Partners. This will be able to support LVC simulation training from the Component Command (CC) level down to the tactical level and across the full spectrum of operations, leveraging national expertise and capabilities. The NATO Joint Forces Training Centre at Bydgoszcz, Poland, as the future Mission Training Centre (MTC) (Figure 1), will provide

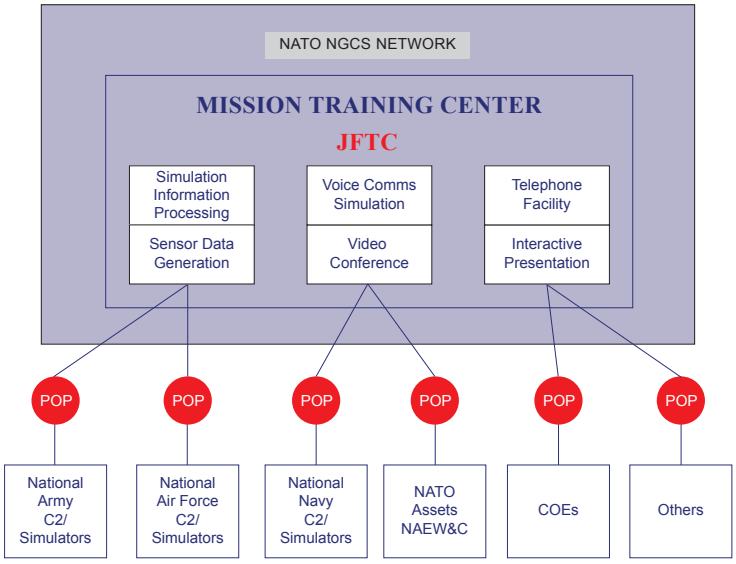


Figure 1

the backbone infrastructure. The connections from the MTC to the training community will be delivered over Points Of Presence (POP), the point in Nations where participants connect to the network. NLVC will, in cooperation with NTF and the NATO M&S Group, institute a common set of standards and procedures for NATO-wide interoperability and training.

NLVC will complement existing programs and technologies to fill gaps in multinational, NATO-led mission training and rehearsal for C2 structures and experienced war-fighters. In particular, the project will capitalise on infrastructure already developed by Nations and existing C2 capabilities, simulation models and databases.

NATO and Nations will be able to conduct training in a NATO operationalenvironment,integrating national tactical simulators/assets with NATO C2 systems and 'human-in-the-loop.' The full spectrum of missions needed for any future challenge may be trained without environmental restrictions. Multi-national unity of command, effectiveness, survivability and interoperability should improve.

The NLVC Initial Operating Capability is planned for the third quarter of 2010 and Full Operating Capability for 2012 (Figure 2).

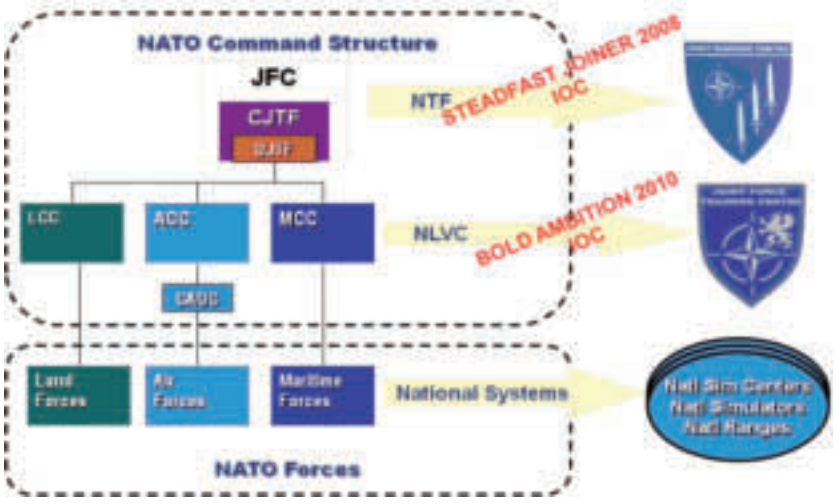


Figure 2

One of the current objectives of the NLVC project is to develop a Test Coordination Centre (TCC) infrastructure at the NATO C3 Agency (NC3A). The TCC will offer interested Nations and NATO the possibility to connect NATO and national simulations and C2 systems for proving purpose prior to IOC.

ADL

ADL has a proven role in education and training. It is a well established capability delivered by ACT and Nations. Initially an advanced slide presentation delivered on CD, technological advances have dramatically changed the way ADL is delivered. The ADL project is aimed at finding new technological solutions, primarily commercial off-the-shelf, for the effective delivery of individual education and training. ACT is particularly interested in how computer based gaming technology is able to offer interactive, high quality and cost effective solutions. The use of Virtual Battle Space 2-software is a first step.

Shared Scenarios

NATO Nations and Partners spend significant resources in developing scenarios and building databases for NATO and National exercises. ACT is confident that substantial savings in manpower and funding can be achieved by the Shared Scenario project. The project will rationalise the development of new scenarios and facilitate the reuse of existing scenarios, to include the sharing of databases and improving scenarios through a lessons learned system. Standardisation and common protocols are important elements. The aim is to provide a Scenario Library at the JWC, Stavanger, Norway, which NATO Nations and Partners can capitalise on.

Mission Training Distributed Simulation (MTDS)

To prepare headquarters and forces to meet challenging mission requirements, effective education and training is critical. Successful applications of distributed training and education within NATO, Nations and Partners already exist. The use and synchronisation of such technology allows the improvement of the quality, interoperability and standard of training. Through Snow Leopard, the aim is for NATO Nations and Partners to get improved training efficiency, high quality training and cost effective solutions**.** They will also be able to link multiple simulation platforms to better integrate joint multinational and national training. The aspiration is that this will enable the creation of new solutions to complex challenges and provide flexible training opportunities. Ultimately, this will mean that force elements are better trained and will maintain that level of training for a longer time period because they will be able to train for the full spectrum of scenarios without any environmental restrictions.

NATO Snow Leopard will reduce the need to move personnel over long distances for training and allow multi-national staffs and forces to exercise together and achieve better interoperability of NATO forces.

Snow Leopard's intention is not to replace traditional training, but MTDS will add a high-value tool to improve the capabilities of our warfighters and prepare them in combination with traditional training best suited for future missions.

The ability to exercise without restriction will lead to the ability to '**Train as you will fight.**' ■

From an airman's perspective,

JAPCC welcomes and fully supports the Snow Leopard project. It is exactly what NATO Air Forces need in order to improve their capabilities.

Snow Leopard will leverage existing programs and technologies to fill gaps in multinational, NATO-led mission training and rehearsal for command and control structures and experienced war fighters. In particular, the project can capitalize on infrastructure already developed by nations e.g. as part of Project 'FIRST WAVE' and existing Air C2 capabilities, simulation models and databases.

Which are the main air force related issues that can be solved by Snow Leopard?

- Flying time is costly and training areas are smaller and more restricted than combat battlefields. NATO and National military budgets for training and exercises are reduced and there is continued pressure to reduce the costs of maintaining combat readiness. Maintaining readiness by using resources and training methods has an impact on personnel and equipment. Realistic combat training requires deployments to training sites and increases the personnel and fiscal burdens of operational NATO and National C2 staffs and the war fighters.
- There are additional peacetime limitations to providing realistic combat training. The firing of live missiles is normally not achievable, certainly not at adversary role-players. Systems often must operate in training modes rather than wartime settings. The full operational and tactical spectrum can't be exercised.
- Mission complexity can be increased step by step to an absolute maximum if required.
- Complex mission scenarios can be repeated more often than in live missions.
- Real missions can be rehearsed before they are actually flown, thus improving planning and reducing risks.
- Flight training reduces the service life of aircraft and other equipment. The risks for personnel during real flight exercises would be significantly reduced in a virtual environment.
- Peacetime flight safety constraints on large complex missions would not apply.

NATO Air Forces will be able to conduct operational and tactical training in a NATO operational environment using a flexible and reconfigurable training architecture that integrates national tactical simulators with NATO C2 systems and the 'man in the loop.' Snow Leopard will help air power decision-makers to screen Courses of Action, make daily combat decisions, such as Air Tasking Orders, and enable fighters to fulfill their mission in a multinational team under real-life conditions in a live, virtual and constructive environment.

The full joint air spectrum of missions needed for any future NATO and national mission may be trained in the virtual environment from the operational to the tactical level. Snow Leopard will improve multinational unity of command, as well as the effectiveness and survivability for all participants from the tactical to the operational level.

Canada's World Class Pilot Training

Major Brian Jeffs, CAN AF, National Defence HQ, Ottawa

Canada's Air Force has a strong heritage of international pilot training dating back to World War II. So it was quite natural that in the 1990s, when the Canadian Air Force examined ways to maintain a world class pilot training programme with a sustainable cost structure, it should do so in a NATO context.

The capacity to operate seamlessly with Canada's NATO Allies has long been an integral part of Canada's operational doctrine and training philosophy. This core belief in international partnerships and cooperation was fundamental to the development of the Canadian Air Force flagship NATO Flying Training in Canada (NFTC) programme. This programme is tailored towards training the calibre of fighter pilots required to operate tomorrow's highly sophisticated fighters in ever more complex and dynamic operational theatres. Building on 10 years of proven success with NFTC, the Canadian Air Force, in mid-2007, introduced the Canada Wings programme to train both rotary wing and multi-engine pilots.

Programmes

Canada Wings and NFTC are undergraduate and postgraduate military pilot training programmes. While Instructor Pilots (IPs) are predominantly military pilots (except for Primary Flying Training), the technical support, classroom and simulator training are largely provided by civilian staff employed by either Allied Wings or Bombardier, the contract providers for Canada Wings and NFTC respectively.

The Canada Wings Aviation Training Centre is located in Southport, Manitoba. At Southport, Phase I – Primary Flying Training, Phase III – Helicopter and Phase III – Multi-Engine Pilot Training are conducted. NFTC operates at 15 Wing Moose Jaw, Saskatchewan, and 4 Wing Cold Lake, Alberta,

where it provides Phase II – Basic Flying Training, Phase III – Advanced Flying Training (Jet), and Phase IV – Fighter Lead-In Training (FLIT). All three training venues boast state-of-the-art training facilities and advanced training aircraft and simulators.

Phase I

Phase I – Primary Flying Training is accomplished on the very reliable Grob G120A single reciprocating engine aircraft. The Grob is a fully aerobatic aircraft with a large cockpit and retractable undercarriage. The Grob also boasts modern cockpit instrumentation and supporting Flight Training Devices (FTD).

Phase II

Upon successful completion of Phase I, candidates proceed to Phase IIA – Basic Flying Training at 15 Wing Moose Jaw. Phase IIA is conducted on the Raytheon Harvard II turbo-prop aircraft. This aircraft features jet-like handling qualities and advanced avionics. The training is augmented with FTDs featuring four and eight channel visual systems. Upon successful completion of Phase IIA, pilot candidates are 'streamed' into one of three specifically tailored Phase III programmes designed to prepare pilots for Canada and NATO's operational helicopter, multi-engine and fighter aircraft fleets.

Fighter Training

Aspiring pilots, who have been selected for fighter training, will remain at 15 Wing Moose Jaw and complete Phase IIB – Basic Flying Training on the Harvard II, before proceeding to the Phase III – Advanced Flying Training (Jet) syllabus on the BAE Hawk 115 aircraft. The Hawk 115 has advanced glass cockpit avionics including Heads-Up Display (HUD) and Hands-On Throttle and Stick (HOTAS) controls. Successful students will receive their pilot's wings before proceeding to Phase IV – Fighter Lead-In Training, conducted at 4 Wing Cold Lake.

Multi-Engine Training

Pilot candidates selected for helicopter or multi-engine pilot training will return to the Canada Wings Aviation Training Centre at Southport. Phase III – Multi-Engine is completed on the Beechcraft King Air C-90B aircraft. This reliable and proven training aircraft, with its modern avionics suite, is ideal for teaching multi-engine, multi-crew and Instrument Flight Rules (IFR) skills. Successful graduates of the Phase III – Multi-Engine course will be awarded

Basic Flying Training at 15 Wing Moose Jaw is conducted on the Raytheon Harvard II turbo-prop aircraft.

Helicopter training begins on the Bell 206B Jet Ranger helicopter followed by the Bell 412CF helicopter.

their pilot wings and then proceed to their respective Operational Training Unit (OTU); where they will convert to operational aircraft such as the CC-177 Globe Master, CC-130 Hercules, CC-115 Buffalo, CC-144 Challenger, CC-150 Polaris, CC-138 Twin Otter or CP-140 Aurora.

Helicopter Training

Phase III – Helicopter training is a two-staged programme beginning on the Bell 206B Jet Ranger helicopter followed by the Bell 412CF helicopter. The Bell 206 is a light, single turbine engine helicopter used extensively around the world for basic and advanced training and light utility tasks. Its handling qualities and auto-rotation characteristics are excellent, and with its throttle-on-collective configuration, the aircraft allows for a large safety margin while practising basic procedures. Students develop basic 'hands and feet' helicopter skills, airmanship, and confidence by flying solo sorties before they advance to the second stage of training on the Bell 412.

The Bell 412CF is a civil certified, multi-engine, IFR-capable helicopter with enhanced night vision goggle compatible avionics – including an Electronic Flight Instrument Systems (EFIS), a Flight Management System (FMS), air conditioning, rotor brake and a three-axis autopilot with coupling capability. The helicopters in the programme are former CF CH-146 Griffons that have been significantly upgraded and re-certified. The resulting configuration is eminently suited for teaching multi-engine, multi-crew and IFR skills. It is an ideal lead-in aircraft for pilots destined to fly operational multi-engine helicopters. Successful graduates of the Phase III – Helicopter programme are presented their pilot wings and then proceed onto operational helicopters such as the CH-124 Sea King, CH-146 Griffon or CH-149 Cormorant, and in the future, the new CH-147 Chinook and CH-148 Cyclone ship-borne helicopter.

Phase IV

Graduates of Phase III – Advanced Flying Training (Jet) at 15 Wing Moose Jaw change venue to 4 Wing Cold Lake, which has a fully instrumented Air Combat Manoeuvring Range Instrumentation (ACMRI), as well as tactical ranges that are ideally suited for fighter lead-in training. Upon successful completion of Phase IV, Canadian pilots proceed on to the CF-18 Hornet while international pilot participants progress onto their respective fighter aircraft such as the Typhoon, F-16 or Gripen.

Extended Course

One thing Canada's Air Force has learned in concert with its partners is that maintaining a world class pilot training system means never resting on one's laurels. To that end, a Phase I – Primary Flying Training – Extended Course has been introduced so that selected candidates may proceed directly from the Grob 120 aircraft to either Phase III – Multi-Engine or Helicopter training. This affords the NFTC and Canada Wings programmes enhanced flexibility in reacting to demands for more fighter, helicopter, or multi-engine pilot graduates.

Benefits

Canada's Air Force has a long tradition of conducting pilot training with its Allies. Benefits include shared capital costs and better economies of scale, while at the same time providing an opportunity for vital exchanges of experience and training doctrines in a multi-national setting. Canada chooses to extend its influence on the global stage in concert with its Allies and security partners, and this has proven very important during many international operations. It remains a tremendous added benefit of Canada's NFTC and Canada Wings programmes that future military pilots learn at the beginning of their careers to work side by side with international partners and Allies. It is also a tangible way that Canada contributes to international defence and security.

Today, in addition to graduating Canadian military pilots, NFTC has proudly hosted participants from Europe, the Middle East and the Pacific Rim. Denmark, the United Kingdom, Singapore, Italy, Hungary, the United Arab Emirates, Greece, Austria and Australia have all graduated pilots from the programme. Similarly, the more recently established Canada Wings programme has graduated pilots from Norway and is generating widespread international interest. A vital component of this international milieu is the contribution made by exchange IPs. All participating nations are encouraged to participate in the exchange programme. Additionally, several nations have, while not providing pilot candidates, chosen to contribute an IP. This diverse cadre of highly experienced IPs is an indispensible element to pilot training in Canada.

'NFTC has proudly hosted participants from Europe, the Middle East and the Pacific Rim.'

International Training Exercises

Canada's contribution to training NATO pilots is not limited to graduating newly winged pilots. The Canadian Air Force places special emphasis on more advanced international training opportunities at 5 Wing Goose Bay and 4 Wing Cold Lake.

