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NATO / Multinational Joint Intelligence, Surveillance and Reconnaissance Unit

A Feasibility Study

Joint Air Power Competence Centre

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NATO military commanders and Alliance Leaders have consistently identified gaps in NATO's Intelligence, Surveillance and Reconnaissance (ISR) capability and capacity including the entailed Processing, Exploitation and Dissemination (PED) processes. Exercises such as Unified Vision have begun to address the challenge of passing target information from one ISR system to another for tactical exploitation, targeting and data fusion.

The most recent NATO summit held in Wales on 4 - 5 September 2014 focused on NATO post-Afghanistan against the backdrop of instability in the Ukraine. Amongst other objectives, the Wales Summit Declaration stated that NATO and EU should cooperate closer to ensure that NATO's Smart Defence and the EU's Pooling & Sharing initiatives are complementary, that sharing of costs and responsibilities should be better balanced between the United States and the European Nations, and that ISR should be enhanced and reinforced whilst emphasizing multinational cooperation.

In this spirit, this study provides an assessment of the challenges and benefits of creating a Joint ISR Unit, either as a multinational arrangement or as a NATO-procured and owned capability. It determines if the creation of such a unit would be justifiable and feasible, and how it would complement NATO's existing and planned ISR capabilities such as the NATO Airborne Early Warning or the NATO Alliance Ground Surveillance force to meet the Wales Summit objectives and mitigate NATO's ISR shortfall. The study concludes with draft structures for both types of ISR units, as well as pre-requisites and recommendations for their design and implementation.

We welcome your comments on our document or any future issues it identifies. Please feel free to contact the RPAS section of the Combat Air Branch at the JAPCC staff via email: rpas@japcc.org.

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TABLE OF CONTENTS

CHAPTER XI

Considerations Regarding Manpower Availability, Personnel Planning, Education and Training

CHAPTER XII

NATO/MNJISRU Structure Considerations

CHAPTER XIII

Flexibility Considerations

CHAPTER XIV

Conclusions

ANNEX

Acronyms and Abbreviations

Figure 1 – Meeting of the North Atlantic Council at the Level of Heads of State and Government, NATO Wales Summit 2014.

CHAPTER 1

Introduction

As a direct result of experience garnered from campaigns in the Balkans, Afghanistan and most recently in Libya, the Allied Heads of State and Government expressed during NATO's 2012 Chicago Summit the ambition to strengthen their cooperation in acquiring and maintaining military capabilities to ensure tighter connections between Allied forces. Seeking to ensure NATO has available an enduring Joint Intelligence, Surveillance and Reconnaissance (JISR) capability to achieve strategic and operational decision superiority, Alliance leaders reconfirmed at the 2014 Wales Summit that JISR would remain a high priority for NATO.[1, 2]

Based in the concept of Smart Defence (SD), the Alliance Ground Surveillance (AGS) programme demonstrates the possibilities multinational cooperation provides in capability development and employment.[3] In this spirit, this study validates the requirement for and analyses the feasibility of establishing a NATO or Multinational JISR Unit (MNJISRU) equipped with a Medium-Altitude, Long-Endurance (MALE) Unmanned Aircraft System (UAS) (to include remotely operated as well as remotely piloted systems; cf. Chapter 2.3 ff.), providing NATO with additional JISR capabilities at the operational and tactical level to complement the AGS' strategic level capabilities.

1.1 Aim

This study provides an assessment of the challenges and benefits of creating a NATO/MNJISRU. Specifically, it determines if the creation of a NATO/MNJISRU is feasible, how it will complement NATO's existing ISR capabilities as well as potential near- and longer-term solutions to address NATO's current Intelligence, Surveillance and Reconnaissance (ISR) capabilities gap. The study analyses and assesses the different options for creating such a unit based on the experiences of already established concepts such as the AGS or the NATO Airborne Early Warning and Control (NAEW&C) force. Finally, the study gives recommendations of a possible future NATO/MNJISRU structure, outlines a concept for integration into the NATO command structure and provides options for suitable UAS and regional basing possibilities.

1.2 Assumptions

This study assumes Alliance Member Nations defence budgets will continue to be constrained, resulting in sustained political will to do things more efficiently within NATO and to support the principles of NATO's Smart Defence (SD) and the European Union's Pooling & Sharing (P&S) initiatives in the long term. Additionally, this study takes into account the proposed drawdown of U.S. ISR forces in Europe[4] as part of the assessment of the future operational environment.

Certain types of U.S. manufactured UAS are subject to the U.S. International Trade in Arms Regulations (ITAR), which may impede their participation in a multinational unit. This study assumes that potential challenges with export restrictions for Foreign Military Sales (FMS) could be overcome if NATO as a whole acted as the customer of the respective UAS. This assumption is based on the fact that consensus of all 28 Allies – including the U.S. - would be required for the employment of a NATO-owned UAS unit. Furthermore, the sale of the U.S. Global Hawk to the NATO AGS force could serve as an example for such an FMS case.

1.3 Methodology

The study first reviews the significant lessons learned regarding the availability of ISR systems and data in recent NATO campaigns and discusses the impact the resource gap in NATO's existing ISR capability imposed on decision makers in those campaigns. The study then introduces the principles of SD and P&S as the conceptual foundation of any combined effort to create a NATO/MNJISRU as well as a short summary of statements from the latest NATO summit in Wales which are relevant to these concepts.

The study then compares the NATO AGS capabilities currently being integrated into the NATO Force Structure (NFS) with the remaining ISR challenges as identified at the NATO summits in Lisbon (2010), Chicago (2012), and Wales (2014), justifying the creation of a NATO/MNJISRU.

Next, considerations for funding such a unit and how to integrate it into the NATO JISR architecture and NATO Command Structure (NCS) are discussed, comparing available UAS platforms and outlining options for manning the unit as well as education and training of dedicated personnel.

Finally, the study concludes with recommendations of how a NATO/MNJISRU could be constructed. The study also provides a proposal for both a NATO and a MNJISRU structure, which, when fully manned and funded, would help mitigate NATO's identified ISR shortfalls.

1.4 Limitations

Research and analysis associated with this study include both open and classified sources. To permit the widest dissemination, the published study has been kept at the unclassified level.

1. 'Joint Intelligence, Surveillance and Reconnaissance', North Atlantic Treaty Organization (NATO), 20 Oct. 2014. [Online]. Available: http://www.nato.int/cps/en/natohq/topics_111830.htm?selectedLocale=en. [Accessed 14 Jan. 2015].
2. 'Chicago Summit Declaration', North Atlantic Treaty Organization (NATO), 20 May 2012. [Online]. Available: http://www.nato.int/cps/en/natolive/official_texts_87593.htm#top. [Accessed 14 Jan. 2015].
3. 'Wales Summit Declaration', North Atlantic Treaty Organization (NATO), 5 Sep. 2014. [Online]. Available: http://www.nato.int/cps/en/natohq/official_texts_112964.htm. [Accessed 14 Jan. 2015].
4. 'Sustaining US Global Leadership: Priorities for 21st Century Defense', U.S. Department of Defense, Jan. 2012. [Online]. Available: http://www.defense.gov/news/Defense_Strategic_Guidance.pdf. [Accessed 12 Mar. 2015].

CHAPTER 11

Terms and Definitions

It is important to note that this study distinguishes between a multinational and a NATO unit and refers to them either as two different types of organizational structures or as a NATO/MNJISRU if considerations apply to both. In reference to unmanned systems, organizations may use different terminology for the same concept, even within a single nation. This chapter introduces the terminology and definitions as they are used in this study.