Established at the height of the Cold War, 5 Wing Goose Bay also has a storied history as a training base for NATO's Air Forces. Goose Bay initially served as a strategic air link between North America and Europe, but the availability of immense areas of unrestricted airspace over very sparsely populated areas led to its rapid evolution into a low-level flying training venue for the RAF's Vulcan Bomber fleet. By the 1980s, several of Europe's major air forces were training individually and in Combined Air Exercises in the vast wilderness of Labrador. Goose Bay continues to provide an ideal location for Canadian and NATO aircrew to bridge that training gap between ab-initio pilot training and the high intensity nature of the FLAG exercises.

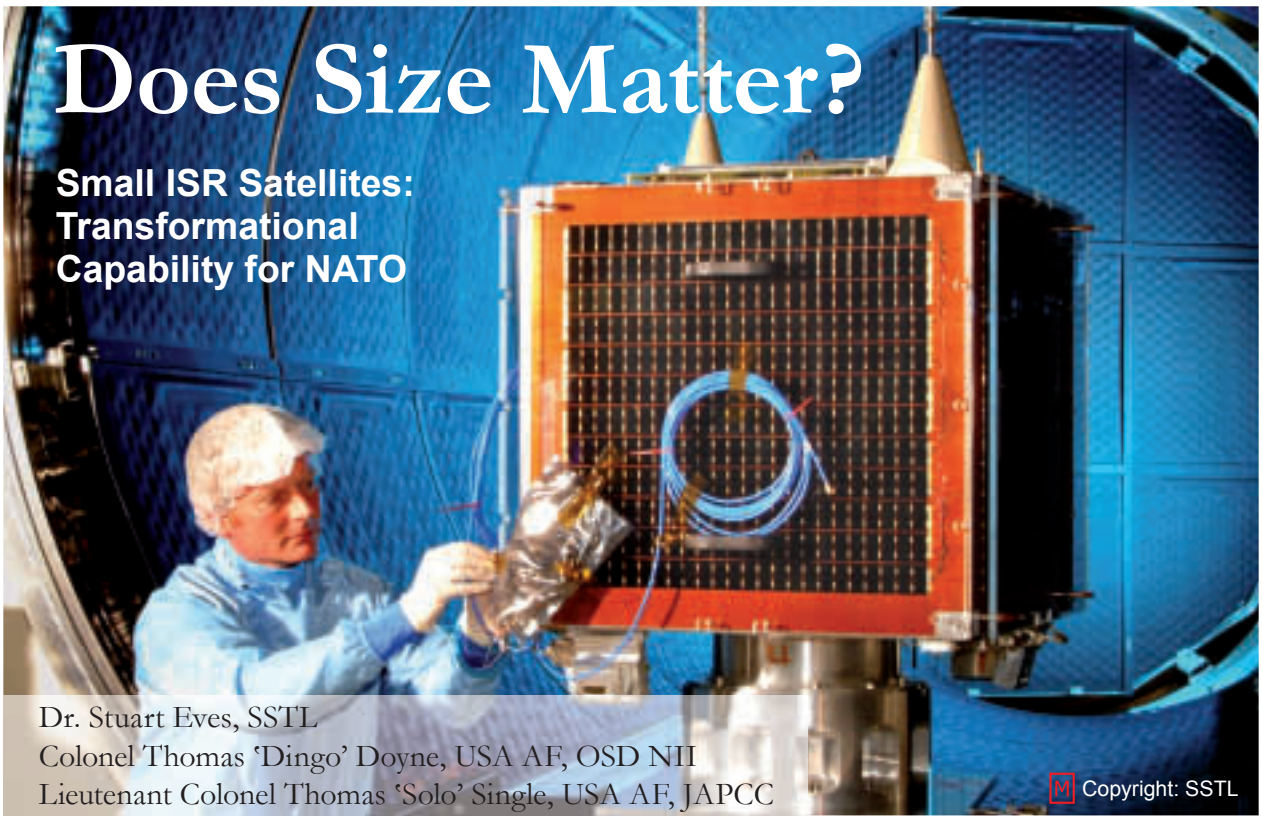
Exercise MAPLE FLAG at 4 Wing Cold Lake provides important training for Canadian and Allied fighter aircrews, as well as transport, electronic warfare, air-to-air refuelling, air defence and airborne early warning and control assets from many different nations. During the exercise's three two-week periods, international participants engage in a simulated, 10-day air campaign. Using the vast, unrestricted airspace and more than 640 targets of the Cold Lake Air Weapons Range (CLAWR), participants engage in daily missions that involve confronting and dealing with both air- and ground-based threats.

The exercise promotes initiative and self-discipline in the air, and provides the opportunity for developing tactical and leadership skills. Working together to plan air combat missions and flying these missions in concert with aircraft from other nations fosters and strengthens the professional bonds between Allied nations.

Canada's values and history have always made it vital to be able to operate effectively with our NATO partners. Training and exercising together in Canada is a way in which Canada can play a positive role in NATO's contribution to international peace and security. Today, as much as ever, this training and exercising relationship is an enduring facet and vital component of NATO. ■

Does Size Matter?

Small ISR Satellites: Transformational Capability for NATO



Dr. Stuart Eves, SSTL
Colonel Thomas 'Dingo' Doyne, USA AF, OSD NII
Lieutenant Colonel Thomas 'Solo' Single, USA AF, JAPCC

Technology and capability have advanced to the point where small satellites* offer the potential to transform NATO ISR capabilities. A consequence of the routine incorporation of advanced terrestrial components in small satellite designs, the technical capabilities of small satellites, much like personal computers, continue to advance very quickly. As a result of their very short development times (typically two years or less), small satellite technology freeze dates are surprisingly close to the launch date, further reducing the performance gap compared to larger satellites, which may be using components available 10 years prior to launch.

Most importantly, small satellites are cheap enough to allow constellations, comprising several satellites, to be a viable financial proposition. This allows groups of small satellites to offer revisit times that are simply not possible with single large satellites, and hence to deliver capabilities in a timescale that is regularly and reliably within the decision timeframe of a deployed military commander. The use of small satellites for operational missions has been pioneered by Surrey Satellite Technology Limited (SSTL) in the UK, and some examples are cited here from SSTL's missions in order to illustrate the 'art of the possible.'

A Short History of Small Satellites

In 2002 and 2003, the first four of the Disaster Monitoring Constellation (DMC) missions were launched. Despite their small size and low cost, these 100 kg satellites carried wide-area optical cameras that were able to emulate the data quality available from Landsat (nearly 2000 kg with 30 m resolution). Due to the very wide swath (600 km) of the camera system, and the use of the satellites as a cooperative constellation, it was possible to provide opportunities to collect disaster relief imagery virtually anywhere on the globe within 24 hours. These satellites were funded by 4 separate nations,[1] who agreed to operate their missions in part for disaster relief over a particular crisis theatre (up to 5% of the time); in part for national purposes such as mapping (perhaps 45% of the time); and leaving approximately 50% of the capacity for commercial exploitation.

In 2005, the capabilities of the original DMC satellites were eclipsed by the fifth satellite in that series, which was launched alongside the UK's TopSat mission. These two satellites provided resolutions of 4 m and 3 m, respectively, from an operational altitude of almost 700 km, and are believed to hold the world record for 'resolution per cost of satellite,' (built and launched for $15M [US] with an overall mass of just 120 kg).

SSTL's most recent launch has been the RapidEye constellation of 5 identical satellites. These satellites provide a resolution of 6.5 m over

* For purposes of this paper, small satellites are defined as those having a dry mass of less than 1,000 kg; furthermore, small cost and small development time, are equally important factors in the small satellite equation.

a swath of 80 km. When stabilised around their common orbital plane, they will, like DMC, offer imagery of anywhere on the Earth's surface on a daily basis. The 5-satellite RapidEye Constellation provides daily global imaging.

Impressive as this capability is, it will be surpassed in 2009 with the launch of the NigeriaSat-2 mission, which will deliver high acuity 2.5 m imagery over a 20 km swath, and wide-area peripheral vision over a 300 km swath at 30 m resolution. NigeriaSat-2 will also operate at approximately 700 km, but a variant of this design, operating at lower altitude, has been proposed to the UK MOD under the name SkySight. This altitude reduction and the use of a higher capability CCD detector in the camera, means that the baseline resolution performance of the SkySight satellites will be close to 1 m.

Arguably the most attractive feature of the SkySight design, from a military perspective, is the satellite's agility. Building on the TopSat heritage, SkySight will be able to pitch and roll at high angular rates, allowing a range of different operational modes to be supported. These highly responsive modes can accommodate: wide-area collection; in-pass stereo; tracking of lines of communication; widely separated snap-shot images within a theatre; and a narrow-swath super-resolution mode, which will drive the effective resolution of the system to better than 1 m.

It should be clear that one of the strengths of small satellites is their flexible concept of operation. In a NATO context, this flexibility could be exploited by giving command authority to the Joint Force Commander when the satellite is over his theatre of operations, whilst retaining the control of the satellite for national purposes elsewhere. (If operated in this fashion, the satellite control architecture would be somewhat similar to the use of the DMC satellites over a region requiring disaster relief imagery).

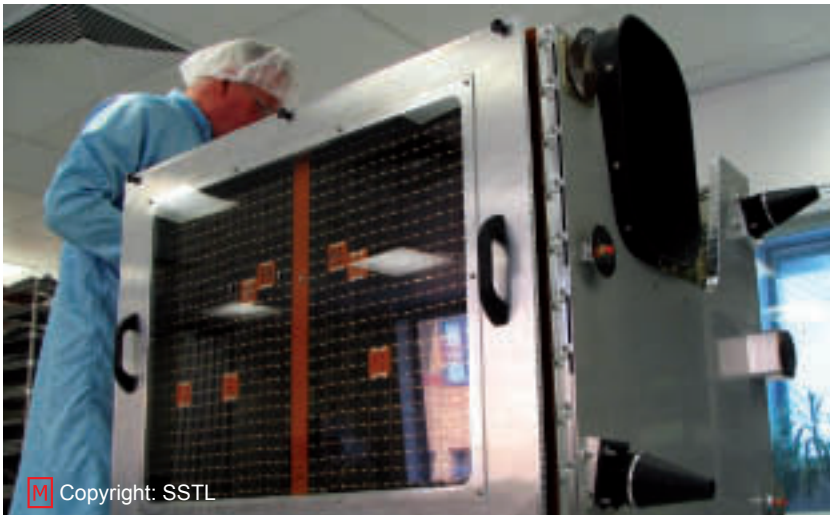
In summary, the key take-aways are:

- The high value to the user of having a source of unclassified imagery that can be distributed and used in common by the coalition partners.
- The need to have assets on orbit to allow military forces to gain experience with the satellite assets at their disposal – whilst some responsive Space assets may well be held in readiness on the ground, it is impossible to 'train as you fight' without placing at least some of the assets in Space.
- A further argument in favour of deployment is the comparatively short obsolescence lifetime of the hardware. The rapid pace of change in small satellite technologies means that satellite lifetimes are only sensibly on the order of 5–7 years. In that environment, putting a satellite 'in the barn' for 3 or 4 years involves paying a high opportunity cost.
- The Space domain is contested and vulnerable. Use of small satellites offers 'defence in depth' options as well as providing Space Situational Awareness (SpSA) and surveillance capability, which is the first step in assuring the Space domain.

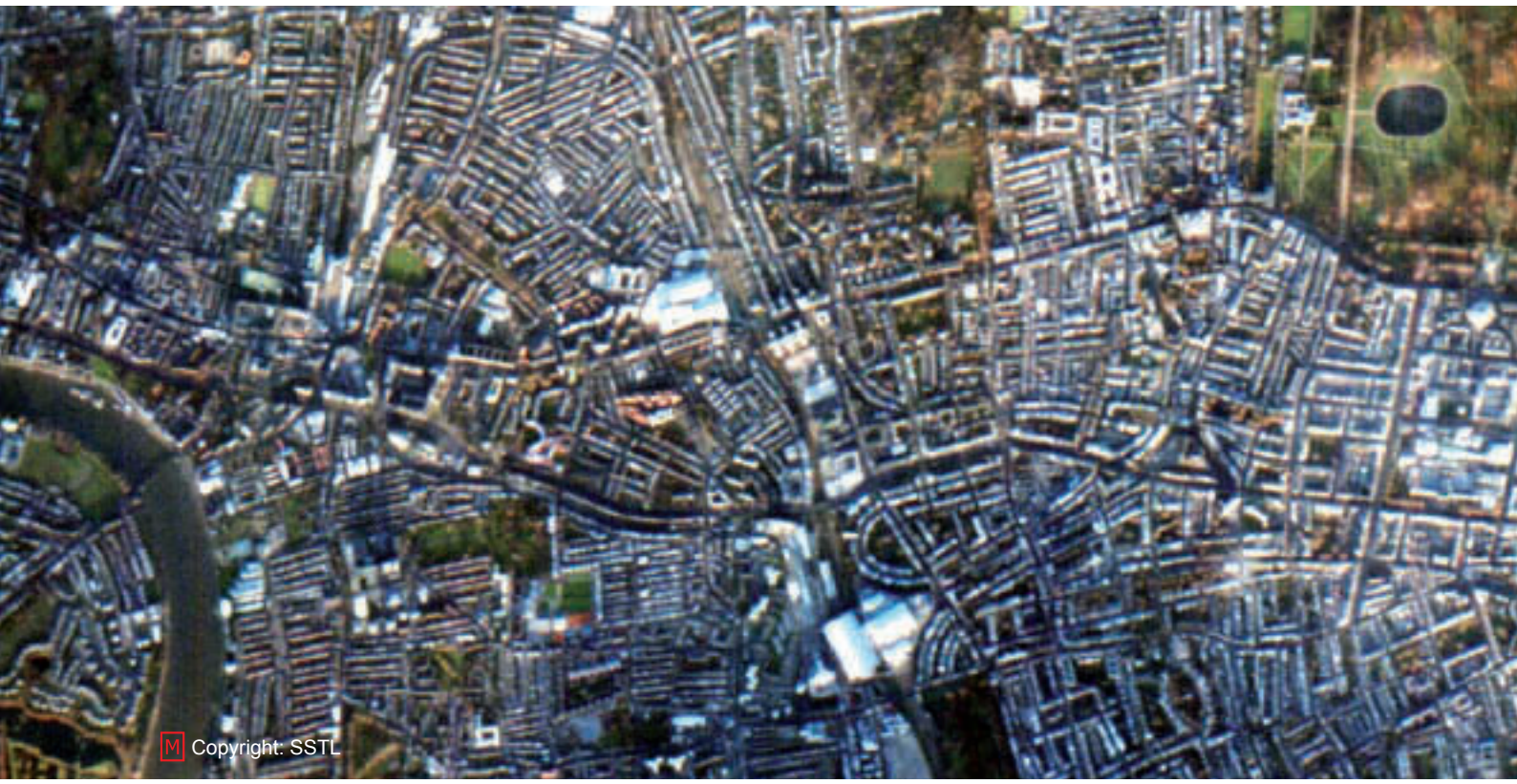
Delivering Space-based ISR Capability to the Warfighter

With the increasing number of NATO Nations having Space-based earth observation capabilities, the time has come for such capabilities to be treated in the same Joint and Combined approach as it has for satellite communications (SATCOM). NATO SATCOM utilizes British, French, Italian and commercial satellites in a coherent and coordinated manner to provide communications for NATO operations. There are more than 20 satellites[2] in orbit that NATO could use and represents a significant and persistent Space-based surveillance capability, if they could be operated in a synchronized fashion.

Small satellite technology has advanced to the point where they have civil and military utility today. Small satellites offer NATO and the Nations real capability, there just has to be the political will to use them. The first step to delivering Space capability to the warfighter



TopSat being assembled at SSTL



TopSat image of central London

is political support. Secondly, Space policy and governance must be established to fully use existing Space capabilities. Policy and governance will provide the structure necessary to work through numerous issues presented by Space systems in general and surveillance/reconnaissance systems in particular. The European Union has been working hard over the last several years to establish a European Space Policy and furthermore, have budgeted 10 Billion Euros for the Galileo and GMES Space systems.[3] The perception in the NATO military community may be that it's too sensitive a subject to discuss, but their civilian counterparts in Europe have been making significant advances! NATO and ISAF forces conducting operations should be able to harness the capabilities of these amazing Space-based systems owned and operated by NATO Nations. The increase of NATO out-of-area operations has highlighted the need for the synchronized use of this growing set of Space-based capabilities.

The DMC has clearly demonstrated that a global coverage capability with tremendous resolution is affordable for Nations with even a modest defense budget. As Nations move forward to modernise their forces, an opportunity exists for several Nations to partner and deliver a small satellite capability for NATO. Potentially, a Joint Task Force Commander could even have some tasking authority over the system. Furthermore, a small satellite system could be available for National and NATO security and defense needs. The international Space community has been advocating for increased cooperation between civil and defense organisations. This NATO small satellite concept could provide a means to improve the ISR capabilities of NATO forces in a cost efficient manner, while also offering an opportunity to improve interoperability and further NATO Net-Enabled Capabilities. This would be yet another way for Nations to meet Alliance obligations, strengthen ties, encourage safe & responsible Space Operations and stimulate the industrial base.

In spite of the challenges inherent in any multinational endeavour, small satellites are likely to provide a myriad of compelling economic and military benefits. These operations present the Alliance another means to further cement historical partnerships between like-minded Nations. NATO will be able to take advantage of state of the art technological capabilities in Space while simultaneously bringing international cooperation to new levels. Just as importantly, small satellites offer the potential to maintain the freedom of Space via deterrence inherent in coalitions and safety inherent in numbers.

NATO's Future Role in Space

In recent years, there has been an explosion in the number of Unmanned Aircraft Systems

(UAS) being used in operations. Their military utility was quickly realised and Nations moved swiftly to develop UAS capability. Like the UAS, small satellites would complement other existing ISR capabilities and provide much needed flexible Space-based ISR capabilities for our forces. The NATO Research and Technology Organisation currently oversees several technical teams conducting research on small satellite technologies.[4] As these systems continue to mature and are increasingly used by the member nations, NATO will have to determine the architecture and programs to deliver capabilities to the warfighter. To improve our understanding of the implications of Space, exercises and training must include exposure to Space capabilities, both at National and NATO events. Personnel must be educated, trained and become accustomed to requesting and using Space capabilities during wargames, exercises and operations. Space Operations are no different from other mission areas, but are not yet commonplace in NATO.

SSTL has clearly demonstrated small satellite technology has civil and military applications. NATO must develop sound concepts and plans to meet increasing demands for ISR capability. To fully leverage small satellites, NATO should take a holistic approach to Space Operations.[5] Vital to moving forward is the establishment of a Space Office to provide leadership, expertise, advice and serve as an interface between NATO, the Nations, agencies and Space industry. Furthermore, a NATO Space Operations Coordination Centre is needed to better integrate existing Space capability, and in the future, manage any small satellite capability.

Space-based ISR capabilities are under-utilised in NATO and ISAF. NATO should not delay in improving how Space is integrated into current operations. Space capabilities can improve how civil and military operations are planned and executed. Small satellites could be a key enabler. With the political support of the Nations and appropriate emphasis by our military leadership, small ISR satellites could be a truly transformational capability for NATO. ■

1. Participating nations include: Algeria, Nigeria, Turkey and the United Kingdom.
2. A brief list of imagery systems (not all small satellites) available to a number of NATO member nations with resolutions ranging from 5 meter to better than 0.5 meter includes the American Digital Globe and Geo-Eye systems, the British TopSat (small satellite), the French designed and operated Helios-2, and the British built, German operated Rapid-Eye (small satellite) optical imagery satellites along with the following radar imaging satellites: the Canadian RadarSat 2, the German SAR-Lupe and the Italian COSMOS SkyMed.
3. Galileo is an EU funded constellation of navigation satellites. GMES (Global Monitoring for Environment & Security) is an earth remote sensing system.
4. Information about the Research and Technology Organisation can be obtained at www.rta.nato.int.
5. The JAPCC's "NATO Space Operations Assessment" provides a snap-shot of Space operations in NATO today, identifies gaps and provides recommendations on developing NATO Space Power. The document is available for download at www.japcc.org.

Learning from Experience

'The underpinning themes of expertise in a profession are knowledge, history and reflection.'[1]

Colonel Sergio Ferreria, PRT AF, JAPCC

Since its beginning in 2002, the Joint Analysis & Lessons Learned Centre (JALLC) has been supporting NATO's operations and transformation. At the 2006 Lessons Learned Conference, Lieutenant General Soligan, Deputy Chief of Staff Transformation at HQ SACT, outlined the need for a responsive lessons learned programme. He noted NATO's challenge in reacting and adapting compared with that of its adversaries, who are not constrained by layers of directives and the need for consensus. He described what is necessary for a successful lessons learned programme, stating that lessons learned are a critical lynchpin in transformation and require close attention if change, the very essence of organisational learning, is to take place.

NATO has invested heavily to improve its organisational learning, to improve the way we learn from experience, to better understand the changing environment and to adapt accordingly. These investments have included the very reorganisation that created ACT and ACO. Every NATO body contributes to organisational learning, both within and collectively, through demonstrations, exercises and real-world events.

'The lesson learned should describe the actions the organisation must take or avoid on similar projects.'

The business community's large body of knowledge on organisational learning also offers the military insights into this field. This article looks briefly at organisational learning in business, specifically within project management, to understand the obstacles to organisational learning, and approaches to overcoming those obstacles. It then looks at the work of the JALLC, citing a real-world example of the lessons learned process, which led to the improved effectiveness of the Afghan National Army (ANA) and its use of Air Power.

A Learning Organisation

'Learning is the process by which knowledge is created from experience and the path by which improvement takes place.'[2] We distinguish between 3 levels of learning: individual learning, team and group learning, and organisational learning. Organisational learning is sometimes defined as 'a process of detecting and correcting error.'[3]

The concept of the learning organisation emphasises the need for an environment that supports learning throughout the organisation. A learning organisation is 'an organisation continually expanding its capacity to create its future.'[4] It is 'an organisation skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights.'[5] A simple model to illustrate organisational learning

in the project management environment is the 'plan-do-study-act (PDSA) cycle.[6]

- In the 'plan' step, the project team determines the nature of the problem and constructs a plan. The plan sets out the steps to be taken to resolve a problem and the expected results.

- In the 'do' step, the project team implements the plan. Implementation produces a set of results about the expected and unexpected actions taken and associated performance. These results are used to understand project status and to move the project forward.

- In the 'study' step, the project team reflects on the plan and associated results to determine the good and bad instances. The output of the 'study' step is a lesson learned.

- The 'act' step is the closing of the loop to show the decision to continue with or abandon the process of improvement.

The lesson learned should describe the actions the organisation must take or avoid on similar projects. A lesson learned is also a mechanism to document the learning to share with others. The sharing part is important. Inter-project learning and intra-project learning increase knowledge.[7]

Because every situation is unique, many debate whether a lesson is learned or merely identified – thus, questioning the value of the process. That debate misses the point. Whilst, a lesson not learned due to institutional inactivity is, indeed, an opportunity wasted, a lesson not implemented after due reflection and consideration of context genuinely adds to the learning process.

Obstacles to Organisational Learning

Within project management, the post-project review is part of the organisational learning process. It has been found that post-project reviews are effective in disseminating knowledge about good practice, correcting errors in individuals' knowledge, and predicting how well alternative practices would have turned out. At the same time, these reviews have demonstrated several limitations.

A study of 79 highly regarded R&D organisations revealed that 80% of their projects are not reviewed after completion, and most of the remaining 20% were reviewed without established review guidelines.[8] The study concluded that great learning potential is lost by failing to take formalised team learning seriously. Regardless, almost all organisations indicated that they would prefer to see more post-project reviews to follow up on completed projects. So, what is stopping them?

Interviews and questionnaires with OMLTs and ANA have been initiated by the JALLC.

Resistance to Learning from Formal Reviews

If post-project reviews were simple, few organisations would pass up the opportunity to benefit from them. However, according to von Zedtwitz,[9] barriers to learning fall into 4 categories:

- **Psychological barriers**. No learning occurs unless individuals create and share information. Humans have a tendency to suppress unpleasant experiences.

- **Team-based shortcomings**. When team members work together towards common goals, they are not well suited to criticising each other. Frank feedback may damage relationships and destroy the team.

- **Managerial constraints**. Organisations are under constant pressure to perform. This pressure leaves little time to step back and reassess a project that has occurred in the past – management tends to focus on future events.

- **Epistemological barriers**. Even if human beings had the time and interest to fully devote their attention to the reflection and analysis of what happens around them, they would still find it difficult to grasp the most important issues and draw important conclusions for future behaviour by themselves.

'... JFC Brunssum requested that JALLC analyse the effectiveness of the OMLTs in contributing to the improvement of the ANA.'

Certain experiences are hard to express and therefore not easily shared with others.

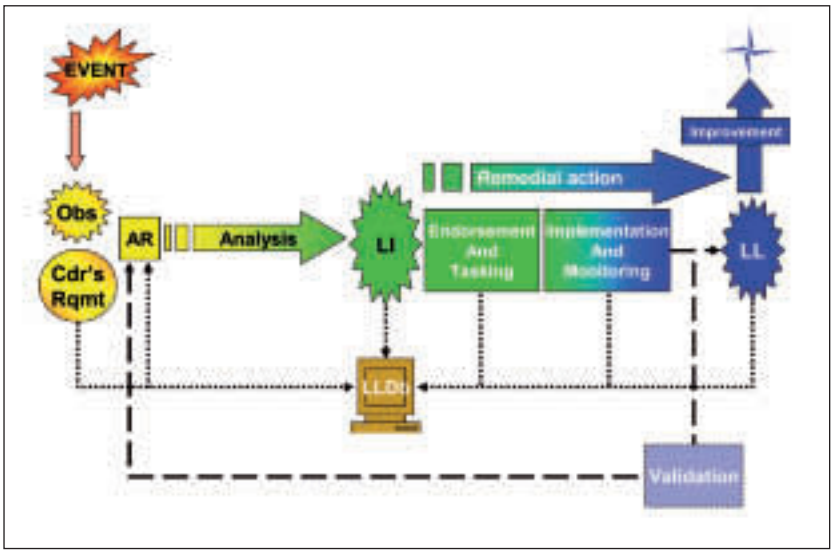
The model for organisational learning identifies several requirements:

- The need to accept the occurrence of failure as an almost natural phenomenon. Without failure there is little learning: failure must become an accepted part of efforts to improve.
- Review results need to be collected and made available across the organisation.
- Reviews must not stop at the database graveyard; all learning must be shared so that procedures (or even doctrine) are adapted accordingly.
- A learning process must be formalised through guidelines and adjusted to meet organisational needs.
- Most importantly, leadership must promote a learning culture.

NATO's Lessons Learned Process

The JALLC acts as NATO's focal point for the analysis of operations, exercises, training, and experiments and for the collection of lessons learned. This includes the maintenance of an interactive managed lessons learned database. JALLC implements the analysis process to ensure that key factors and lessons identified are characterised and, where appropriate, the proper remedial action proposed.

The NATO lessons learned process consists of six steps: initiation, analysis, endorsement and tasking, implementation and monitoring, validation and lessons learned. The lessons learned are retained in the NATO Lessons Learned Database (LLDb), managed by the JALLC. This is the key management tool used to support the process. The LLDb is accessible through the NATO Secret network and the unclassified portions of the database are available on the internet.



NATO Lessons Learned Process

Reports from exercises, operations, and experiments should always encompass an annex expressly depicting the lessons identified. These lessons may be actioned either by the identifying level or, where agreed and requiring further action, by a higher level of command. For operations, the release authority is the operational commander and for exercises, it is the officer conducting the exercise.

To make proper use of the feedback from all NATO activities, lessons must first be properly identified and disseminated, followed by analysis and, when required, the application of corrective actions to produce actual lessons learned. This process must, however, be continuous and clearly understood to ensure that lessons learned form an integral part of any commander's way ahead.

Output of a Lesson Learned

In the ongoing ISAF mission, JFC Brunssum requested that JALLC analyse the effectiveness of the Operational Mentor and Liaison Team (OMLT) in contributing to the improvement of the Afghan National Army (ANA).[10] This example serves to illustrate how the lessons learned process has served a current operation.

A meeting was arranged between the JALLC and the customer, in this case JFC Brunssum, to clarify the Analysis Requirements and transform them into Analysis Objects (AOs). Questions addressed included: What do you need? What do you intend to do with it? Why do you need it? When do you need it? And, how we will do it? The outcome was, 'to see if the OMLT training programme is the best way to support ANA operations.'

Once the AOs were shaped, the JALLC Team initiated a passive collection by reading all related documents, either conceptual or doctrinal, that have been used by OMLTs or by the ANA. The Analysis Team also established contact with ISAF J7 to initiate in-theatre data collection. Data collection included interviews and questionnaires with OMLT members and with members of the ANA in order to thoroughly understand their relationship and dynamics. The team also observed selected ANA/OMLT training and operations.

Analysis followed the collection phase. The analysis phase is the most challenging; the team must strive to reach its conclusions driven by holistic consideration of all the findings rather than an understanding derived from partial analysis of individual findings. The interim report was written with the active participation of the main players (ISAF HQ, Region Commands, OMLT members). The report gave conclusions and recommendations, which led to lessons identified. The report was sent to SHAPE by JFC Brunssum for analysis and further work.

SHAPE endorsed the recommendations in the JALLC interim report and nominated lead divisions to fulfil the recommended actions. SHAPE took the lead on report implementation and coordination, with JFC Brunssum in support. Action plans were developed to implement the recommendations and SHAPE J7 monitored the plans and the overall report status regularly until completion.

This was a long and drawn out process. Without the full commitment of higher commands to the process, and their acceptance that an independent body could help and advise, it could well have been wasted effort. There is an understandable human reluctance to let others see our mistakes. However, unless we do so, we end up 'marking our own homework,' and the chance to learn lessons may be lost. So was the effect worth the effort? ANA patrols working with OMLTs were subsequently engaged by the Taliban and required close air support. The lessons learned process had ensured the presence of trained forward air controllers, enabling patrols to call in timely air support and to accurately direct its effect. In the process, lives were no doubt saved. Whilst the lessons learned process cannot claim all the credit, it played its part in delivering effect and supporting troops in contact. ■

1. G.M. Pender, 'The Military Profession,' *Humane Warfare: The Practice of Military Ethics – an aerospace perspective*, RAAF Air Power Development Centre, Canberra, 12.
2. Ibid., 393.
3. Maximilian von Zedtwitz, 'Organizational learning through post-project reviews in R&D,' in R&D Management (Oxford: Blackwell Publishers Ltd, 2002), 257.
4. Tim Kotnour, 'Organizational learning practices in the project management environment,' *International Journal of Quality & Reliability Management*, Vol. 17 (2000), 394.
5. Ibid., 394.
6. Ibid., 395.
7. Ibid., 397.
8. Maximilian von Zedtwitz, 'Organizational learning through post-project reviews in R&D,' in *R&D Management* (Oxford: Blackwell Publishers Ltd, 2002), 255.
9. Ibid., 262.
10. Col Dan Lewandowski, 'Operational Mentor and Liaison Teams,' *The Journal of the JAPCC, Edition 7*, (Spring 2007): 18. Col Lewandowski discusses how the OMLTs increase the combat effectiveness of the ANA through network-enabling and through the addition of skill sets that permit the employment of close air support, controlled by the OMLT.

How do we get there?

Maximising NATO and EU Airlift

Lieutenant Colonel Gerard Boink, NLD AF, JAPCC

During the Cold War, European NATO Nations worked under the assumption that their militaries would operate very close to home. Consequently, many Defence budgets were used to sustain large armies and fleets of small jet aircraft for close-air-support, air-to-air combat, and the occasional short bombing run. One result of this approach was that NATO has insufficient strategic and tactical airlift to support current operations. Although long-recognised and subject to many solutions, this shortage of strategic and tactical lift capacity still remains.[1] Perhaps because of this, force planning models always assume that the available airlift is being utilised to its full extent. However, any evaluation of current practice (current operations included) shows that this assumption is not always correct. Despite the efforts of national and multinational movement coordination centres, inefficient flights, spare capacity and empty legs are still an unfortunate fact of life.

Airlift Capabilities in NATO

NATO policy makes individual nations ultimately responsible for the deployment of their forces to and from an area of operation. Therefore, planning and tasking of airlift capacity still resides at the national level and only in recent years have multinational programmes, and multinational planning and coordination of airlift, become more common. Nevertheless, only a minority of airlift missions are subject to any multinational coordination.