2.1 Multinational Unit

This study prefers the term 'multinational' rather than 'combined' to describe all activities, operations and organizational structures consisting of more than one nation. A multinational unit is funded, owned and deployed by the participating nations in support of NATO requirements. In this type of unit, governance of assigned resources remains with the respective participating nation as outlined in the Memorandum of Understanding (MoU) unless individually assigned to NATO for a specific mission or operation.

2.2 NATO Unit

The term 'NATO unit' refers to an organizational structure consisting of one or more NATO member nations or partnership countries. A NATO unit is owned by NATO, funded by NATO Joint or Common Funding, and is fully integrated into the NATO Command Structure (NCS). One of the NATO Component Commands will be designated to govern units of this type. However, nations retain full sovereignty over national personnel. The NATO Airborne Early Warning & Control Force (AEW&C) is an example for such a type of unit.

2.3 Unmanned Aircraft

Unmanned Aircraft (UA) is the overall term for all aircraft that do not carry a human operator and are operated remotely using varying levels of automated functions. Depending on their aircrew's qualification, UA are further subdivided into Remotely Operated Aircraft and Remotely Piloted Aircraft as outlined below.[1]

2.4 Remotely Operated Aircraft

A Remotely Operated Aircraft (ROA) is a UA that is remotely controlled by an Unmanned Aircraft Operator (UAO) who is tasked with the overall responsibility for operation and safety of the ROA but has probably not been trained and certified to the same standards as a pilot of a manned aircraft. This is typically the case for small and tactical UA operated by the army or for commercially available quadcopters for recreational use.[2]

2.5 Remotely Piloted Aircraft

A Remotely Piloted Aircraft (RPA) is an unmanned aircraft that is controlled from a remote pilot station by an Unmanned Aircraft Pilot (UAP) who is tasked with the overall responsibility for operation and safety of the RPA and who has been trained and certified to equivalent standards as a pilot of a manned aircraft. This is usually the case for all Medium- and High-Altitude Long-Endurance (MALE/HALE) UA, which are almost always operated by the air force.[3]

2.6 Unmanned Aircraft System

Unmanned Aircraft System (UAS) is the overall term for a system whose components include one or more unmanned aircraft, the supporting network and all equipment and personnel necessary to control the unmanned aircraft.[4]

2.7 Remotely Piloted Aircraft System

A Remotely Piloted Aircraft System (RPAS) is a UAS whose components include one or more RPA and requires a UAP for operation.[5]

1. 'NATO Glossary of Terms and Definitions', Allied Administrative Publication 6 (AAP-06), North Atlantic Treaty Organization (NATO), Edition 2014, 2014.
2. The terms 'Remotely Operated Aircraft (ROA)' and ' Unmanned Aircraft Operator (UAO)' have been proposed and are currently under revision by the NATO Joint Capability Group Unmanned Aircraft Systems (JCGUAS) and haven't been included into the AAP-06 yet.
3. The term 'Remotely Piloted Aircraft (RPA)' is defined in the AAP-6; the term ' Unmanned Aircraft Operator (UAO)' has been proposed and is currently under revision by the NATO Joint Capability Group Unmanned Aircraft Systems (JCGUAS) and hasn't been included into the AAP-06 yet.
4. Ibid. 1.
5. The term 'Remotely Piloted Aircraft System (RPAS)' has been derived from the terms 'Unmanned Aircraft System (UAS)' and 'Remotely Piloted Aircraft (RPA)' and is not included in the AAP-06.
6. 'Guidance for the Training of Unmanned Aircraft Systems(UAS) Operators', Allied Tactical Publication 3.3.7 (ATP-3.3.7), North Atlantic Treaty Organization (NATO), Edition B Version 1, April 2014

Figure 2 – NATO UAS Classification Table.[6]

Class	Category	Normal Employment	Normal Operating Altitude	Normal Mission Radius	Primary Supported Commander
CLASS I < 150 kg	MICRO <66 J	Tactical Subunit (manual or hand launch)	Up to 200 ft AGL	Up to 5 km (LOS)	Platoon, Squad
	MINI <15 kg	Tactical Subunit (manual or hand launch)	Up to 3K ft AGL	Up to 25 km (LOS)	Company, Platoon, Squad
	SMALL >15 kg	Tactical Unit	Up to 5K ft AGL	50 km (LOS)	Battalion, Regiment
CLASS II 150 kg - 600 kg	TACTICAL	Tactical Formation	Up to 18,000 ft AGL	200 km (LOS)	Brigade
CLASS III > 600 kg	Strike/Combat	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre
	HALE	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre
	MALE	Operational/Theatre	Up to45,000 ft MSL	Unlimited (BLOS)	JTF

Figure 3 – Combined Air and Space Operations Center at Al Udeid Air Base in Qatar.

CHAPTER III

The Evolution of RPAS in ISR

The concept of radio controlled aircraft was developed in the 1930s with the introduction of the first mass-produced target drone to the U.S. Army and Navy. Nearly 15,000 were built and used as targets for anti-aircraft training. During World War II the United States attempted to weaponize unpiloted, specially modified B-17 Flying Fortresses with explosives. However, none of the B-17s ever made it to their intended targets. Perhaps the best-known unmanned vehicle of World War II was the German V-1 (Vengeance Weapon One). Although not radio controlled, it had a sophisticated guidance system consisting of gyroscopes, barometers, and an anemometer, which was used to calculate distance flown. The Germans launched roughly 20,000 V-1s at Allied targets, primarily in London and Antwerp, killing more than 10,000 civilians. In 1955, the first reconnaissance drone was introduced to the U.S. Army. It was launched by two rockets and recovered by parachute, carried a still film camera and could transmit crude video. Further developments led to the AQM-34, the first U.S. Air Force (USAF) reconnaissance drone, which ushered in modern unmanned reconnaissance aircraft. From the mid-1960s to the mid-1970s, the AQM-34 flew tens of thousands of missions over North Vietnam, parts of China, and even the Soviet Union, obviating the risk posed by manned reconnaissance flights. In the 1970s, Israel began to develop new designs and took the global lead in certain types of UA. In the 1980s, with the development of lighter, smaller unmanned aircraft like the RQ-2 Pioneer, UA technology maturation accelerated. Along with its sibling, the Israeli Aerospace Industries (IAI) RQ-5 Hunter, the Pioneer flew extensively in the 1991 Gulf War.[1]

3.1 Operation Allied Force (Mar – Jun 1999)

The NATO operation known as Operation Allied Force was the largest operational use of Medium-Altitude

Long-Endurance (MALE) RPAS in the battlespace to that time. Although RPAS had seen limited use in previous coalition campaigns (including Operation Desert Storm), they had not yet developed 'over the horizon' video transmission capability and were primarily used for non-real time intelligence collection to support the Intelligence Preparation of the Battlespace (IPB) process. MALE RPA and other smaller tactical UAS opened the door to an evolution in the operational and tactical use of video feeds provided by these platforms.

When Operation Allied Force air operations began, a change in mind-set regarding the operational employment of RPA occurred. Concept of Operations (CONOPS) for RPA shifted from the familiar surveillance and intelligence gathering roles to direct coordination into current operations. With this shift, one new challenge for commanders was to how this new capability could assist in effectively targeting and attacking the operational centres of gravity.[2]

The biggest challenge in the Balkans campaign quickly became locating, tracking and targeting mobile air defence systems. The Joint Force Air Component Command (JFACC) was frequently hampered by both the lack of available ISR assets for locating these systems and then, once located, the lack of enduring ISR assets to track them long enough to be successfully engaged.