National Airlift Assets

Most European Nations rely on transport aircraft from the Cold War. The C-160 Transall and older versions of the C-130 continue to fulfil a mixture of strategic missions and tactical roles in the Middle East and Africa, although they were originally acquired primarily for tactical missions in Europe. Requirements for cargo movement have changed from small and light to much larger and heavier equipment, while the required range has increased dramatically. On top of this strategic demand, considerable capacity must be reserved to cover tactical missions such as Intra-Theatre Airlift (hub and spoke) and tactical airdrop. Airlift is also increasingly used as an alternative to surface movements in high threat environments. Against this higher need, the actual serviceability and availability of aged aircraft has sometimes dropped to less than 50%, leaving little capacity with which to plan. Moreover, current operational environments require transport aircraft that have defensive aids and are capable of short strip operations. In response, a number of nations are procuring new aircraft to meet these requirements, such as the C-17 and A400M.[2]

However, reality shows that these will not be fully available until 2020. To fill the gap, nations

are looking at short term solutions, including chartering on the civilian spot-market. Additionally, a growing number of nations are actively coordinating their airlift through various movement coordination entities, thereby optimising the utilisation and efficiency of their airlift capacity.

Multinational Approach

Reduced national defence budgets, leading to a reduction in aircraft numbers, have forced nations to combine their efforts in fulfilling their airlift requirements. The fact that operations are increasingly joint and multinational requires similar, or at least interoperable, airlift systems. The acquisition of new 'state of the art' aircraft like the A400M is multinational; cooperation in planning and tasking of airlift is the logical next step in this process.

The C-130 continues to fulfil a mixture of strategic missions and tactical roles.

Currently several multinational movement agencies are active and more are planned. Some are limited to airlift or another single mode of transport, while others are focusing on more than one mode or are, indeed, truly multimodal. They also differ in the level of cooperation, ranging from passive coordination up to integrated pro-active planning. As a consequence, while they all strive for optimisation in their own areas, inefficiencies survive and thrive because no organisation has oversight of the complete picture.

Movement Coordination Centre Europe

As a result of the European Air Group (EAG)[3] Airlift Study in 2001, the 7 EAG nations established the European Airlift Coordination Cell (EACC) in order to optimise the use of airlift resources through active coordination. The EACC transformed in 2004 into the European Airlift Centre (EAC) and merged on 1 Jul 2007 with the Sealift Coordination Centre (established 2002) in what has become the Movement Coordination Centre Europe (MCCE). The MCCE's objective is to coordinate and optimise the use of air, sea and road transport and air-to-air refuelling capabilities between its participants, thereby improving their overall efficiency and effectiveness. To enable a flexible and non-bureaucratic exchange of flying hours, those MCCE members that deal with airlift and air-to-air refuelling can apply the Air Transport, Air-to-Air Refuelling and other Exchanges of Services (ATARES) Technical Arrangement,[4] thereby avoiding any financial payments. The MCCE has proven very successful in enhancing operational movement for its participating nations, while reducing the associated costs. Its effectiveness is, however, limited by the provision of information to the MCCE by its participating nations, which is entirely voluntary and therefore not always complete.

A400M and European Air Transport Command

Seven NATO Nations[5] are together procuring the Airbus A400M. After recent delays, first delivery is now (perhaps optimistically) expected by 2013 and, by 2020, these 7 nations should operate 180 aircraft between them. Although planning and tasking of this capacity is still foreseen to be a national responsibility, initiatives are emerging to cooperate on training, maintenance and other support activities. The A400M programme encouraged four European NATO Nations (Belgium, France, Germany and the Netherlands), to establish a European Air Transport Command (EATC).[6] EATC aims to gradually transfer and integrate within one single multinational command all relevant national responsibilities and staff. Since EATC's key aim is to manage the planning, mission generation and execution of the combined air transport capabilities, nations will have to transfer parts of their national authority if the EATC is to achieve its goals. For the MCCE, the EATC will represent one airlift planning entity, embodying all air transport and air-to-air refuelling requests and the capabilities of the 4 nations. Currently, IOC is planned for 1 Mar 2010, while FOC is forecast by the end of 2010. The location of the EATC has yet to be decided, but the ties and the necessary cooperation and information exchange between EATC and MCCE will (and must

16 Nations have pooled their resources to charter Antonov AN-124-100 transport aircraft.

be) close; the two entities must have at least near real-time information exchange and proper liaison to ensure effective coordination, but ideally the two organisations should be collocated.

Strategic Airlift Interim Solution and Strategic Airlift Coordination Cell

The majority of the 7 NATO A400M nations currently participate in the Strategic Airlift Interim Solution (SALIS) in order to fill their airlift capability gap. Within SALIS, 16 nations[7] have pooled their resources to charter Antonov AN-124-100 transport aircraft for the airlift of heavy equipment and other outsized cargo across the globe. SALIS has assured quick access to six Russian and Ukrainian AN-124-100 aircraft: two on full-time charter in Leipzig-Halle, while the other four are available on short notice in Kiev and Ulyanovsk through assured availability. Based on a prioritisation scheme, the Strategic Airlift Coordination Cell (SALCC) manages, allocates and tasks the available minimum capacity of 2000 SALIS flying hours. Although the SALCC is co-located with the MCCE in order to foster further coordination and optimise the utilisation of the associated airlift capabilities, there is currently no full integration/coordination of SALCC and MCCE capabilities.

C-17 Strategic Airlift Capability

Twelve nations[8] not participating in the A400M programme signed a Memorandum of Understanding (MOU) to acquire, manage and operate 3 Boeing C-17 transport aircraft (representing 3,000–4,000 flying hours) to satisfy their outsized airlift requirement. This Strategic Airlift Capability (SAC) of (initially) 3 C-17s will be based on Papa Air Force Base, Hungary and flown and maintained by multinational crews under the command of a multinational military structure – the Heavy Airlift Wing (HAW); the first aircraft will be delivered in 2009 and FOC reached in late 2011.

While participating nations will share the liability and acquisition costs, a new NATO Airlift Management Agency (NAMA) has been created to support the management and logistics of this multinational airlift fleet. Although the MCCE might play a future role in the optimisation of the utilisation of SAC capacity, details of the external relationships with other multinational airlift coordination and planning agencies is yet to emerge. Adequate coordination and cooperation of SAC with other airlift coordination entities (MCCE, EATC, and SALCC) should enhance efficient utilisation of this capability. However, in order to fully exploit the SAC C-17 capability and to provide and exploit all options for the MCCE, near real-time information exchange and proper liaison between SAC and MCCE is vital.

Airlift is used as an alternative to surface movements in high threat environments.

Civil Charter

Despite all these initiatives, NATO and EU Nations still rely heavily on the civil charter 'spot market' to satisfy their airlift requirements.

Unless supported by appropriate assured access contracts, there are two main risks:

- The civil market has insufficient readily available capacity and nations are all fishing in the same pond, competing with each other with no honest broker.

- The aircraft on the civil charter market that might be available on short notices are not ideally suited for military tasks (lacking ramp loading capability and defensive aids, for example).

A multinational military coordination agency, acting as chartering clearing house, would help mitigate these risks.

Optimised Utilisation Through Enhanced Coordination

As proven by MCCE, active coordination and cooperative planning can significantly improve the effectiveness and efficiency of airlift operation and optimise the utilisation of scarce airlift capabilities. Pro-active planning can ensure that the best mix of airlift assets will be scheduled for a mission, thereby avoiding empty legs and spare capacity. Currently, the various planning cells, coordination centres and other involved entities only have visibility of a part of the tasks and the assets; they are, therefore, handicapped in their planning activities. This leads to optimisation of only a part of the airlift operation and often to the inefficient execution of airlift tasks. Therefore, it is vital that a single planning authority has a complete overview of the airlift tasks and the available airlift assets. Ideally, such a planning authority should be a legal entity,[9] also able to act as a chartering clearing house for civil chartered airlift on behalf of nations. A global view, network enabled information exchange and sufficient authority would be prerequisites. The MCCE would be the most logical starting point from which to create this capacity. An MCCE Enhanced would encompass all the strengths and benefits of the existing centres. Although being a next best solution, connecting existing centres and their capabilities via a virtual network centred on the MCCE and using a common database would be a significant step forward. Eventually, international pooling of existing and new airlift capabilities is required to ensure maximised operational output (better value for money) to meet ever growing operational demands on finite resources.

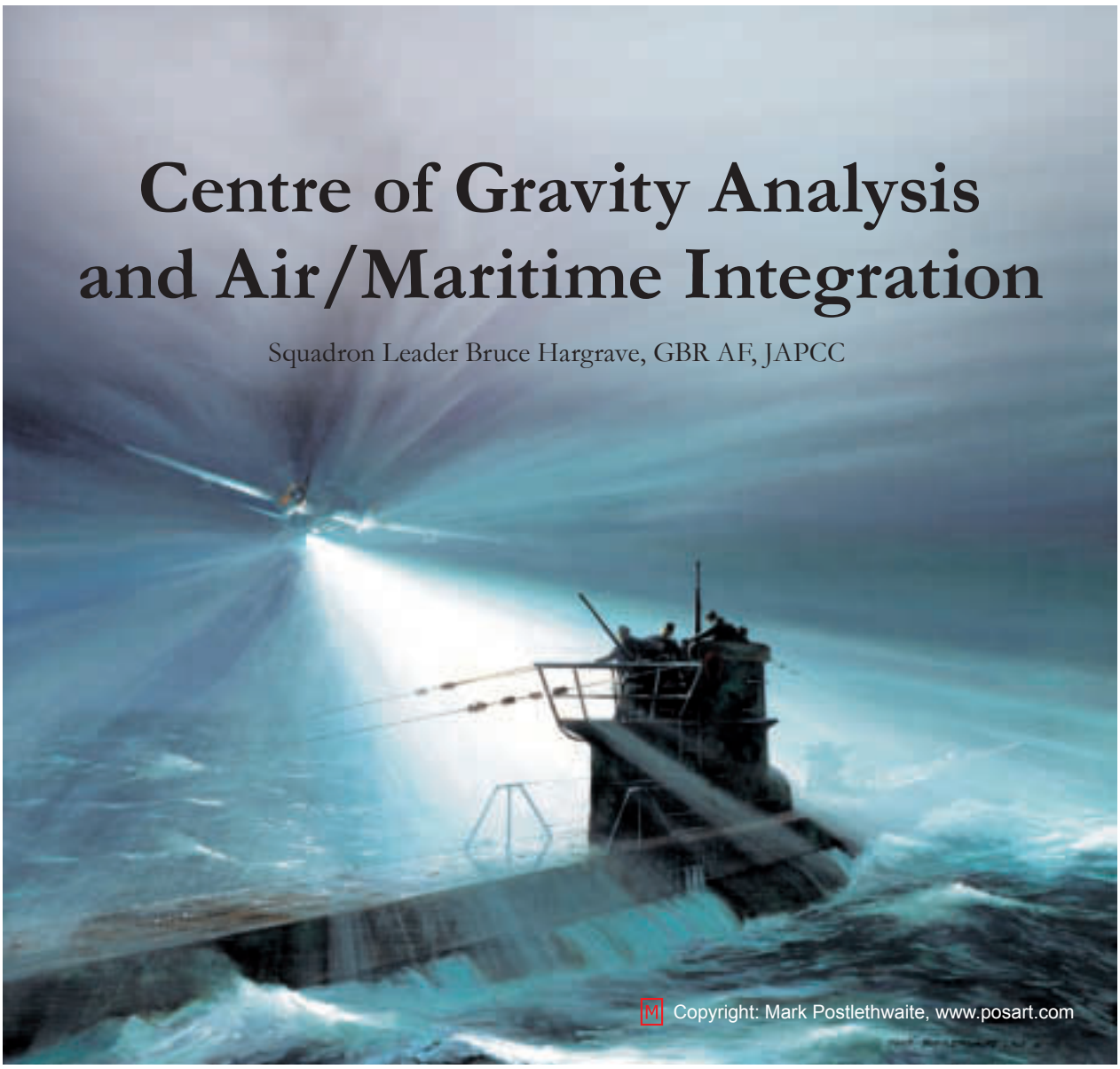
Conclusion

Although the shortage of airlift capacity for NATO and EU should be somewhat mitigated in the future with the arrival of new and better capabilities such as the A400M and C-17, nations will still rely on the civil 'spot market' for peak requirements. Pro-active, coordinated planning of existing airlift capacities is vital to optimise the utilisation of the available capacity. Coordination centres play a pivotal role in achieving this goal, but the current set up is inadequate. Integration or collocation of these centres or, at the very least, the creation of a virtual network of building blocks would be instrumental in guaranteeing that the right asset and the right capability for a specific job is tasked. Inefficient use of available capacity (spare capacity, empty cargo bays and empty legs) is just not affordable for nations and their tax payers anymore.

1. Examples are the various NATO Summits where NATO launched multiple initiatives, many of them concentrating on enhancing the deployability and mobility of forces. Also the EU launched comparable initiatives like the European Headline Goal and the Air Rapid Response Concept.
2. Other programmes include the USA C-5 update and the UK Future Strategic Tanker Airlift (FSTA) programme and widespread procurement of (particularly for tactical airlift) the C-27J.
3. The 7 nations working together in the EAG are Belgium, France, Germany, Italy, the Netherlands, Spain and the UK. Norway joined these 7 nations within the EACC/EAC in 2003.
4. ATARES TA; Air Transport and Air-to-Air Refuelling and other Exchange of Services Technical Arrangement. This TA provides a compensation system to achieve a balance of exchanged services in such a way as to avoid compensatory financial payments. It enables the exchange of flying hours, based on the C130 Flying Hour as an agreed equivalent value unit of exchange.
5. Belgium (7), France (50), Germany (60), Luxemburg (1), Spain (27), Turkey (10) and the UK (25); in addition also Malaysia and South Africa are procuring the A400M.
6. The EATC was proposed by the European Airlift Study as a further evolutionary consequence of the EACC/EAC, but not all EACC/EAC participants could agree on its further development. The EATC is not in existence yet, but an Implementation Management Team is currently preparing the ground.
7. Canada, Czech Republic, Denmark, France, Germany, Hungary, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and Turkey.
8. Bulgaria, Estonia, Finland, Hungary, Lithuania, Netherlands, Norway, Poland, Romania, Slovenia, Sweden and the USA.
9. Rather than an MOU based organisation, such an entity should at least be an Intergovernmental Agency (IGA).

Centre of Gravity Analysis and Air/Maritime Integration

Squadron Leader Bruce Hargrave, GBR AF, JAPCC



Recent operations have made the air and land components look again at the lessons learnt in the major conflicts of the previous century and air/land integration is a phrase that has re-entered the military lexicon. With a large part of the world's surface covered by ocean, it may be as well to reflect on similar lessons learnt at the other environmental interface – that between air and maritime. The vital role of air power in attacking an enemy's critical vulnerabilities and, indeed, in protecting our own is well documented. Confusion still sometimes exists, however, about centres of gravity. This article attempts to clarify this confusion and to draw out some lessons from history by identifying the vital part played by air/maritime (as opposed to air/land) integration in the Battle of the Atlantic.

Why Do Centre of Gravity Analysis?

Faulty analysis of friendly or adversary centres of gravity can have very serious consequences; specifically, the inability to accomplish the military objectives at an acceptable cost and the unconscionable expenditure of lives, time and materiel in efforts that do not produce decisive strategic or operational results.

JP 5-0, Doctrine for Planning Joint Operations (USA)

This quote gets straight to the heart of the matter – if the analysis is wrong, more lives are lost.

Problems with Existing Models

As discussed earlier in this journal, Dr. Joe Strange's 1996 Centre of Gravity model is for general use and, used properly, will aid Centre of Gravity (CG) analysis. Strange defines CG as 'primary sources of moral or physical strength, power and resistance.' These, in turn, generate **Critical Capabilities** (CC). The essential resources (or means) for the CC to work properly are the **Critical Requirements**

Strange's Four Box Model

Centre of Gravity (CG)	Critical Capabilities (CC)
Critical Requirements (CR)	Critical Vulnerabilities (CV)

(CR). If any of the CR are lacking in some way, or if they are vulnerable to attack, then they may also be **Critical Vulnerabilities** (CV). The model is perhaps best explained by way of an example; one will follow shortly.

When problems occur with the use of Strange's model, it is often because the analysis does not properly 'bound' the problem being examined – i.e. it looks at too broad or too narrow a situation.

Poor application of the model can be further compounded because:

- Confusion exists between what is a CV and what is a CG.
- The actual definition of CG in doctrine can serve to confuse and, in some cases, is wrong.
- Doctrinal direction that ties a CG to a level of warfare (e.g. to the strategic or operational level) can sometimes hinder rather than help the analysis.

Better Definition

The first two problems are connected. The confusion that exists about what a CG is and what a CV is gets compounded by their apparent interchangeability in some texts and by some rather broad definitions. For instance, the NATO definition in AAP-6 states that CGs are: 'characteristic(s), capability(ies), or locality(ies) from which a nation, an alliance, a military force or other grouping derives its freedom of action, physical strength or will to fight.'

The German navy was able to sink large numbers of merchant ships.

In attempting to give the broadest possible definition, the NATO definition only serves to confuse. A brief look at Strange's 4-box model explains one reason why. A CG gives rise to, or enables, one or more CC. The CG is not, itself, the capability. The CG is a noun and the critical capability is a verb or 'the ability to do something.' The NATO definition also suggests that a military force will have a CG, but appears to discount the possibility that the military force itself can be a CG.

Strange's definition (given earlier) allows for a military force to be a CG because, in accordance with his 4-box model, the CG is the power source that creates one or more CC that, in turn, allow us or our enemy to accomplish a task or purpose. Eikmeier (2004) further simplifies this so that his definition becomes: 'A system's source of power to act.'

Eikmeier's use of the word 'system' is crucial here. Whether the analysis is of our own or an enemy's CG, it is always the analysis of a system. Additionally, that system is striving to achieve something and it may be useful to call that 'something' an end state. Incorporating this into the definition, it becomes: *A system's CG is the source of power that may enable it to achieve a desired end state.*

The word may is used here because the opposing system will, predictably, act to prevent the achievement of that end state.

Value of End States

Thinking in terms of an end state is of great use in conducting a CG analysis. Consideration of the desired end state enables the analysis of the problem to be kept within bounds and prevents those

doing the analysis from looking either too narrowly or too broadly at the problem. Such an approach is demanded by NATO's Effects Based Approach to Operations (EBAO), where actions are only undertaken in order to produce desired effects. These effects then lead to objectives being accomplished and, in turn, to the achievement of the end state. End state, or outcome-based thinking, is also one of the guiding principles of the Comprehensive Approach.

We can usefully consider an example here – the Battle of the Atlantic in the Second World War – and use it to illustrate the model and develop the theme of air/maritime integration. Throughout the Second World War, the UK relied on supplies of personnel, fuel and materiel coming across the Atlantic Ocean from Canada and the US. The German navy was able to sink large numbers of the merchant ships transporting these vital supplies. From this, it would seem that the desired end state of the German navy was to deny the UK sea supply route from Canada and the US. Clearly, the ultimate end state of the German navy was to win the war against the Allied powers, but this was an end state that it shared with all other elements of German military and national power. By bounding the 'problem' – the Battle of the Atlantic – with the first end state – the denial of the UK sea supply route, we can start to focus our systems analysis.

Next, we need to consider what constitutes the 'system' that was the German navy in the early 1940s. Although not exhaustive, elements of the system might be:

- Major surface ships (Admiral Sheer, Bismarck, Hipper, Scharnhorst etc)
- U-boats

The German U-boats were the critical source of power in the Battle of the Atlantic.

- Long Range Aircraft (Focke-Wulf Kondor)
- Sailors and airmen
- Port facilities
- Communication systems
- Doctrine and training
- Belief in the cause

Using Strange's 4-box model, adapted to include end state, we have to ask what the CC are that may enable the German navy to achieve its desired end state. One CC would be the ability to sink Allied merchant shipping in great numbers. The source of power that enabled it to do this was the U-boat force.

In discounting major surface ships as the navy's CG, we may consider that, modern and well armed as many of them were, their ability to sink large numbers of merchant ships was severely hindered by their vulnerability to detection and attack from the air. The role of airpower in defeating heavily armed surface ships in the Second World War is overwhelming. Despite the Bismark's impressive potential (e.g. sinking the Hood in a brief engagement), it must be remembered that her break out into the Atlantic in 1941 was detected and tracked by a combination of land-based aircraft and surface ships and that organic airpower delivered the blow that slowed her progress sufficiently for the British Navy to catch up and destroy her. The vulnerability of battleships at sea to airpower was a painful lesson repeated on numerous occasions, not least the sinking of HMS

One CC was the ability to sink Allied merchant shipping.

Enemy C of G analysis for the Battle of the Atlantic
End state – deny UK supplies from USA/CAN

Centre Of Gravity The U-Boat force	**Critical Capabilities** Ability to sink Allied merchant shipping in great numbers
Critical Requirements Port facilities, intel on shipping movements, remain undetected, fuel and weapons	**Critical Capabilities** Ability to sink Allied merchant shipping in great numbers

Prince of Wales (and the battle cruiser HMS Repulse) by Japanese aircraft later that same year.

So, having established the U-boats as the CG, our analysis will look like the diagram above.

Hindsight, of course, is a wonderful thing and makes the analysis considerably easier than it would have been at the time. U-boat communications were targeted via radio intercepts decoded by Enigma code breakers and these formed the *Ultra* intelligence source. The U-boat requirement to remain undetected was countered by, amongst other things, airborne radar, long range aircraft equipped with Leigh lights to facilitate night attack and surface escorts for convoys fitted with ASDIC (later SONAR) radar. The (eventual) joint approach to anti-submarine warfare was key to the defeat of the U-boat threat. Convoys protected by ASDIC equipped escorts were a part of the answer, but it was not until airpower was integrated into both planning and execution that the tide of the battle turned.

The U-boat port facilities, whilst a critical requirement, were heavily protected both by reinforced concrete pens and by large numbers of anti-aircraft guns. So, whilst aircraft and aircrews were expended attacking U-boat port facilities, once the reinforced concrete pens were completed, they were relatively invulnerable to the aircraft and air-delivered weapons of the day.

The important point here is that only those CR that are deficient in some way (or open to attack) can be CV. The value of a thorough CG analysis can be further illustrated here by considering the use of airpower in the Battle of the Atlantic. Calls in the UK for long range four-engined bombers to be used in the maritime patrol role were resisted by the Air Force, who argued that their use in the strategic bombing role was paramount. Instead, until much later in the battle when Long Range Maritime Patrol Aircraft began to come on the scene, the twin-engined, shorter range aircraft shouldered much of the burden. Unfortunately this meant that, outside their range from the UK mainland, the U-boats had nothing to fear from land-based aircraft.

Conventional doctrine usually suggests that a CG resides in one particular level of warfare. UK doctrine, for instance, until quite recently acknowledged just four centres of gravity: two at the operational level (one each, for own and enemy) and one each at the strategic level, again for own and enemy. This has since been brought more into line with US doctrine, which allows for multiple CG and also acknowledges that they may exist at the tactical level. However, most doctrine still ties a CG to a discrete level of warfare. Looking at the example above, it could be argued that the U-boat force was an operational CG. However, had the U-boat force achieved its end state, the effect would have been a strategic one – the probable defeat of the UK. Trying to tie a CG to a specific level of warfare from the outset can confuse the issue and hamper the analysis. The potential for tactical actions to produce strategic effect continues to suggest that the accepted hierarchy in the levels of warfare is an oversimplification and may need rethinking. ■

References

Eikmeier, D.C., 2004. Center of Gravity Analysis. Military Review, Jul – Aug 2004, pp. 2–5.

Strange, J. 1996. Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language, Perspectives on Warfighting Series 4, 2nd Ed. Quantico, VA: Marine Corps University Foundation.

Exposing Gaps in NATO's Air and Space Training Environment

Colonel David Pedersen, USA AF, JAPCC

NATO's future strategic environment points to an increasing requirement for combined (multinational) and joint (multi-service) forces to accomplish the full range of missions. NATO training must, therefore, be tailored accordingly to enhance interoperability and standardisation.

Currently, basic training policy dictates that NATO trains headquarter staffs and Member Nations train their forces.[1] Clearly, this policy itself could lead to potential training gaps that, if significant, should be addressed to improve the efficacy of NATO's overall training environment. While the best integration and improved standardisation come from combined/joint training ventures, this article will narrow the scope to examine Air and Space training, albeit within its contribution to the wider environment. It will examine the complexity of training in NATO with regards to Air and Space Power and highlight any obvious gaps in NATO's Air and Space training environment. The article will then offer thoughts on the development of a framework for future study and debate. Exposing gaps in training could lead to better unity of effort between multiple NATO staffs and organisations dedicated to managing various training programs. This could further lead to the development of a roadmap for training improvements as well as a prioritised list of recommendations to best address these improvements.

To begin, what do we mean by a training gap? We train to fight; we train to be effective when our skills are needed in a real operation. Real operations range from the very simple to very complex combined/joint operations. It's not the simple tasks that we are talking about here. It is the complex tasks of integrating Air and Space Power into the larger joint fight. At its core, training is about integration; so, it follows that a training gap is where NATO's (and member Nations') training effort has delivered sub-optimal integration. Also, unless otherwise specified, 'training' refers to proficiency or continuation training (rather than initial qualification training), as well as exercises designed to enhance proficiency and integration. Here is a practical example of what a training gap looks like.

Air-Land Integration

At the seam between Air and Land power is Air-Land integration. Nothing exposes gaps in this integration more than dropping weapons that you thought were near friendly troops only to find out that the weapon killed several of your own people. There is considerable trust and responsibility placed on the NATO Forward Air Controller (FAC) to pass the right information and for the Close Air Support (CAS) pilot to cross check this data before weapons release. It's a team effort. Oversimplified in this example, but

a fratricide investigation reveals the complexity of the problem. FACs and CAS pilots need to be 'on the same page.' If some nations use a 15-line coordination standard while training FACs but the CAS pilot uses a 9-line standard, there's a potential problem when FACs trained to one standard have to integrate with CAS pilots using another. Similarly, if FAC training is not sufficiently robust and comprehensive, and he does not understand the full range of aircraft or weapon capabilities or does not have the right equipment, the complexity of the problem, and the gap increases. The FAC is the critical link in this Air-Land integration scenario; he has weapons release authority with his 'Cleared Hot' call. To be on the 'same page,' training standards must detail the minimum competences required to obtain and maintain FAC qualifications. This is where NATO standards can specify how member nations train their forces (the FAC in this case) for combat.

Sadly, the above scenario was played out in 2006 and the investigation pointed to a gap in FAC training and listed several recommendations to improve the integration between CAS procedures and FAC training.[2] Many of these improvements have been implemented. While this vignette is not intended to flush out the details, it highlights that if this gap had been indentified earlier, the most critical of the improvements could have been implemented and potentially this type of incident avoided.

Training Gaps

Gaps in training begin with the nature of NATO and its training policy. As mentioned, NATO trains HQ staffs, Nations train forces. In a perfect world, there would be unity of effort across the Alliance and Nations would play an equal and shared role. However, a recent study on the NATO training environment concluded that NATO lacked unity of effort in this area.[3] The Alliance, for lack of a better word, 'advises' the nations on what they should do. Nations, having first, their own interests, and then the interests of the Alliance, interpret and adhere to these standards differently. Some of this advice comes in the form of Standardisation Agreements (STANAGs), Allied Joint Publications (AJPs), Strategic Commander Directives and Force Standards. These documents constitute the essence of NATO Doctrine and are promulgated through Member Nations for consensus. Consensus can, for the best of reasons, result in compromise, which does little to ensure that doctrine offers best military advice and practice. Here lies the crux of the problem, the consensual nature[4] of NATO has an imbedded gap in the standards that it uses as the main tool to tell nations how to train their forces. So, on one end of the training spectrum is NATO training the staff elements and headquarters to operate under a given set of command and control procedures. On the other end of the spectrum are the Nations training the forces that are inevitably destined to be commanded by NATO Staffs and Commanders. For Air, as well as for other components, there is arguably a built in training gap when it comes to NATO operations.

'Cleared Hot!'

This leads us to a process for what to do when a training gap is exposed. Generally, when NATO has a problem with training standards, a corresponding change to the doctrine associated with that training emerges. In the CAS-FAC scenario, NATO added a list of minimum essential training tasks and minimum equipment list, among other things, to STANAG 3797 (Minimum Qualifications for FACs); it also updated the AJP on CAS procedures to close some of the training and procedural gaps. The question, nevertheless, remains *how do we proactively expose a training gap before something fails or someone is hurt*?

NATO Task List

NATO uses a set of seven Essential Operational Capabilities (EOCs) as a broad structured approach for organising tasks. These EOCs are further broken down into levels of operation and levels of command. There is a loose strategy-to-task relationship in this breakdown. There are several key concepts that feed this linkage and together they lead to a source document known as the NATO Task List (NTL). The NTL is a comprehensive hierarchy of joint and combined missions and tasks at the strategic, operational, and tactical levels based on Military Committee (MC) guidance.[5] Using this as part of the approach, a JAPCC study is underway to review, identify and expose gaps in NATO's Air and Space Power training. This should lead to a roadmap of where we are today and how to fill some of the gaps over time using NATO doctrine to fix the problem.

By looking at the tasks that NATO asks Nations to perform and reviewing NATO Airpower doctrine, we can build a framework for exposing training gaps. Some initial investigations show that potential gaps exist in NATO current operations with regards to Air's contribution to irregular warfare in ISAF compared with the Force Standards used to evaluate nations during Tactical Evaluations (TACEVALs). The latter standards are designed for major force on force operations and procedures reminiscent of the Cold War. In particular, part of this study will focus on the use of kinetic versus non-kinetic activities, whether we have the issue in balance and how NATO members train in the non-kinetic sphere. Furthermore, we are hopeful that a structured framework for exposing gaps, coupled with a roadmap analysis, could lead to a better understanding of the growing need for various types of simulation and the increased complexity that it brings

'... exposing these gaps [in training] on the battlefield, is too high a price for the Alliance to pay!'

to the joint training environment in the form of Live-Virtual-Constructive architectures. The Space side of our domain is also a challenge, given that experience in Space Operations really only exists in a few nations and NATO has little doctrine to guide its use of Space assets. Currently, Space awareness and training is nationally driven, although the Joint Warfare Centre recently introduced Space issues into NATO HQ staff training. Nevertheless, outside this relatively small catchment, only those nations with Space assets will be party to how this important area can make a difference on operations – another example, perhaps, of the Nation/NATO training divide? Another area that would appear to currently tax our training and exercise planners is Unmanned Aerial Systems (UAS); only through familiarity in training will operators understand how to integrate and optimise the performance of these increasingly important assets.

Summary

The purpose of this article, however, is not to build a litany of despair, but to show that gaps exist and to establish the need to build a framework to study the issue. Such a study would also need to explore strategies to evaluate the effectiveness of the doctrinal process as well as other NATO tools used to enhance the training environment; in particular, the NATO training schools and curriculum as well as major exercises and organisations specifically geared for training Air and Space Power. It is clear that NATO is a large complex organisation and its training environment is equally complex. The nature of NATO consensus increases the possibility that training gaps may emerge and need to be studied and discussed in order to reduce or mitigate operational risks. We would contend that the alternative, exposing these gaps on the battlefield, is too high a price for the Alliance to pay!

If you have more thoughts on this subject, please don't hesitate to contact the JAPCC. You can find us on the web at www.japcc.org. ■

1. NATO, Military Committee, *MC 0458/1 NATO Education, Training, Exercise and Evaluation Policy*, 13 March 2006, this policy document is currently under review to reflect changes in the training process and terminology.
2. NATO, Bi-Strategic Command, *Bi-Strategic Analysis Lessons Learned Report*, This report summarised the observations, recommendations and status of the efforts to prevent fratricide in NATO operations.
3. International Solutions Group, Limited, *NATO Education, Training, Exercises, and Evaluation (ETEE) Study Part II Report*, 20 January 2009.
4. Nature implies something permanent that can not be changed.
5. NATO, Bi-Strategic Command, *Bi-SC Directive 80–90 NATO Task List*, 7 November 2007.

Replacing the Main Battle Tank

The Case for The Attack Helicopter

Major Gianmaria Cianciolo, ITA A, JAPCC

There is no other weapons system, save perhaps for the fully equipped infantryman, that has the potential of the attack helicopter to contribute across the complete spectrum of conflict, from peacekeeping operations to general war, in such a predominant manner.