Enabling air power to hunt down and destroy targets swiftly and with minimum collateral damage requires robust ISR systems and Precision Guided Munitions (PGM). Terrain masking and deception measures by small forces in complex terrain, such as the hilly and/or wooded terrain found in Kosovo, resulted in extreme difficulty in locating and positively identifying targets. The locating, tracking and targeting of difficult-to-find targets often required technological capabilities that exceed available material resources.[3]

In the aftermath of Operation Allied Force, NATO commanders identified the need for improvement both in asset capability and capacity and in the overall joint targeting process. For example, the British Ministry of Defence conducted a study of its operations in OAF and recognised the need for the UK and its Allies and partners to improve capabilities in the following areas:

- Precision joint all-weather attack capability against both static and mobile ground targets;
- Intelligence, Surveillance and Reconnaissance (ISR);
- Improved secure communications/data links, and better "sensor to shooter" links.[4]

3.2 Operations in Afghanistan (Aug 2003 – Dec 2014)

During the early days of U.S. operations in Afghanistan, as a result of the availability of ISR systems capable of persistent target tracking prior to, during and after the attack phase, as well as increased public awareness regarding the effects of collateral damage, decision-makers at the JFACC became more reliant on real time cueing (specifically video) prior to issuing a strike order. The Combined Air Operations Centre (CAOC) in Al Udeid, Qatar, has an entire screen wall that can be dedicated to real time video feeds from RPAs for use not only by Battle Watch Captains, but legal advisors and JFACC decision-makers in the routine prosecution of targets. Political influences on the Rules of Engagement (ROE) resulted in a change in pre-targeting requirements which fostered a critical need for increased ISR capability.

During this period, ROE evolved to imply that targets had to be positively identified from more than one source and could only be attacked if a visual 'chain of custody' had been maintained. Under this ROE, continuous observation is mandatory such that the persistent presence of a remotely piloted aircraft becomes indispensable. Legal advisors are now stationed on the combat operations floor of the CAOC to provide counsel to commanders on the 'prosecution' of the target. They are required to consider international law, the Rules of Engagement and any special instructions, but they must also have their "eyes on the screen".[5]

As the course of the campaign continued, the availability of both manned and remotely piloted ISR assets improved. This meant ISR systems could be dedicated to tactical ground units in addition to the more traditional Intelligence Preparation of the Battlespace (IPB) roles. This had a direct and noted impact in decreasing the response time for Troops in Contact (TIC) requests for Close Air Support (CAS).

RPAs provided what is referred to as 'armed overwatch' for combat troops – streaming live video to a Forward Air Controller (FAC) while maintaining the capability to drop bombs or fire missiles if required. They could also provide Close Air Support (CAS) to Troops In Contact (TIC) with hostile elements when the aircraft were cleared to engage emergent targets. This radically compressed the time required to intervene in a fire fight. For example, at the start of the Vietnam War, it took on average 100 minutes for strike aircraft to respond to a request for assistance. Whereas currently, in Afghanistan, the average response time is now around ten minutes.[6]

Although the United States' military experience in both the Iraq and Afghanistan campaigns remains coloured by ISR challenges in the Counter-Insurgency (COIN) environment, NATO must evaluate its own Afghanistan experience against potential future crises the Alliance is likely to encounter. With regard to ISR, the biggest lesson NATO should take from Afghanistan is remembering what it takes to develop a fully capable JISR architecture. Doing so requires more than just a platform capable of providing a certain quality of targeting data; the key is the system behind the system, i.e. the right mix and quantity of ISR assets in place as well as an appropriately manned and trained organisation supported by mature procedures and network-enabled CIS support.

3.3 Operation Unified Protector (Feb – Oct 2011)

One of the challenges NATO faces coming out of Afghanistan is the relatively small number of ISR assets available in the European theatre of operations. This was immediately noticed during Operation Unified Protector. It had a dramatic impact on the JFACC's conduct of that air campaign.

However, the ISR gap identified in both the Balkans and in operations over Afghanistan consists not only of availability of collection assets, but also in the Processing, Exploitation and Dissemination (PED) portion of the ISR chain. During Operation Unified Protector, the Alliance relied on the United States to provide the communications networks, trained personnel, and the body of tactical expertise needed to integrate those capabilities into a coherent capability.[7]

'We were able to do things like cross-cuing, but it took us a few months to get that going and get it right. And I think the point that you've been working on with Unified Vision is that we need to have those things in place right now so that when the next operation comes about – humanitarian assistance, disaster relief, or a kinetic operation in support of whatever it might be up through Article 5 – that we have all those things in place so that you don't have to develop these TTPs as you're conducting the operation.'[8]

Lieutenant General Ralph Jodice, USA
Joint Force Air Component Commander for Operation Unified Protector

Additionally, the shortage of ISR assets to provide persistent coverage of mobile targets was a causal factor in the loss of battlefield awareness regarding enemy locations and movements. This had a negative impact on successful weapons employment.

After pro-Gadhafi forces abandoned their conventional equipment, differentiating between those forces and NATO-supported forces without persistent ISR assets to develop pattern-of-life information proved nearly impossible. Coupled with United Nations Security Council Resolution (UNSCR) 1973, which restricted the employment of NATO ground forces, the shortage of ISR inhibited accurate battle damage assessment and led to additional strikes on "targets that might have already been neutralized."[9]

3.4 Assessment

RPA have evolved over the past few decades to the point where they have become not only a critical enabler for operations, but were identified as a critical resource shortfall impacting the execution timeline of those operations. NATO Operations since the introduction of RPAs in ISR missions have produced the following observations, among others:

- There is a demonstrated need for improved ISR capability and capacity across the NATO force;
- RPAs are employed in an ISR role to support targeting; this capability and capacity as well as the overall joint targeting process must be improved;
- There is a requirement for improved secure communications/data links, and better "sensor to shooter" links;
- Persistent presence of a remotely piloted aircraft is indispensable during the tracking and targeting phase;
- ROE have evolved to effectively 'require' persistent video of targets during the engagement phase;
- Development of an ISR PED process and a robust network for information sharing is critical to rapid decision-making; that this capability must be included in the planning process, not developed ad-hoc during the execution of the operation;
- The shortage of ISR assets to provide persistent coverage of highly mobile targets was a causal factor in the loss of battlefield awareness and impacted operational objective accomplishment timelines.

The ISR mission has evolved in parallel with the development of smart weapons capable of engaging highly mobile targets which present a small time window for successful engagement. Since their introduction into the joint battlespace in the late 1990s, RPAs have been employed to address the commander's ISR requirements. However, many of the lessons identified regarding ISR capability, information exploitation and RPA inventory shortfalls have persisted from decade to decade, from operation to operation. As the Alliance looks to the future, this ISR capability gap resident in NATO must be addressed.

1. 'A Brief History of Early Unmanned Aircraft', John F. Keane and Stephen S. Carr, Johns Hopkins APL Technical Digest, Volume 32, Number3, 2013. [Online]. Available: http://www.jhuapl.edu/techdigest/TD/td3203/32_03-Keane.pdf. [Accessed 5 Oct. 2015].
2. 'UAV Employment in Kosovo: Lessons for the Operational Commander', Naval War College, Lieutenant Commander JD R. Dixon, U.S. Navy, 8 Feb. 2000. [Online]. Available: www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA378573. [Accessed 11 Mar. 2015].
3. 'Revisiting the Lessons of Operation Allied Force', Air Power Australia Analysis 2009-04, Martin Andrew, BA(hons), MA, PhD, RAAF(Retd), 14 Jun. 2009. [Online]. Available: http://www.ausairpower.net/APA-2009-04.html. [Accessed 11 Mar. 2015].
4. Ibid.
5. 'Lines of descent', openDemocracy.net, Derek Gregory, 8 Nov. 2011. [Online]. Available: https://www.opendemocracy.net/derek-gregory/lines-of-descent. [Accessed 11 Mar. 2015].
6. Ibid.
7. .'Unifying our vision: joint ISR Coordination and the NATO Joint ISR Initiative', National Defense University Press, Lieutenant Colonel Matthew J. Martin, USAF, 1 Jan. 2014. [Online]. Available: http://ndupress.ndu.edu/Media/News/NewsArticleView/tabid/7849/Article/577482/jfq-72-unifying-our-vision-joint-isr-coordination-and-the-nato-joint-isr-initia.aspx. [Accessed 9 Mar. 2015].
8. Ibid.
9. 'The Air War in Libya', Air and Space Power Journal, Major Jason R. Greenleaf, USAF, Mar./Apr. 2013. [Online]. Available: http://www.airpower.maxwell.af.mil/digital/pdf/articles/Mar-Apr-2013/F-greenleaf.pdf [Accessed: 25 Mar. 2015].

Figure 4 – NATO Conference of National Armaments Directors (CNAD).

CHAPTER IV

Concepts, Initiatives and Summit Declarations

'In these times of austerity, each euro, dollar or pound sterling counts.'
NATO Website on Smart Defence

4.1 The Concept of Smart Defence

NATO's Smart Defence concept is a cooperative way of generating modern future defence capabilities for the Alliance by mutually developing, acquiring, operating and maintaining military capabilities. The aim is to harmonise capability requirements and adjust acquisition priorities as well as to pool and share existing capabilities. Current Smart Defence projects cover a wide range of efforts addressing the most critical capability requirements, such as precision-guided munitions, cyber defence, ballistic missile defence and Joint Intelligence, Surveillance and Reconnaissance. In the long term, an equitable sharing of the defence burden within NATO should be achieved to reduce the gap between the United States and the other Allies. This can be done by acquiring capabilities that are believed to be critical, deployable and sustainable. [1]

4.2 The Concept of Pooling and Sharing

Quite similar to NATO's concept of Smart Defence, the European Defence Agency (EDA) initiated the Pooling & Sharing initiative in 2010 to advance military co-operation in Europe. This initiative strives for more pooling and sharing of military capabilities among European Union (EU) Member States. To promote a systematic approach towards Pooling & Sharing, the 'Code of Conduct on Pooling & Sharing' [2] was drafted in 2012. Since then, a handful of successful projects have been initiated. In December 2013 the European Council made a clear case for increased defence co-operation and welcomed the progress achieved by the EDA's Code of Conduct on Pooling & Sharing. Additionally, Heads of State and Government asked for a policy framework to foster more systematic and long-term cooperation by the end of 2014. Current RPAS-related activities include the Joint Investment Programme on RPAS for Air Traffic Insertion, the Future European RPAS MALE Programme, and the Establishment of a MALE RPAS community.[3]

4.3 The Wales Summit Declaration

The most recent NATO summit was held in Wales on 4–5 September 2014. The primary theme was the changing focus of NATO post-Afghanistan against the backdrop of instability in the Ukraine. The meeting concluded with the Wales Summit Declaration issued by the North Atlantic Council (NAC) consisting of the NATO Heads of State and Government.[4]

4.3.1 Objectives

The following objectives relevant to this project originating from the Wales Summit Declaration are highlighted below:

- Close cooperation between NATO and EU, to ensure that NATO's Smart Defence and the EU's Pooling & Sharing initiatives are complementary and mutually reinforcing, avoiding unnecessary duplication and maximizing cost-effectiveness;
- Reversal of declining defence budgets as depicted in Figure 5, to make the most effective use of funds and to balance the sharing of costs and responsibilities;
- Enhancing and reinforcing intelligence, surveillance, and reconnaissance, whilst emphasizing multinational cooperation;
- Continuation of the Joint Intelligence, Surveillance and Reconnaissance (JISR) initiative to deliver an Initial Operational Capability (IOC) from 2016 onwards;
- Further development of the Alliance Ground Surveillance (AGS) capability that will become available for operational deployment in 2018;
- Multinational development of forces and capabilities by lead nations providing a framework for other partners to 'plug in'.

4.3.2 NATO Framework Nations Concept

Endorsed during the Wales Summit, the NATO Framework Nations Concept focuses on groups of Allies, facilitated by a framework nation, coming together to work multinationally for the joint development of forces and capabilities required by the Alliance. As a start, a group of ten Allies, facilitated by Germany as the frame-

Figure 5 – Defence Expenditures NATO Europe.[5]

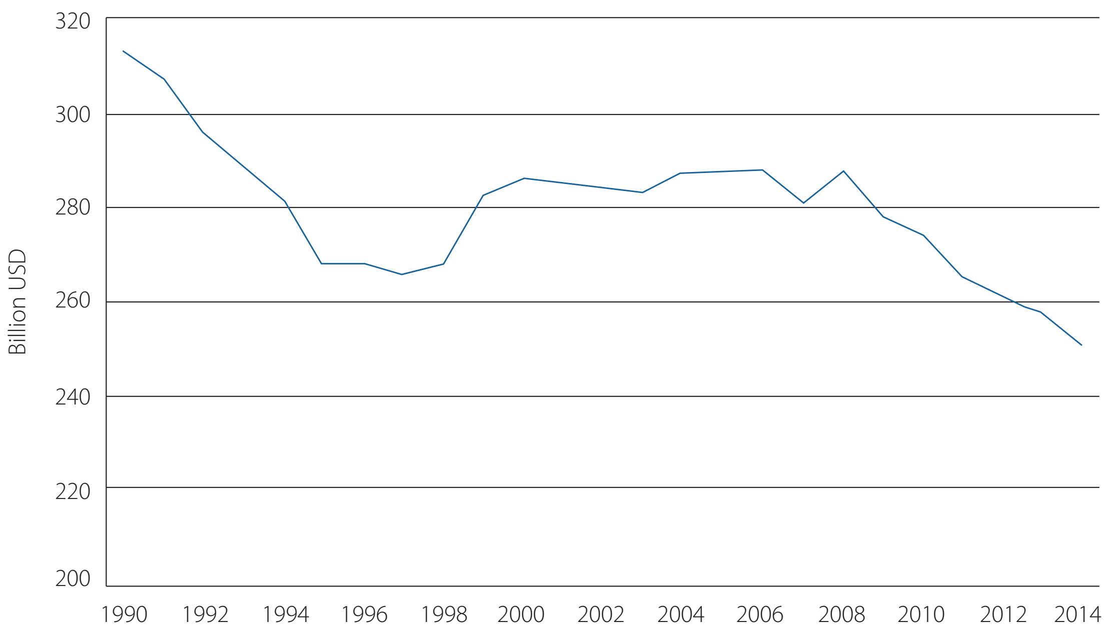


Figure 7 – The Trial Control Room at NATO's Exercise Unified Vision 2014.

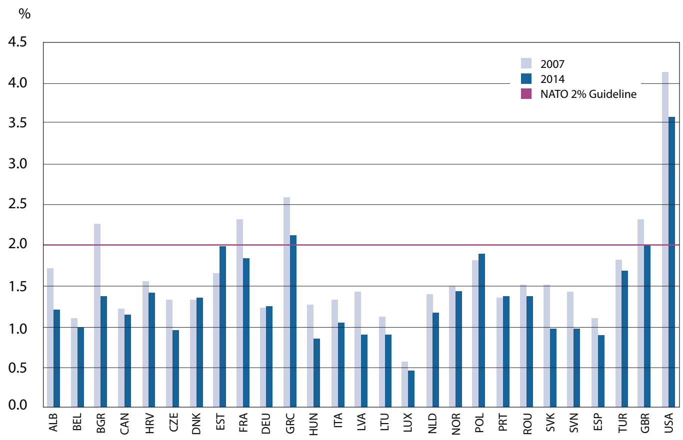
work nation, committed to working together systematically, intensifying cooperation in the long term and creating a number of multinational projects addressing identified Alliance priority shortfall areas across a broad spectrum of capabilities. This effort is designed to help address common security interests within NATO and improve the balance of the provision of capabilities between the United States and European Allies, as well as among European Allies themselves. In this spirit, several Allies are also establishing a multinational MQ-9 RPAS users group in particular, to enhance interoperability and reduce overall costs.