General Sir Charles Guthrie,
Former Chief of the British General Staff

Main Battle Tanks (MBT) evolved from WWI, when something was needed to protect the lives of infantrymen in contact with enemy forces. Since then, they have become the backbone of Land Force operations and their use has dominated the development of manoeuvre tactics to defend, attack and to hold ground. However, modern precision anti-tank weapons are capable of 'killing' tanks relatively easily and recent experience in Afghanistan has revealed that MBTs provide only limited force protection against even primitive roadside bombs. Moreover, in modern conflict, when agility is a primary aim, MBTs are relatively slow in manoeuvre, bulky, extremely heavy and challenging to deploy by sea or air; they need massive logistic support arrangements and, even then, they struggle with serviceability. Contemporary attack helicopters, on the other hand, offer modern technology and serviceability, and equivalent or better fire power to MBTs; they are also fast, agile and, by comparison, easy to deploy by air or sea. **Is it feasible then, that the attack helicopter could replace the MBT in land warfare?** To answer this question, we need to look in a little more detail at the development and operational employment of attack helicopters.

What do we mean precisely when we talk of 'attack helicopters?' Doctrinal publications and specialized magazines offer numerous definitions, but the military environment frequently uses the generic term 'armed helicopter.' However, attack helicopters and armed helicopters are quite different. Attack helicopters have been designed and built to meet fire support requirements; while 'armed helicopters' are those that were originally designed for utility, escort or recce purposes, but which have been armed later with different weapons to fulfil an operational need.

Evolution

The evolution of the Attack Helicopter starts from the army's need for the right instruments to conduct several ground operations. The first step forward was made during the Korean War, when helicopters for general-purpose were modified to carry weapons. But it was the Vietnam War, which gave the biggest push to develop the first purpose-built attack helicopter, the AH-1 'Cobra,' for use in Close Air Support and Escort.

During the late 1970s, the US Army saw the need to provide attack helicopters with all weather capabilities. The Apache, a twin-enginew army attack helicopter developed by McDonnell Douglas, was selected and entered service with the US Army in 1984. Soviet helicopters went through a similar evolution. Starting with adding rockets and machine guns to MI-8 troop transports, they soon progressed to a dedicated design, the Mil Mi-24 Hind. Both of these helicopters have subsequently been used in various conflicts, mostly in the infantry support role.

With the helicopter gunship concept now battle-proven, more advanced attack helicopters were developed in the early 1980s. The US fielded the AH-64A Apache and upgraded AH-1 Cobras, while the Italians developed the A129 Mangusta. The 1990s could be seen as the age of maturity for the attack helicopter. They were used extensively during major operations with great success in both their operational roles: to direct attack against enemy armour and as aerial artillery in support of ground troops. When the Soviet Union crumbled at the end of the 1980s, the need for attack helicopters may have been in doubt, but Operations ENDURING FREEDOM and IRAQI FREEDOM put any doubts to rest, as fleets of Apaches and Cobras, in concert with fixed wing aircraft, proved their effectiveness against Iraqi armour in the open desert.

Roles

But what are the roles of attack helicopters and missions in which they can be involved now?

Attack helicopter roles and missions can be broadly divided into 4 areas:

- **Raids.** Attack helicopters can be used to destroy specific targets by conducting raids against the enemy. The target must be located in advance of the mission and continuously tracked because at the limit of its range, the attack helicopter has little endurance left for manoeuvre to search and find the target. Attack helicopter raiding can be used as a combat support capability not only for the Land Component Commander, but also in conducting raids in support of the Air Component Commander (e.g. Suppression of Enemy Air Defences) or the Maritime Component Commander (e.g. advanced force operations).

- **Manoeuvre.** Attack helicopters are also ideally suited to the conduct of ground-related manoeuvre missions, which require both a relatively long-term presence and operational endurance to achieve the effect. These missions include screening, guarding, delay, meeting engagement, seizing of key terrain (with all arms air manoeuvre units), the denial of ground, flank security, and protection of road moves. All these missions require the ability to find, fix and strike while manoeuvring in response to a manoeuvring enemy.

- **Reconnaissance.** Although primarily used for attack missions against enemy armoured forces, attack helicopter units can be used for reconnaissance. The ability to move quickly to areas of interest and then use their integral optics and sensors enable attack helicopters to provide timely intelligence across the area of operations.

- **Additional Roles.** The range of weapons and sensors carried by attack helicopters makes them suitable for a wide range of tasks in addition to those given above. Support to Combat Search and Rescue and special operations, protection of other helicopters, cueing of fixed-wing aircraft and demonstrations of force or intent are but a few; many are particularly relevant in non-Article V crisis response operations.

Since their inception, attack helicopter operations have diverged into two distinct categories, Air Interdiction and Close Air Support (CAS). Both operational concepts have been called different names and taken various forms and interpretations but CAS, or aerial fires in direct support of ground forces, remains a primary application.

Air Interdiction and CAS missions both involve using aircraft to attack targets on the ground, but they differ mostly in where the targets for each mission are located on or around the battlefield. In conventional conflict with two field armies meeting on a frontline, interdiction usually occurs well behind the collision of forces and outside the range of most weapons organic to

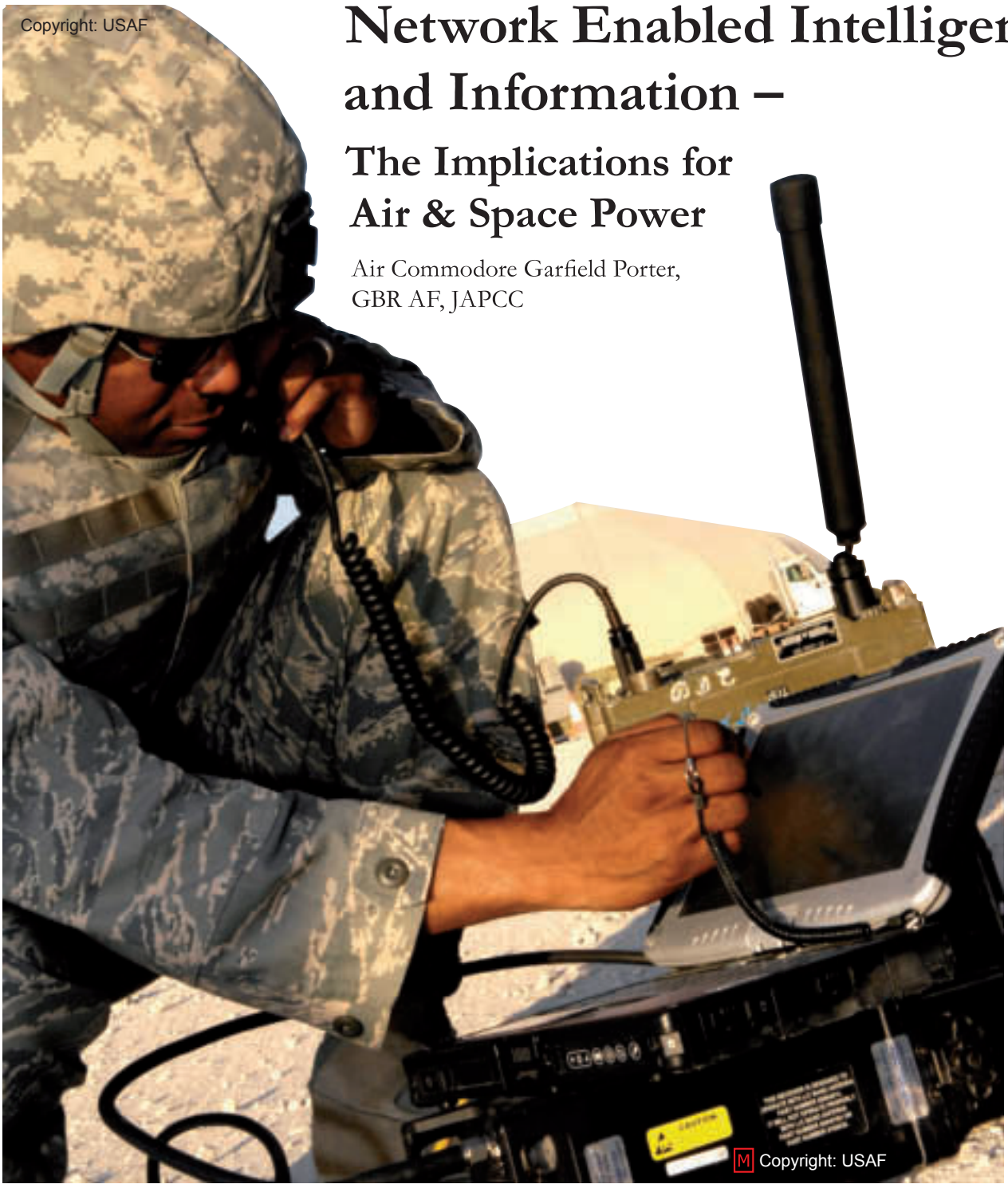
'... the backbone of Land Force operations ... to defend, attack and to hold ground.'

ground combat, while CAS occurs where the forces actually meet. Moreover, in non-conventional conflict, even though a traditional frontline may not be evident, there are usually areas in which forces are able to operate without significant interference from the other side's ground forces, so attack helicopters could still be employed in either CAS or Air Interdiction roles.

While CAS has stood the test of time (Operations DESERT STORM and IRAQI FREEDOM) for attack helicopters, Air Interdiction is more problematic. Attack helicopters, despite their unique capabilities, have inherent limitations due to the problem of aircraft survivability against a robust low-altitude air defence. Whilst attack helicopters in a CAS role face similar problems, direct integration with ground forces will often mitigate the issue. Safe areas for loitering, and improvements in survivability equipment allow the attack helicopter to continue as a successful CAS platform across a range of conflict. Therefore, from lessons learned and doctrine of the Western countries, the opinion is that attack helicopters are most suited to perform CAS while their employment in air interdiction is more problematic and may be better suited to fixed wing aircraft. Moreover, once they have attacked forces occupying a piece of territory, attack helicopters, on their own, struggle to occupy that land. This can only be achieved by land-based forces, who will always need the best available force protection facilities, and will be conditioned by a force's ability to control the air overhead.

'... the days of the battle tank are not completely over – but the future will undoubtedly see their numbers dwindle.'

Applying lessons learned and doctrine of the Western countries, this author's opinion is that attack helicopters are most suited to perform CAS while their employment in interdiction is more problematic and may be better suited to fixed wing aircraft. Moreover, once they have attacked forces occupying a piece of territory, attack helicopters will struggle to occupy that land without support. This can only be achieved by land-based forces, which will always need the best available force protection facilities. Therefore, the days of the MBT are not completely over – but the future will undoubtedly see their numbers dwindle. Attack helicopters provide the Commander with a weapon system that can operate on the complete spectrum of conflict: from peacekeeping operations to all out war. ■



Network Enabled Intelligence and Information –

The Implications for Air & Space Power

Air Commodore Garfield Porter, GBR AF, JAPCC

Although modern military thinking frequently refers to Intelligence and Information (I2), the distinction between them is far from clear. Of particular interest is the way, and by whom, each is processed and delivered to Commanders. APP-3 defines information as '*unprocessed data, which when concerning an adversary may be processed into Intelligence.*' This article contends this definition is at best unhelpful and more likely plain confusing; what for instance is processed data about anything but an adversary? And why is data given a higher order meaning than information? Consequently, this article assumes that Intelligence is processed data concerning an adversary and Information is processed data regarding everything else.[1] So in process terms, both deal in a similar currency, albeit Intelligence tends to draw caveats over its use.

The problem is that any network enabled, effects based approach requires information on enemy, neutral and friendly players to be presented in harmony, with a rich understanding of each contributing to provide knowledge (even wisdom) regarding the

pursuit of any desired end-game. Moreover, it must do this in such a way that accommodates the reality that information (sometimes in a partially processed state) will, through networking, be available to many in the command chain who will have different transient priorities, albeit in pursuit of a commonly agreed goal. This article aims to explore the changes that could be demanded of our I2 processes in such a future construct and their potential impact on the Air environment.

The Media Model

The Media (particularly TV) has been forced to address many of these issues over the past decade and, arguably, will continue this journey as the true implications of the Internet unfold. Not so long ago, news reporters collected their information and filed it to their broadcasting authority, who perhaps twice a day compiled, assessed and delivered 'the News.' Today, we have 24-hour news coverage and reporters in the field reporting directly to our homes. This means we now receive, at best, practically raw data (vice information), processed by a reporter's potentially limited perspective based on a localised view. If that view is misinformed, it may get updated in the studio, but only after verification in the equivalent of a periodic editorial summary. Beyond that, weekly (or occasional) programming will deal with the emergence of trends and deeper analysis. In the interests of credibility, any misperceptions by the field reporter will be corrected, but such corrections will often fail to capture the impact of the original post. It is also difficult (if not impossible) for the Media to avoid this situation, given that the commercial pressure to report live and fill a 24-hour schedule is overwhelming.

'The trick is to ensure that higher level I2 is available to those who need it, while tactical I2 is retained to contribute to more than the immediate fight, and in addition to the tactical information itself, any consequences of its tactical use are fed into higher level assessments.'

The other major change is the sheer variety of programming (information) available to all viewers, all of the time. Satellite television allows us to choose from literally hundreds of channels with programmes aimed at the widest of audiences (broadcasting in the true sense) through to those aimed at select minorities (narrowcasting?). From this, we get both the opportunity to either focus in on events of particular interest or to casually pick up on the atmospherics on any given day. Furthermore, the very fact that everyone gets a chance to view events means that details, which are often missed by the analysts, may get picked up.[2]

Future I2

This paper contends there are parallels between the Media experience and the delivery of information in our future effects based, networked world. First, through networking and Unmanned Aerial Systems (UAS), a lot more detail is instantly available at all levels. The number of Rover Full Motion Video (FMV) terminals in Afghanistan is substantial and growing all the time. In addition to those that view FMV from their networked PC terminals, the number of

'ISR assets for the contact battle should either be organic, or depending on priority, allotted from a pool to the tactical commander.'

Through networking and UAS, a lot more detail is instantly available at all levels.

customers, who can do the same in the field, is also rapidly growing. This latter group are, however, more like the field reporter than the viewer at home, in that they may have a tactical reason to do something immediately with the information at their fingertips. Depending on their interpretation of this information, such actions can contribute to the overall aim or add unintended consequences to the overall equation. Just like the newsman's dilemma between live and edited news, there will always be a tactical case for the former and the new reality will involve assimilating and mitigating the outcome.

So, just like the News media, there may be 2 types of I2 – that which we react to immediately and that which is subjected to a more considered analytical approach. It might be argued that the former is tactical and the latter operational/strategic I2. Put another way, we should configure our efforts to provide tactical I2 to forces engaged in the contact battle and higher level I2 to those conducting the deep battle and beyond. The trick is to ensure that higher level I2 is available to those who need it, while tactical I2 is retained to contribute to more than the immediate fight, and in addition to the tactical information itself, any consequences of its tactical use are fed into higher level assessments.

It would follow from this that Intelligence, Surveillance and Reconnaissance (ISR) assets for the contact battle should either be organic, or depending on priority, allotted from a pool to the tactical commander, and that higher level I2 should be orchestrated at the appropriate strategic/operational, and by definition, Joint or even Political level. Indeed, the latter might be an insight into the division of responsibility for further breaking down the use of valuable strategic ISR assets. This would certainly provide a reasonable template for nations to deliberate over the environmental ownership of ISR platforms, particularly as UAS continue to proliferate.

Fusing Intelligence and Information

It follows from this approach that non-tactical I2 is largely the product of service provision and can be fused in an organised manner, whereas tactical I2 may need to be fought for as it is being collected in and for the contact battle. Moreover, tactical I2 is more likely to be perishable and, due to that characteristic, made up of more disparate data. Consequently, this author would propose that priority be given in process and technology terms to fusing higher level I2 and Tactics, Techniques and Procedures developed to optimise the capture and fusing of tactical flows.

At the higher levels, this will place a premium on Commanders to not only understand the Information Management (IM, but perhaps it should be I2M) structure in place, but also to shape it to meet the needs of the operation. In short, it is a Command-led business. If the right assessments are to be delivered, the right information must be available and flow as required. Not only will national caveats need to be overcome, but cross-environmental boundaries eliminated wherever possible. None of these potential speed bumps should be un-navigable, but neither should we assume they will be mitigated through wishful thinking. That said, adopting a tactical/higher level I2 approach could place both the responsibility and accountability for delivering and passing on I2 at the right levels and should, at least, make the linkages clearer.