4.4 Joint Intelligence, Surveillance, and Reconnaissance Initiative

4.4.1 Overview

Nations provide the Alliance with a variety of ISR capabilities via maritime, air and ground systems. However, at the 2010 NATO Summit in Lisbon, the exchange of Intelligence, Surveillance and Reconnaissance (ISR) data was identified as a pressing capability need, critical to the successful conduct of Allied operations.[6, 7] Two years later, at the Chicago Summit, the Alliance Ground Surveillance (AGS) system concept was initiated to improve Joint Intelligence, Surveillance and Reconnaissance (JISR) capability within NATO.[8] The overall NATO JISR initiative, including AGS, strives to

Figure 6 – Alliance defence expanditures as a percentage of Gross Domestic Product 2007 and 2014.



enhance the cooperation between Allies as well as link national and NATO assets into a powerful network, improving the tasking, collection, processing and sharing of key information in support of political and military decision makers.[9]

Following the concept of 'need to share' rather than 'need to know', an integrated NATO JISR capability will allow the Alliance to share information uploaded by the linked surveillance assets, while simultaneously providing assurance and protection of the distributed data and its network. This should provide all the Allies with a holistic picture of the current situation, helping NATO decision-makers to make well-informed, timely and accurate decisions.

4.4.2 Capabilities

The NATO JISR initiative is expected to achieve its initial operational capability (IOC) at the end of 2016. To this end, NATO is not only establishing and resourcing the NAGSF, but also undertaking numerous efforts to develop, test and implement new JISR related doctrine and procedures. The Unified Vision trial series was specifically designed to test technical capabilities and interoperability of national ISR capabilities as well as the necessary JISR management procedures and tools. Unified Vision 2014, conducted in May 2014 in Norway, successfully demonstrated NATO's ability to gather information and fuse intelligence from multiple sources, such as satellites, manned and remotely piloted aircraft, naval vessels, ground sensors and human intelligence provided by 18 participating nations.[10] The Ramstein Ambition and Trident exercise series further lay particular emphasis on the employment of JISR in order to train their intelligence and operations staff accordingly.

4.4.3 Assessment

Once established, NATO JISR will be a key enabling capability supporting the Alliance's ability to achieve information superiority over potential adversaries. However, to accomplish this goal, it is essential that each Allied nation actively participates and willingly contributes national assets. Deep-rooted national caveats regarding information sharing must also be addressed.

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CHAPTER V

Rationale for a NATO/MNJISRU

The requirement for a NATO/MNJISRU in addition to other existing or emerging JISR capabilities in NATO must be thoroughly validated in order to avoid any cost increases resulting from duplication of efforts and structures. The purpose of this chapter is, therefore, to justify the requirement for a NATO/MNJISRU against the already long-established NATO Airborne Early Warning and Control (NAEW&C) Force as well as the future NATO Alliance Ground Surveillance Force (NAGSF).

As seen in the previous chapters, NATO military commanders and Alliance Leaders have consistently identified gaps in NATO's ISR capability (asset and sensor), capacity (asset availability) and PED processes. Exercises such as Unified Vision have begun to address the challenge of passing target information from one of the myriad of NATO or national systems to another for tactical exploitation, targeting and data fusion. Until a unit is created that is directly 'taskable' by NATO commanders, any future operation will have to rebuild this process from scratch based on which nations provide capability and assets to the effort. Until a NATO unit is created, it is also likely that any future ISR effort will be confronted with data dissemination challenges. This will make the task of providing critical information to the commander challenging and could potentially induce critical delays. This principle has been discussed at length during both the Chicago and Wales summits. From those discussions, this ISR initiative was born.

'Through our operations, including Libya and Afghanistan, we have identified the areas where our capabilities do not go far enough or too few countries have them. Libya revealed shortfalls in precision-guided munitions; intelligence, surveillance and reconnaissance assets; and experts trained to interpret the data they provide. Work has been ongoing, but the economic crisis has not made it any easier. So we need to take a long hard look at the most effective way to work together to close those gaps.'[1]
Anders Fogh Rasmussen
Former NATO Secretary General

Figure 8 – NATO's Airborne Warning and Control System (AWACS) Aircraft.

Currently, there are two capabilities addressing JISR shortfalls within NATO. These are the NATO Airborne Early Warning and Control (NAEW&C) Force and the Alliance Ground Surveillance (AGS) system. The following sections briefly describe these organisations.

> ***'If we are to be prepared for the future beyond 2020, we must make important investment decisions today. We need to mark the path from the capabilities we have today to those we need in the future, and we need to begin to identify how we might work better together on important capabilities in the future.'*** [2]
> *Anders Fogh Rasmussen*
> *Former NATO Secretary General*

5.1 NATO Airborne Early Warning and Control

5.1.1 Overview

The NAEW&C Force is one of the few military assets that is completely owned and operated by NATO. It is the Alliance's largest collaborative venture and is an example of what NATO member countries can achieve by pooling resources.

The NAEW&C Force conducts a wide range of missions, such as air policing, support to counter-terrorism, evacuation operations, embargo, initial entry and crisis response. This force operates a fleet of 17 Boeing E-3A 'Sentry' Airborne Warning & Control System (AWACS) aircraft.[3]

5.1.2 Capabilities

AWACS aircraft are equipped with long-range radar and passive sensors capable of detecting air and surface contacts over large distances. Under normal circumstances, the aircraft can operate for about eight hours (longer with air-to-air refuelling) and is able to track and identify potentially hostile aircraft operating at low altitudes as well as to provide fighter control of Allied aircraft. It can simultaneously track and identify maritime contacts and provide coordination support to Allied surface forces.

During Operation Unified Protector, the NAEW&C Force performed the crucial command and control function for all Alliance air assets operating over Libya. This included issuing real-time tactical orders and tasks to NATO fighter aircraft, surveillance and reconnaissance aircraft, air-to-air refuelling aircraft, and RPAS. NATO E-3A aircraft also supported Allied ships and submarines enforcing the maritime arms embargo against Libya by providing an aerial maritime surveillance capability.

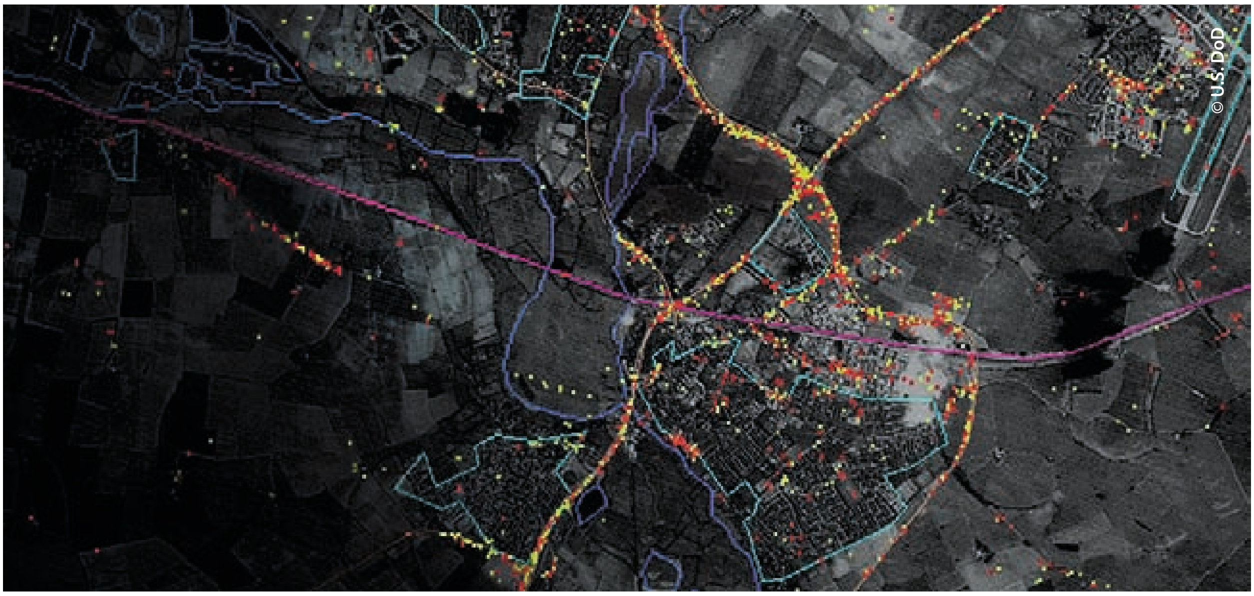

Figure 9 – Synthetic Aperture Radar Picture with Ground Moving Target Indication.

5.1.3 Assessment

Although originally not designed as an ISR platform, AWACS can provide support to the JISR mission through employment of its organic sensors such as Air-to-Surface Surveillance Radar and Electronic Support Measures (ESM). It can also act as a JISR coordinator, providing direction, management and protection of JISR systems within the battlespace. Therefore, the NAEW&C Force is actually a non-traditional ISR resource whose primary role as an Air C2 and airspace control asset will usually take precedence.

Additionally, AWACS aircraft support the Alliance with an extensive surveillance capability on the strategic and operational level, providing complete radar coverage for an area the size of Central Europe and offering a full Recognized Air Picture (RAP) for the joint commander.

5.2 NATO Alliance Ground Surveillance

5.2.1 Overview

AGS was recognized at the 2010 Lisbon Summit as a critical requirement for the Alliance and is planned to be a major contributor to NATO's overall JISR capability. The prime contract for the AGS system was awarded to Northrop Grumman in May 2012 during the Chicago Summit.[4]

The AGS core capability will be owned and operated by NATO. The system is currently being acquired by 15 Allies,[5] which are represented by the NATO Alliance Ground Surveillance Management Agency (NAGSMA). The AGS core capability will be made available to the Alliance in the 2017 - 2018 timeframe. NATO will then operate and maintain it on behalf of all 28 Allies.[6]

5.2.2 Capabilities

Based on Northrop Grumman's Global Hawk Block 40 High-Altitude Long-Endurance (HALE) RPAS, the AGS air segment is equipped with a highly sophisticated Synthetic Aperture Radar (SAR), which is able to provide Ground Moving Target Indication (GMTI) and provide SAR imagery over land and water at considerable stand-off distances and in any weather or light condition. The collected data can then be exploited at the AGS ground segment and disseminated to members of the NATO Intelligence Community for further analysis and fusion.[7]

The AGS core system is expected to be supplemented by additional national airborne surveillance systems provided by NATO member nations as national contributions in kind, partly replacing financial contributions to the AGS initiative. [8]

5.2.3 Assessment

The NAGSF will provide the Alliance with organic ISR collection and exploitation capabilities to support NATO's peacetime collection requirements, such as those associated with Indications & Warning and NATO intelligence production.

The Global Hawk can collect SAR/GMTI sensor data with long range and endurance. It also has a reasonable level of survivability because it can operate at a suitable stand-off distance. However, the AGS's overall contribution to the tactical intelligence picture is limited due to its strategic mission orientation as well as the lack of certain sensor types such as Electro-Optical (EO) / Infrared (IR) imagery, Electronic Warfare (EW) or Signals Intelligence (SIGINT) capabilities.

5.3 Assessment

'The NATO ISR gap is nothing new and was made obvious as early as Operation Allied Force, where the United States contributed approximately 95 percent of the ISR capability as measured in hours flown. While NATO has made great strides in equalizing the pro-rata contributions of Allies to operations in other mission areas (particularly in precision-strike and electronic warfare), the enabling capabilities such as air mobility, command and control, and ISR in particular remain stubborn areas of overreliance on the United States. This is evidenced by the comparison of sorties flown in Allied Force to those flown in Operation Unified Protector in 2011.'[9]

Lieutenant General Michael Short, USAF
Joint Force Air Component Commander
Operation Allied Force

The AGS's core capability will enable the Alliance to perform persistent surveillance over wide areas from high-altitude, long-endurance (HALE) aircraft, operating at considerable stand-off distances and in any weather or light condition. The AGS system is capable of cross-cueing detected targets to MALE ISR assets for further target tracking and eventually target engagement as required. This engagement could be the delivery of a PGM or insertion of a small tactical force to accomplish the Joint Force Command's (JFC) objective. Exercises such as Unified Vision 2014 (UV14) are developing Tactics, Technics and Procedures (TTPs) to hand off targets identified by AGS to smaller, tactical UA for prosecution of the targeting phase.

Exercise UV14 tested NATO's ability to gather information and fuse intelligence from multiple sources – from space, in the air, on land and at sea – at different stages of a crisis. In the planned scenario, the crisis began at a local level and gradually escalated into a full-blown international conflict. UV14 was designed to test existing doctrine, organisation, training, materiel, leadership, personnel, facilities and interoperability with the aim of helping NATO to quickly process, exploit and disseminate information to commanders in combat and the exercise was an unqualified success. Assets used included the Predator, Global Hawk, Hunter, Raven, Puma, NATO's AWACS aircraft, a naval Corvette and Raccoon reconnaissance vehicles. Techniques were also introduced such as using special techniques to find terrorists in dense areas.[10]

Although TTP development is critical in solving the ISR gap, it will not provide the Joint Force Air Component Commander (JFACC) the overall solution to the ISR problem nor will it address the capability shortfall of tactical assets across the NATO alliance. Rather, it is a step along the path toward solving the ISR gap problem identified earlier. Even after doctrine and TTP are refined to produce a fused ISR picture from HALE, MALE and Small Tactical UAS (STUAS), the main concern in this ISR gap will continue to be one of asset availability.

Moreover, despite the availability of the NAEW&C and NATO AGS Forces, there remains a high probability that individual nations will still need to provide ISR data to fulfil Alliance requests for collection or satisfy force generation requirements with additional ISR capabilities needed for future deployed NATO operation.

Based on this analysis, NATO's European member nations will not be adequately equipped with deployable and sustainable ISR capabilities thought to be critical for NATO operations. This could result in continued dependency on the United States to provide the required ISR capabilities. Moreover, since the end of the Cold War, the defence budgets of NATO's European member countries have been declining rapidly (cf. Figure 5, p. 10), which has aggravated the defence expenditures imbalance between Europe and the United States.[11, 12] These factors point to a need for additional jointly owned and operated ISR assets to be fielded in support of NATO operations.

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2. 'National Armaments Directors discuss NATO capabilities', North Atlantic Treaty Organization (NATO), 25 Apr. 2013. [Online]. Available: http://www.nato.int/cps/en/natohq/news_100107.htm. [Accessed 30 Jan. 2015].
3. Additionally, six United Kingdom E-3D aircraft are based at RAF Waddington, UK, whereas UK exercises limited participation, but its fleet of E-3D aircraft is an integral part of the NAEW&C Force.
4. 'Alliance Ground Surveillance (AGS)', North Atlantic Treaty Organization (NATO), 21 Aug. 2014. [Online]. Available: http://www.nato.int/cps/en/natohq/topics_48892.htm. [Accessed 30 Jan. 2015].
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7 'NATO Alliance Ground Surveillance (AGS) (U)', Presentation by SHAPE J3/AGSIO to JAPCC, 26. Nov. 2015.
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CHAPTER VI

Requirements for a NATO/MNJISRU

Building on the previous chapter, which outlined the rationale for establishing a NATO/MNJISRU, this chapter outlines the financial, operational, governance, technical, education and training as well as mission requirements for a NATO/MNJISRU.