Live Tactical I2

One of those linkages will involve a vastly increased access to live I2 across the Battlespace; we already see this today with FMV feeds routinely displayed in CAOCs. Furthermore, as we continue to roll-out the means to receive and view FMV (and live chat), it is inevitable these new recipients will look for innovative ways to utilise it. In its most obvious form, this will be in the way it is currently intended – FMV to support the task at hand. However, it is clear that the numbers able to receive a picture or data will soon (actually, probably already do) exceed our ability to

provide dedicated support. So if dedicated support can be seen as 'narrowcasting,' should we also look to provide 'broadcasting' to allow those with the time and interest to pick up on the atmospherics of adjacent or specific areas of interest? Something akin to satellite TV programming comes to mind here, where those with the right viewing cards (a need to share equivalent?) can scan through available channels looking for FMV of direct or indirect interest. We could, then create a chat site for each of the channels, perhaps moderated by an I2 professional. Thus, we could establish powerful Communities of Interest genuinely geared to the atmospherics of the battle, who just might spot the anomaly in the crowd that would otherwise be missed.

Implications for Air and Space

The JAPCC has argued in other papers[3] that Air and Space (A&S) Power activity falls into 3 broad categories: Joint Enabling, Control of A&S and Deep Persistent Operations (DPO). The first involves co-ordinating activities to support the surface environments in their Close Battles. The second, to co-ordinate the support of the other environments in winning A&S' Close Battle. Finally, DPO is A&S' contribution to the Joint Commander's fight for the Deep Battle. In I2 terms, the 3rd dimension through UAS, manned aircraft and satellites will have much to offer all 3 categories.

Furthermore, the distinction mentioned earlier between tactical and higher level I2 could be neatly matched to these areas of activity. ISR assets for Close Battles would be either organic (for example, an AEW aircraft supporting Control of A&S) or allotted (a fast jet with electro-optical pod supporting a land action as a Joint Enabler), the latter being tasked based on agreed Joint priorities. These priorities would, in turn, compete with the Joint Commander and perhaps, even higher authority's requirements for Operational and Strategic level I2. Indeed, it is quite possible that, in co-ordination terms, the strategic nature of Space-based assets would be reinforced through this approach.

The important point is that any user of tactical I2 would be responsible for not only passing the tactical product into the higher level structure, but also highlighting any 2nd degree information (unintended consequences) from any subsequent tactical action. Similarly, higher level command would need to ensure the best overall I2 provided the backdrop for tactical action, and that the allotment of Joint ISR assets was tailored to best meet the overall plan. The achievement of such an approach should then herald an I2 structure, which caters for a 24 hour/day operational tempo, whilst ensuring the view of the 'field reporter' was suitably dealt within the 'editorial' assessment. ■

1. Interestingly, the new NATO IM Policy document redefines Information as *Any communication or representation of knowledge such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual forms.*
2. A good example is something happening in a crowd at a sporting event that might have triggered a wider reaction, which is missed by the commentators, but picked up by a casual viewer.
3. *Inter alia*, NATO Future Air & Space Power, and Air & Space Power in Countering Irregular Warfare (both précised in JAPCC Journal, Edition 8).

FMV feeds (live tactical I2) are routinely displayed in CAOCs.

NEWS

Lt Gen Ploeger (Executive Director) and Gen Brady (Director) at the 2008 Joint Air & Space Power Conference.

JAPCC CONFERENCE 2008

The fourth annual conference of the JAPCC was held on 15th and 16th October 2008, in Kleve, Germany. The conference theme was 'Joint Air & Space Power – Decision Superiority in the 21st Century.' More than 230 high-ranking military officers and civilian delegates from NATO and other nations, academics from international universities and research centres and representatives of military industries came together to exchange information and knowledge pertinent to Joint Air & Space Power.

The conference was opened by General Roger A Brady (USAF), Commander, U.S. Air Forces Europe; Commander, Air Component Command, Ramstein; and Director JAPCC. In his opening remarks, General Brady discussed the recent achievements of NATO's Air and Space Power Centre of Excellence, aided in significant part by important contributions from last year's conference. As a direct product of the 2007 conference and related coordination, a paper on *'The Role of Air Power in Security and Stability Operations'* was published and provided invaluable support to air component staffs. In addition, ideas developed from the 2007 conference in the area of the critical application of command at all levels of air power, led to the publication of the 'NATO *Future Joint Air and Space Power'* paper. Moreover, core concepts from this had significantly shaped the 2008 conference panels. The *'NATO Space Operations Assessment'* provided numerous recommendations that, whilst not yet universally accepted, have continued to move the dialogue forward for a formal NATO policy on space.

Special Guest of Honour at the conference was General Karl-Heinz Lather (DEU [L]), Chief of Staff, Supreme Headquarters Allied Power Europe. In his keynote address, General Lather underlined the latest procurement programmes within the alliance. He noted that the integration of new capabilities in air operations needs to be further defined and it is Centres of Excellence, like the JAPCC, that are NATO's drivers for change and innovation in this area. The keynote address was followed by a presentation from Major General Koen Gijbers, ACOS C4I, on the subject of Allied Command Transformation's View on Decision Superiority. Air Commodore Garfield Porter, Assistant Director Transformation, JAPCC, then spoke on the subject of 'Air & Space and Decision Superiority in the 21st Century.'

Panel Discussions

Key areas for Joint Air & Space Power – Decision Superiority in the 21st Century had been identified and these formed the basis for the conference panel discussions:

- Panel 1 – Command, Control and Shared Situational Awareness.
- Panel 2 – Battlespace Management.
- Panel 3 – Space as a Critical Enabler of NATO's Operations.
- Panel 4 – Gaining Intelligence and Information Superiority.

While designed to focus on strategic and operational concepts and solutions, the panel discussions

understandably devoted a significant portion of time to ongoing operations. The Shared Situational Awareness, Battlespace Management, and Information Superiority topics invariably moved toward the challenges of applying these concepts in the challenging Air-Land Integration environment of the current conflict in Afghanistan. Concepts such at enhancing Mission Command at all levels and spreading enabling situational awareness to the lowest level brought questions and comments that made the continuing need for cross-service planning, exercising and execution more critical than ever if we are to see operational gains from technology. On the issue of Space as a critical enabler, most of the discussion and questions were focused on two areas; making space capabilities more accessible to all alliance and coalition members, and finding better ways to leverage space-based capabilities against dispersed less technologically-reliant adversaries.

In his closing remarks, Lieutenant General Friedrich W. Ploeger, Executive Director JAPCC, reaffirmed the aim of the conference to exchange ideas and opinions on enhanced situational awareness and using that awareness for better management of forces and the conflict. The panel discussions would help the JAPCC focus its thinking on concepts to enhance the use of Air and Space Power. Whilst Air and Space Power remains very relevant, ideas on its use and application need to continue to evolve and transform and there was a good deal of agreement on the main topics and capabilities that NATO now needs to tackle. LTG Ploeger stated that the JAPCC can and will continue to play an important role in the transformation of NATO Air and Space Power.

NATO SOF Air Forum Report:

In Sep 08, NATO Special Operations Coordination Centre (NSCC) held the 3rd annual meeting devoted to special air operations. Over 40 special operations airmen, from 13 member nations, gathered at JAPCC for debate and discussions concerning the future of special operations airpower. With a theme of 'Defining Future Requirement for Special Operations Aviation,' NSCC's goal for the conference was to define the way ahead for establishing NATO's special operations air and aviation capabilities.

NATO's Special Operations Forces (SOF) are going through a transition. Across the board, NATO SOF are improving their capabilities to accomplish traditional tasks of special reconnaissance and direct action, increasing capacities to conduct military assistance, changing organisational structures to meet expeditionary operations, and creating new doctrine to address the requirements of future conflicts. Nowhere is this transformation more dramatic than in NATO's special operations air and aviation forces.

According to Allied Joint Publication (AJP) 3.5, *Special Operations*, special air operations are defined as, … *activities conducted by specially organised, trained, and equipped air and aviation forces to support military strategic or operational objectives by unconventional military means in hostile, denied, or politically sensitive areas.* Within NATO, however, there is a wide disparity between the resources available to conduct special air operations – from nations with technologically sophisticated aircraft and highly trained, dedicated special operations aircrews to those nations whose assigned special operations aircraft and crews have little tactical, night operations capability. In order to support current special operations in ISAF and to prepare for future conflicts, the NSCC has begun efforts to help define the minimum capabilities required for designation as special operations air and aviation units. In addition, NSCC is acting as the focal point for new allied joint doctrine and procedural handbooks that will lead to increased capacity to support special operations ground and maritime units, while improving interoperability among the troop contributing nations.

One of the major issues dealt with during the conference was establishing common terms of reference for special operations air/aviation resources. The NATO Industrial Air Group (NIAG) briefed the results of their year-long study, *Requirements for Joint Personnel Insertion, Extraction, and Re-supply for Special Operations Aviation.* The study was an in-depth

2008 NATO SOF Air Forum at JAPCC.

examination of platforms, systems, and equipment solutions, looking at 4 areas of special air operations: aviate, communicate, navigate, and survive. The group concentrated on capability enhancements to meet current and near term special operations requirements. Any system and equipment solutions identified for future development were left for later studies. The NIAG Study identified 4 levels of capability categories for special operations aviation. Conference delegates envisioned the minimum level of platforms, systems, and equipment to be designated as special operations would be Category II. While this is a lesser capability than currently fielded by some nations, for many nations building to this level will require significant investment in equipment, personnel selection and retention, as well as training. The NSCC agreed to take on this challenge and include these categories in future Defence Requirement Reviews.

The second major issue to come out of the conference was a commitment by NSCC to lead an effort to produce an Allied Tactical Publication (ATP) for special operations aviation. This ATP, subordinate to the AJP 3.5, *Allied Joint Doctrine for Special Operations,* will address the organizational, procedural, and planning considerations of combined/joint special operations air commands (CJSOAC) and special operations air task groups (SOATG) in an expeditionary context. The conferees set the goal of a draft ready for review by Sep 2009, in time for distribution at next year's conference.

Throughout the conference, each nation described their current and projected special operations aviation capabilities. The wide range of equipment, training, and relationships with the ground and maritime SOF confirmed the findings of the NIAG study. Many of the nations attending the conference acknowledged the challenges they were facing as they worked within national processes to develop their special operations aviation capabilities and provide the capacity needed for ground and maritime SOF to be successful.

As a result of national briefings and extensive discussions, both formal and informal, it became obvious that NATO's special operations airmen had many more issues they wished to deal with; but they ran out of time in the two-day conference. Some of the challenges they identified are being worked behind the scenes, including establishing standards and common training programs for special operations terminal attack controllers, defining NVG illumination standards for special air operations, and investigating the possibility of a NATO special operations air wing, analogous to the NATO Airborne Early Warning & Control force or the NATO Strategic Airlift Capability. While these and many other issues were all endorsed as critical areas needing attention due to limited manning at NSCC and high operational tempo among special operations airmen, these issues were noted and will be addressed in future special operations air forums.

Nations Represented:
Belgium
Canada
Czech Republic
France
Germany
Italy
Netherlands
Norway
Poland
Spain
Turkey
United Kingdom
United States

2008's NATO Special Operations Air Conference was the most successful to date. The conferees set goals for themselves, with timelines established for agreed products, and with the NSCC assuming a leadership role to ensure the deadlines are met.

The next NATO Special Operations Air Conference is planned for September 2009. Location and final dates of this conference will be released to the national military representatives at SHAPE as soon as they are confirmed. For further information on the 2008 special operations air forum or to discuss issues related to NATO special air operations, Lt Col Cory Peterson (USA AF), NSCC/J7-Air, is the point of contact. He can be reached at cory.peterson@nscc.bices.org.

JAPCC Conference 2009

The annual JAPCC conference will take place from 13 to 15 October 2009 in Kleve, Germany.

NATO celebrates its 60th Anniversary in 2009 and the Alliance continues to transform with new members; better responses to security challenges and more deployable capabilities. NATO needs to further articulate and strengthen the vision of its role in meeting the evolving challenges of the 21st century and maintaining the ability to perform the full range of its missions, collectively defending the Member Nations' security at home and contributing to stability abroad. Air Power can significantly contribute to achieve these goals. For this purpose, the 2009 conference will include four main topics shaping the panel discussions:

Training & Exercising NATO A&S Power

Given uncertain strategic environments, NATO must train and exercise Air and Space forces to be prepared across the spectrum of conflict from humanitarian

operations to collective defence under Article V. These forces must be validated prior to deployment and be interoperable between services and coalition nations. Panel 1 of the conference will focus on the gaps in training and exercising A&S Power. Gaps are where NATO A&S forces are not fully interoperable between the training they conduct at the national level and the missions that NATO Operational Commanders expect once deployed. It is a classic 'do we train like we fight' argument. The panel discussion will look at potential gaps and consider emerging technologies and concepts to bridge these gaps and improve A&S Power's contribution to the joint fight.

Leveraging NATO's Common A&S Assets

Although most of NATO's Air and Space forces are maintained under National auspices, there are a growing number of Alliance assets that are pooled under multi-national arrangements. At the top end, there is ACCS and the CAOC structures, which will soon be fully integrated into the NATO Command Structure. Elsewhere, we have an impressive array of assets, from NAEW and SATCOM through to Air Transport and, potentially, Rotary Wing elements under varying degrees of C2 and governance. To this list AGS will soon be added. Against this backdrop, Panel 2 will be geared to exploring the various mechanisms in place for the use of these assets and how such use might be optimised for NATO's collective benefit.

Assuring a favourable Air Environment in Operations Short of War.

Air and Space is critical in an uncertain future where the world community seeks to counter terrorism and the proliferation of nuclear weapons. The aim of this panel is to inform the debate on how we assure a favourable air environment in the complex scenarios that NATO face both over NATO territory and in expeditionary operations.

In addition to Air Policing and No-Fly zone activities, the panel will consider how Air might contribute to the containment of both irregular adversaries and rogue regimes, as well as stabilisation and rebuilding in ungoverned space. The concepts and arguments will need to bear in mind the political and economic necessity for NATO military action and the legality of proposed Air activity. NATO commanders need to achieve operational freedom whilst building for the future and working towards an exit strategy. To this end, NATO Air and Space commanders' ultimate goal after an intervention needs to focus on the transition of the Air Environment back to a peaceful civil air sector. This panel will identify NATO capability gaps and highlight issues for more detailed study.

Assuring Access to Space

The Space security environment has changed dramatically over the last few years. Space can be a Transformational capability for NATO, but it requires an holistic approach. We must better integrate existing capability and develop Space Situational Awareness in order to assure access to the Space Domain, which we have become dependent upon for both civil and military operations. In particular, given the Alliance's reliance on Space to service its emerging expeditionary posture, the way ahead for Space could be addressed through the establishment of a NATO Space Office as a focus item. The Panel will consider such developments along with emerging threats and Space's critical contribution.

Registration at www.japcc.org

Airbase Laydown

Work has begun on a new JAPCC project entitled Airbase Laydown, which is featured in the JAPCC 2009 Programme of Work. The aim of the project is to produce a concept paper and decision support tool encompassing the entire process of selecting, configuring, operating and the closure and handover of an airfield during deployed operations. This is intended to ensure that from the outset of planning, an optimal, cost-effective balance can be achieved between the requirements associated with conducting military operations and short and medium term humanitarian aid and longer term economic and commercial development.

The project will identify current doctrine, policy and practice where it exists and explore the development of new approaches to Airbase Laydown. It will require consultation with relevant agencies and entities within and outside NATO. This work is expected to confirm that while a number of nations and organisations have already addressed aspects of the Airbase Laydown issue, there has not been an attempt to include in a single document the totality of associated factors and requirements. An Airbase Laydown forum at the JAPCC is planned for March 2010.

Advice is invited in respect to published work in this area, extant documentation and developmental activity currently being conducted. Comments and suggestions are also welcomed. The office of primary responsibility for this project:

Lt Col Denis Stengel, FRA AF,
+49 (0) 28 24/90 22 54,
email: stengel@japcc.de.

Biographies

Air Marshal David Walker joined the RAF in 1978. After Staff College he commanded No1(F) Squadron, before becoming the MA to the UK Minister for Armed Forces. After attending the UK's Higher Command and Staff Course, he took command of RAF Cottesmore. Posted to HQ 3 Group, he spent his tour deployed supporting operations in Afghanistan. In 2002 he took the post of Assistant Chief of Staff J3, responsible to the UK Commander Joint Operations for oversight and management of all UK expeditionary operations. After time as Assistant Chief of the Air Staff he took command of 1 Group in Apr 05 with responsibility for RAF's fast jet forces. In Apr 06 he assumed command of the RAF Support Helicopter Force contribution to the UK Joint Helicopter Command and in Jun 07 he was appointed the Deputy Commander of the Air Component Headquarters, Ramstein.

Colonel Tom 'Dingo' Doyne is assigned to OSD Networks Information and Integration as Deputy for Space Programs and Policy. His background includes assignments in satellite, space surveillance, missile warning and launch operations. Col Doyne's staff assignments include: HQ US Space Command; Air Staff; and the National Reconnaissance Office. Col Doyne was also deployed to HQ US Central Command as an operations planner for Operation Enduring Freedom right after 9/11. Col Doyne is a graduate of the Air Force Institute of Technology, Air Command and Staff College, the USMC's School of Advanced Warfighting and the Geneva Center for Security Policy. He has Master's degrees in Space Systems Management and Space Operations.

Colonel David Pedersen heads the Combat Air Branch of the JAPCC. He has served as deputy commander for the largest operations group in the USAF; commanded a team of advisors to train Egyptian F-16 pilots; and was Director of Operations for a Republic of Singapore F-16 squadron. Col Pedersen was a distinguished graduate from Embry-Riddle Aeronautical University with a BS in Aeronautical Engineering and was commissioned in 1986. He graduated top of his NATO pilot training program. He is a command pilot with over 2,500 flight hours. Col Pedersen graduated with distinction from the US Naval War College with a Masters of Science, National Security and Strategic Studies and is a graduate of Air Command and Staff College and Air War College.

Colonel Mihai STIR has 24 years of operations and staff experience. He was the Romanian Senior National Representative in the JAPCC, where, in the Future Capabilities Branch, he has contributed to the Transformation of Air and Space Power in NATO. He has focussed particularly on manned and unmanned aircraft issues and the transformation of NATO Air Command and Control structures. In Feb, Col Stir was posted to the Romanian MOD, J3. He received his bachelor's degree in economics in 1992 from the West University, Timisoara, Romania. He was recently awarded a PhD in Post Conflict Air Operations issues at the National Defence University 'CAROL 1st' in Bucharest, Romania. He is married with 2 children.

Air Commodore Garfield Porter joined the RAF in 1978. A navigator, he has served as a crew captain, Flight Commander and Squadron Commander on the RAF's Nimrod Maritime Patrol Aircraft amassing some 5500 flying hours. He was awarded the Queen's Commendation for Valuable Service in the Air for the Search and Rescue operation following the Piper Alpha oil rig disaster. Following attendance at the RAF Staff College in 1993, his ground tours have predominately been in strategic plans and programmes, and concepts and doctrine. He assumed command of RAF Kinloss in 2002 and in 2006 completed an operational tour as the UK Air Component Commander Middle East. He joined the JAPCC in May 2007 as Assistant Director Transformation from his previous assignment as Director Air and Space in the UK's Development, Concepts and Doctrine Centre.

Colonel Sergio Ferreira is an Airlift SME at the JAPCC Combat Support Branch since Aug 07. He graduated from the Portuguese AF Academy in 1986 and went through Undergraduate Pilot Training at Laughlin AFB in USA. He gathered more than 4300 flying hours as a transport pilot in different aircraft. He served in different squadrons, starting as a line pilot and having different assignments including deputy executive and executive officer of squadron. Appointed as Flight Commander in 1993 and 1999, later on in 2001 he served as Branch head at Portuguese Air Force Academy and instructor pilot at the same time. His last assignment in Portugal was as Lessons Learned Staff officer since 2004 at Production Branch in Joint Analysis and Lessons Learned Centre.

Colonel Helmar Storm joined the DEU AF in 1976. As a pilot, he has amassed over 3100 flying hours in the T37, T38, RF-4E Phantom, F-4F Phantom, and PA-200 TORNADO. He was awarded the Silver Cross and Gold Cross (Ehrenkreuz), and the US Legion of Merit. Colonel Storm's recent tours included serving as the Wing Commander TacRecce Wing 51 'Immelmann,' Jagel/Kropp and Executive Officer to Air COM CC-Air Ramstein. Since 2007, he has been the JAPCC Liaison officer to HQ SACT, Norfolk, USA. This year, Colonel Storm will be posted as the Branch Head for the Transformation Network Coordination Cell, SACT, Norfolk, USA.

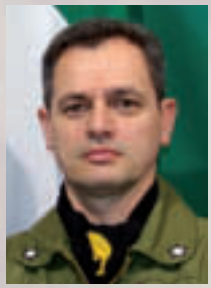
Lieutenant Colonel Michael Kentsch is a Research & Technology Analyst in ACT Future Capabilities Research & Technology Division in Norfolk, Virginia. He represents ACT at the Applied Vehicle Technology Panel of the NATO Research & Technology Agency, Neuilly – sur – Seine, France. In addition he is the project manager of ACT's 'NATO Live Virtual Constructive' project. LtCol Kentsch joined the German Army in 1980. His last positions were company commander of a German – French maintenance company, Teacher for Tactics and Logistics and commander of a Support Group. In 1996 he was deployed to Bosnia – Herzegovina as a company commander during the 1st SFOR contingent and in 2005 to Kosovo as J4 Chief Plans.

Biographies

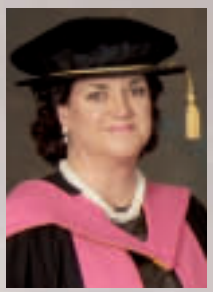
Lieutenant Colonel Gerard Boink is the Logistics and (Air) Mobility Staff Officer in the JAPCC. He joined the RNLAF in 1980 and subsequently held various logistic and movement & transportation positions. His assignments include postings at operational airbases, missile groups, transport units, military schools, and staff positions at the Netherlands air force staff. He was heavily involved in movement & transportation planning and evaluation of UN and NATO Balkan operations, as well as EU Operations. Before joining the JAPCC in 2005, he was the Deputy Director of European Airlift Coordination Cell (EACC) that after its transformation to European Airlift Centre (EAC) merged with Sealift Coordination Centre (SCC) into what now has become the Movement Coordination Centre Europe (MCCE) in Eindhoven.

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

Squadron Leader Bruce Hargrave joined the RAF in 1985 and holds an MBA from the Open University. He has a background in maritime aviation, both as a Nimrod MPA navigator and aircraft captain and as an ASW helicopter observer working with the Royal Navy, operating from HMS Ark Royal. Prior to coming to the JAPCC, he taught campaign planning on the Higher Air Warfare and Air Battle Staff courses at the RAF Air Warfare Centre. In his spare time he is a tutor for the Open University Business School and has recently begun studying for a PhD, researching the different learning outcomes achieved on part-time and full-time MBA courses.



Major Gianmaria Cianciolo is an Italian Army aviation helicopter pilot who joined the Policy, Concept and Coordination branch of JAPCC in September 2008. He was formerly posted at the 5th IT Army Aviation AH Rgt "Rigel" in Casarsa, Pordenone (IT), where he served as Training Staff Officer and he was responsible for the AH pilot training program. He has flown more than 2300hrs on UH-1 and he is also a test pilot. He has served on Operations, in Lebanon (1997/98), Somalia (1993) and Balkans, as Sqdn leader and chief of Operations. During his service in Somalia, he was awarded with the 'Silver medal to the value of IT Army.'



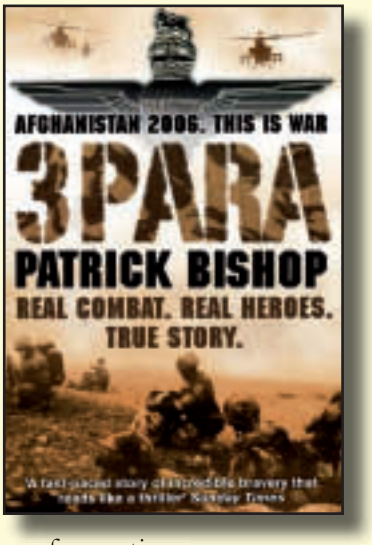
Dr. Anna Maria Brudenell, BA, Ph.D., received her BA in East European History from the School of Slavonic and East European Studies, University of London, and her Ph.D. on the air campaign in Kosovo from Cranfield University. She is a Lecturer in Military and Security Studies at the Defence Academy of the United Kingdom at Shrivenham, where she is also the Academic Leader of the International Security MSc.

Major Brian Jeffs is a former military pilot with operational tours on the CF-5, F-16, CP-121 Tracker and CP-140 Aurora. He is currently serving as a Reserve Officer in the International Training Programmes Section of the Directorate of Air Contracted Force Generation within the National Defence Headquarters in Ottawa, Canada.

Dr. Stuart Eves is responsible for military business development at the UK's world-leading small satellite manufacturer, Surrey Satellite Technology Limited (SSTL). He spent 16 years with the UK Ministry Of Defence, in various space-related posts, before joining SSTL in January 2004. During his time with the MOD, Stuart initiated the TopSat satellite programme, which has now been on-orbit for more than 3 years conducting its Earth-observation mission. Stuart has an MSc in Astrophysics, a PhD in constellation design, and has been a fellow of the UK's Royal Astronomical Society for more than 15 years. He takes an active interest in 'all things space.'

Malcolm Hammans served in the RAF from 1981 to 1997, specialising in Electronic Warfare (EW). He carried out EW duties on Nimrod MR2 Maritime Patrol and Tornado GR1 Strike Attack aircraft, including 19 Operational Missions on Tornados during Operation DESERT STORM. Tornado tours followed including one as a simulator instructor and a second as an airborne Navigator instructor at the Tornado Weapons Conversion Unit where he managed the Tornado EW Instructors' Course. Mal spent a period managing EW trials and evaluations at the Air Warfare Centre. Since 1997 Mal has been with FR Aviation as Head of EW Operations, providing EW services to a variety of UK and overseas customers.

3 PARA
by Patrick Bishop
Harper Perennial, 2007



The United Kingdom's 3rd Battalion, The Parachute Regiment (3 PARA) was deployed to the Helmand Province in Afghanistan from April to October of 2006. They were sent to 'win hearts and minds' and to conduct reconstruction activities. Instead, they were involved in some of the fiercest fighting in the history of the British Forces. This book is written from first hand accounts of those involved in the operations. It highlights the challenges and complexities of today's Counter-Insurgency (COIN) operations.

3 PARA was given the Herculean task of manning isolated 'platoon houses' in far-flung towns in the middle of Taliban controlled territory. They are an elite force, educated and experienced in conducting COIN operations. They had the best of intentions to improve security and conduct reconstruction activities. However, the Taliban and local political complexities completely changed the nature of operations.

3 PARA highlights the difficulty of conducting COIN and security and stabilisation operations. Application of COIN doctrine and concepts in the 'real world' faces many obstacles and actions must reflect the local environment. The student of COIN operations should use the first hand accounts of this book to challenge their thinking and that theory, planning and implementation are not always possible.

Reviewed by Thomas Single, Lieutenant Colonel, USA AF

Fighting Talk
by Colin S. Gray
Praeger Security International, 2007

'Fighting Talk,' primarily inspired from Clausewitz's ideas, explains and aids the understanding of war, peace and strategy. Instead of employing lengthy dissertations, Gray uses 40 maxims to introduce well known, but not always well understood, ideas intellectually essential for the education of a strategist.

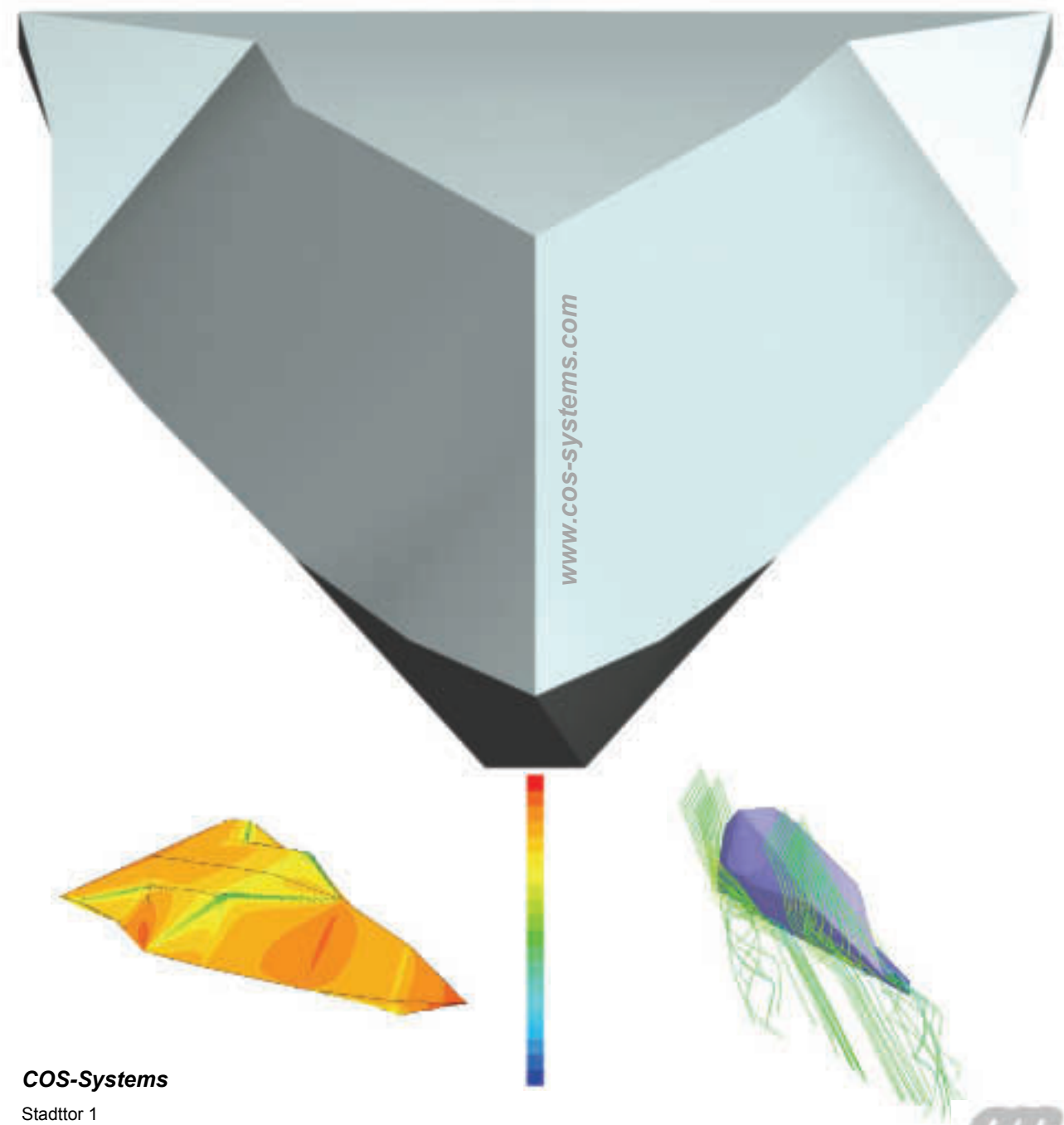
The book starts with the nature of war and relationships between War and Peace, 'It Is More Difficult to Make Peace than It Is to Make War.' The author then explains his view of strategy as the bridge between political intent and military power. He believes, 'If Thucydides, Sun-Tzu and Clausewitz Did Not Say It, It Probably Is Not Worth Saying.' Part III covers 'Military Power and Warfare.' The essays discuss the people, military conduct, and logistics of war, 'There Is More to War than Firepower: The Enemy Is Not Just a Target Set.' Gray then delves into 'Security and Insecurity.' The author 'steps back' to the strategic level and explains why strategy is important and discusses the interface between strategy and politics, 'Arms Can Be Controlled, but Not by Arms Control.' Gray's background as a historian comes through in the final chapters on 'History and Future.' These essays give the reader a better understanding of the processes of historical change and the influence of history on strategy. 'History Can Be Misused to "Prove" Anything, but It Is All That We Have as a Guide to the Future.'

Dr. Gray's work explains war, peace and strategy and their interactions and dependencies so that even non-strategists can grasp these complicated matters.

Reviewed by Helmar Storm, Colonel, DEU AF

We know,

that System Engineering is both a technical and management process. It is a discipline that ties together all aspects of a program to assure that the individual parts, assemblies, subsystems, support equipment and associated operational equipment will effectively function as intended in the operational environment. It also is a logical sequence of activities and decisions transforming an operational need into a description of system performance parameters as well as a preferred system configuration.



COS-Systems

Stadttor 1

40219 Düsseldorf – Germany

Phone +49 211 3003 205

Telefax +49 211 3003 200

COS-Systems