6.1 Financial Considerations

During the latest NATO summit meeting in Wales, the delegates not only agreed to work on reversing declining defence budgets but also to make the most effective use of available funds. The objective was to eventually balance the sharing of costs and responsibilities between the United States and the European member nations. However, reducing the gap with the United States will be a major challenge, especially for smaller nations. Mitigating acquisition costs based on multinational cooperation and burden sharing could create additional ISR capabilities on the European side of NATO without overstraining national defence budgets.

Acquisition Costs can be significantly reduced in a multinational, joint or common funding arrangement. (cf. Chapter 7.1) It does not necessarily require a large number of nations to realise a notable effect on acquisition costs. Large savings can effectively be achieved with only four to six nations, allowing for an approximately 80% reduction of the individual share on acquisition costs. Cost sharing arrangements with more than six nations obviously reduce the individual share per nation even further, although no longer that significantly. Figure 11 illustrates this effect.

Personnel Expenses. In contrast to acquisition costs, expenses for personnel sometimes increase in a multinational organisation. This is due to personnel being stationed abroad and being eligible for allowances and other individual costs, which differ from nation to nation. Therefore, cost savings can only be achieved if nations can reduce their manpower contribution to a level which is below the threshold at which less money for the multinational capability has to be spent than it would have to be invested for personnel providing the same capability on a national basis. Figure 12 illustrates an example assuming that expenses for personnel abroad are raised by 110 percent. In this example, costs for 47 percent of a multinational unit's manpower would equal the same budget as a comparable unit's full manning on a purely national basis. This threshold differs from nation to nation and would have to be calculated individually. However, to achieve close to 80% cost savings as for the acquisition model (cf. Figure 10), a share of roughly 5 – 15 percent of a multinational unit's personnel seems reasonable, whereas a 50% reduction of costs could still be achieved if the share is between 15 – 35 percent.

To achieve the above mentioned effects, acquisition costs must be shared amongst the Allies and preferably by more than six nations. Additionally, to achieve the stated goal of mitigating the defence expenditures imbalance and the capability dependencies on the United States, the majority (if not all) of these costs should be borne by NATO's European member states. To make the most effective use of available funds, synergies with ISR platforms already in service should be maximized. Costs for operations and maintenance as well as for general unit support should come from NATO common funding (as it is planned for the NAGSF) and therefore shared amongst all Allies, as a NATO/MNJISRU will provide support to the entire Alliance.

6.2 Operational Considerations

AGS is primarily a strategic capability, which can be used similarly to the NAEW&C force as an early warning asset. It can also be deployed to provide persistent monitoring of an area of interest during an operation. However, NATO missions demand a wide range of JISR resources consisting of the right number and combination of assets to meet intelligence and operational requirements. A NATO/MNJISRU owned by or made available to NATO could complement the predominantly strategic AGS capabilities on the operational

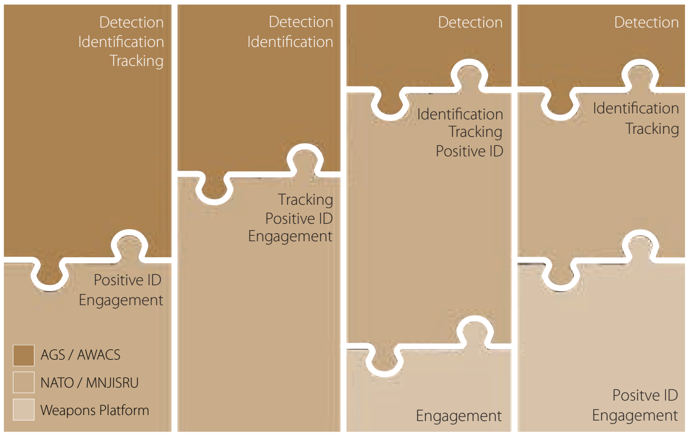


Figure 10 – Layered Approach to ISR Operations – How a NATO/MNJISRU could integrate with AGS.

and tactical levels, focussing on reconnaissance rather than on surveillance. This could be implemented with a layered approach[1], as illustrated in Figure 10. While AGS and AWACS conduct surveillance to initially detect the target, cross-cueing to the ISR assets of a NATO/MNJISRU could be used for target tracking and positive identification before engagement. In this regard, the NATO/MNJISRU capability contributes to layered ISR coverage across strategic, operational and tactical levels and thereby to the "Find – Fix – Finish" concept employed in attacking mobile targets.

Imperatively, a NATO/MNJISRU must complement NATO's strategic JISR capabilities (such as AGS and AWACS) on the operational level. To achieve this, its primary role should generally be reactive and focus on reconnaissance rather than surveillance. Therefore, it should include platforms and sensors that allow for broad-spectrum target identification, target tracking, positive identification of individual targets and optional weapons employment.

6.3 Governance Considerations

National ISR assets may not be available when requested, because either their readiness state is not sufficiently high or national caveats prevent them from being put at NATO's disposal. National caveats may also result in the withdrawal of capabilities already pledged to NATO. A NATO/MNJISRU could be under direct governance of a NATO commander and therefore could be expected to have a high readiness state and availability. Also, it could be structured in a way that permits it to cope with potential personnel withdrawals that come as a result of national caveats.

Conclusively, legal and authoritative arrangements for a NATO/MNJISRU must ensure its seamless integration into NATO peacetime and wartime JISR architectures. This will allow NATO commanders to employ its collection capabilities in line with recognised caveats and validated intelligence priorities as well as through the NATO standard processes of Intelligence Requirements Management & Collection Requirements Management (IRM & CRM).

6.4 Technical Considerations

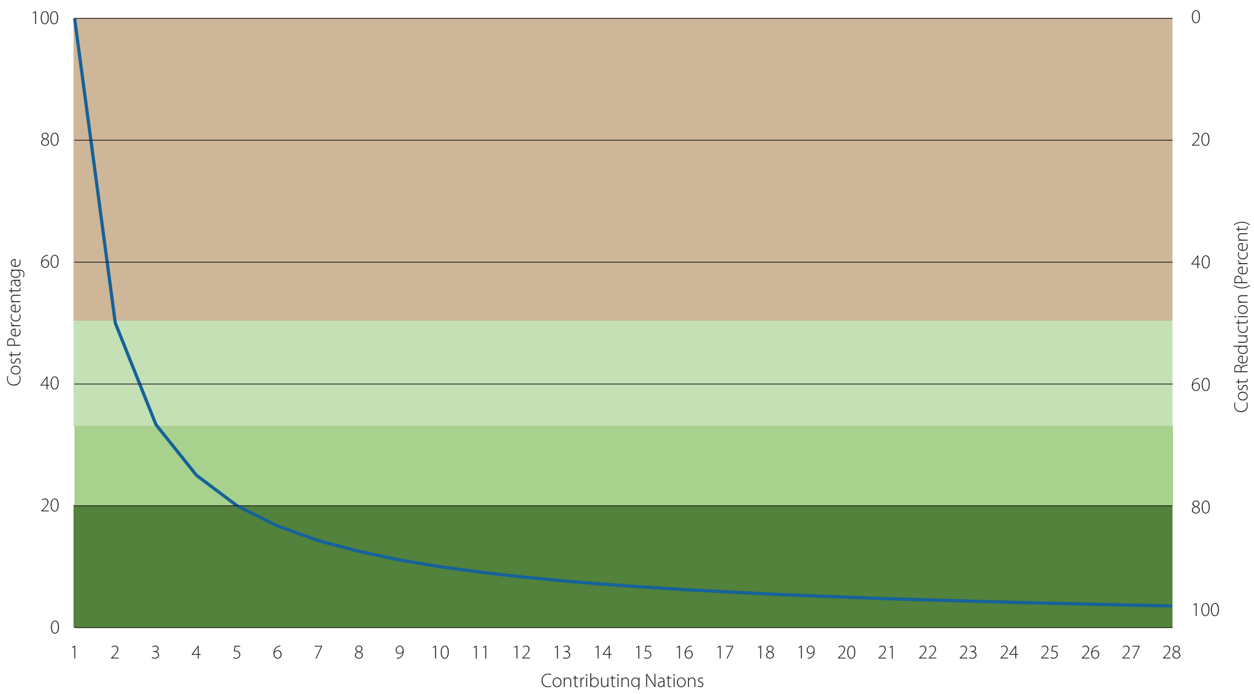
The AGS system is capable of providing radar imagery with Ground Moving Target Indication (GMTI). However, although MTI may be displayed, the system is not designed to provide real-time, high-resolution electro-optical Full-Motion Video (FMV) for positive target identification or to support certain missions such as Combat Search & Rescue (CSAR) or Special Operations. A NATO/MNJISRU's RPAS's sensors could complement AGS by providing this capability.

A long-endurance aircraft with high-resolution electro-optical sensors is required to provide tracking and positive identification of discrete targets. It must be capable of providing real-time, high-quality imagery and Full Motion Video (FMV), which should require no further technical expertise to use by operational mission commanders and their staffs. To support CSAR and Special Operations, it should be capable of relaying communications to the ground forces at the specific location.

6.5 Manpower Availability, Personnel Planning, Education and Training

A permanently established NATO/MNJISRU should be expected to maintain a high level of preparedness, availability and responsiveness. Establishing a NATO/MNJISRU could ensure that high quality ISR capability

Figure 11– Sharing of Acquisition Costs.



is permanently available to meet short notice NATO requirements such as humanitarian crises.

To minimize the cost of training flight crews and sensor operators, the NATO/MNJISRU should use an RPAS platform which is already being employed by NATO nations. This would allow training simulators already in service to be used, and personnel with comprehensive experience with the existing platform to be available.

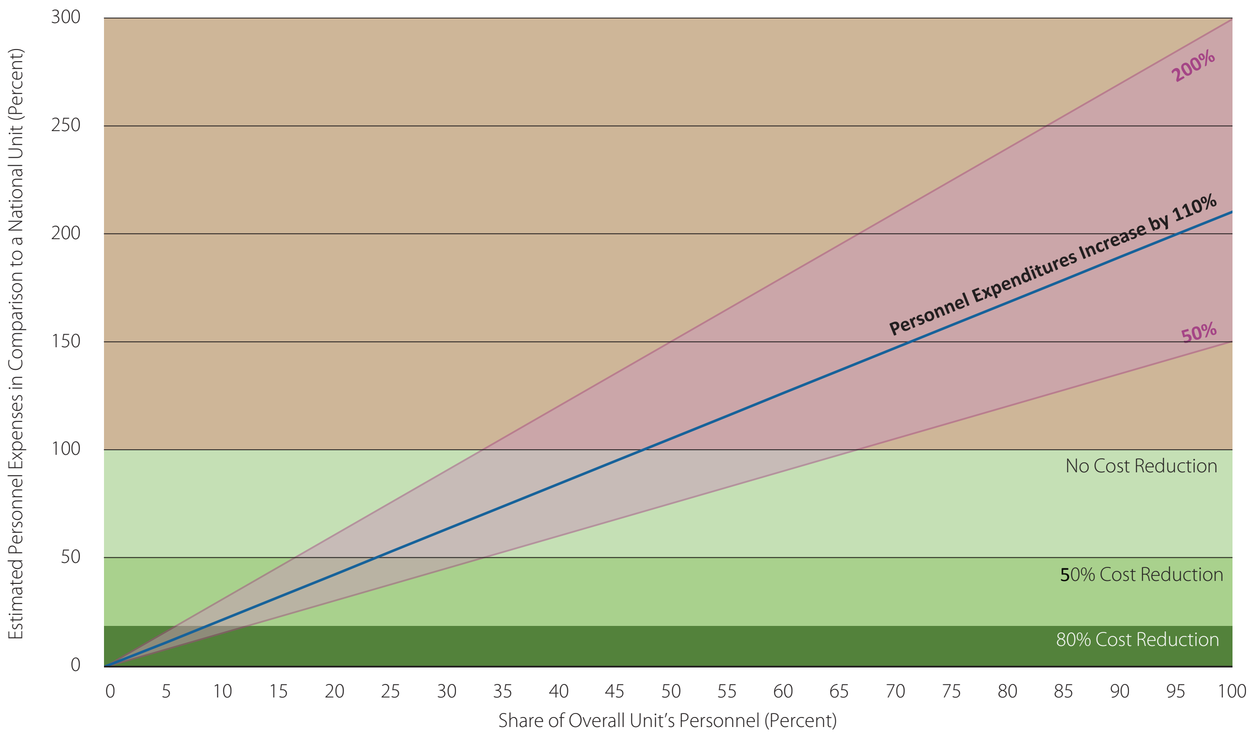
6.6 Mission Flexibility

RPAS are very versatile as they typically offer more than just simple ISR capabilities. These platforms can often provide laser designation or, when so equipped, the option to employ kinetic weapons. This adaptability provides mission commanders with greater flexibility and utility than a purely ISR platform does. As such, this capability would be available across the entire spectrum of land, maritime and special operations for a wide variety of operational applications. Also, peacetime use of this capability could include Search and Rescue, border control, International Law Enforcement, Humanitarian Crisis Response or other activities supported by NATO Leadership in accordance with stated requirements.

The structure of a NATO/MNJISRU should principally offer commanders the flexibility of having both ISR and kinetic engagement capability as required by the mission. Hence, the RPAS platform should be capable of providing high-resolution, full motion video, target acquisition and laser designation capability with an option to carry kinetic weapons. The unit structure must ensure, that participating nations can opt in or out of this capability as national caveats require.

1 'Air and Space Power in Counter-Piracy Operations', Joint Air Power Competence Centre (JAPCC), Dec. 2012, [Online]. Available: http://www.japcc.org/publications/report/Report/2013-01-14_-_CP_2012_web.pdf. [Accessed 17 Feb. 2015].

Figure 12 – Reducing Personnel Expenditures.

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CHAPTER VII

Considerations for Funding a NATO/MNJISRU

This chapter provides an overview of the variety of methods NATO has available to fund the organization, training and equipping of a NATO/MNJISRU.

7.1 Funding NATO Activities

NATO member countries have the option of making direct and/or indirect contributions to fund NATO capability requirements and implement its policies and activities. Examples of indirect contributions include National Funding and Multinational Cooperation. Examples of direct contributions include Joint Funding and Common Funding. (cf. Figure 13)

7.1.1 National Funding

National defence budgets typically cover NATO personnel expenses such as wages, pensions, travel per diem, individual training, equipment procurement to include research and development, logistics, maintenance, and support to NATO operations (troop deployments). These national contributions are offered voluntarily by individual nations in support of NATO. This funding comes from their overall defence capability in order to form the combined Alliance capability.

With regard to capability acquisitions, obviously, national funding (acquiring a capability in support of national defence priorities that will also at times be provided to NATO) does not offer any specific financial benefits for an individual NATO member country from a capability sharing point of view. However, national funding remains the only option which allows a nation to retain sovereignty over a military capability, as it simply remains an integral element of the national military force.

7.1.2 Multinational Cooperation

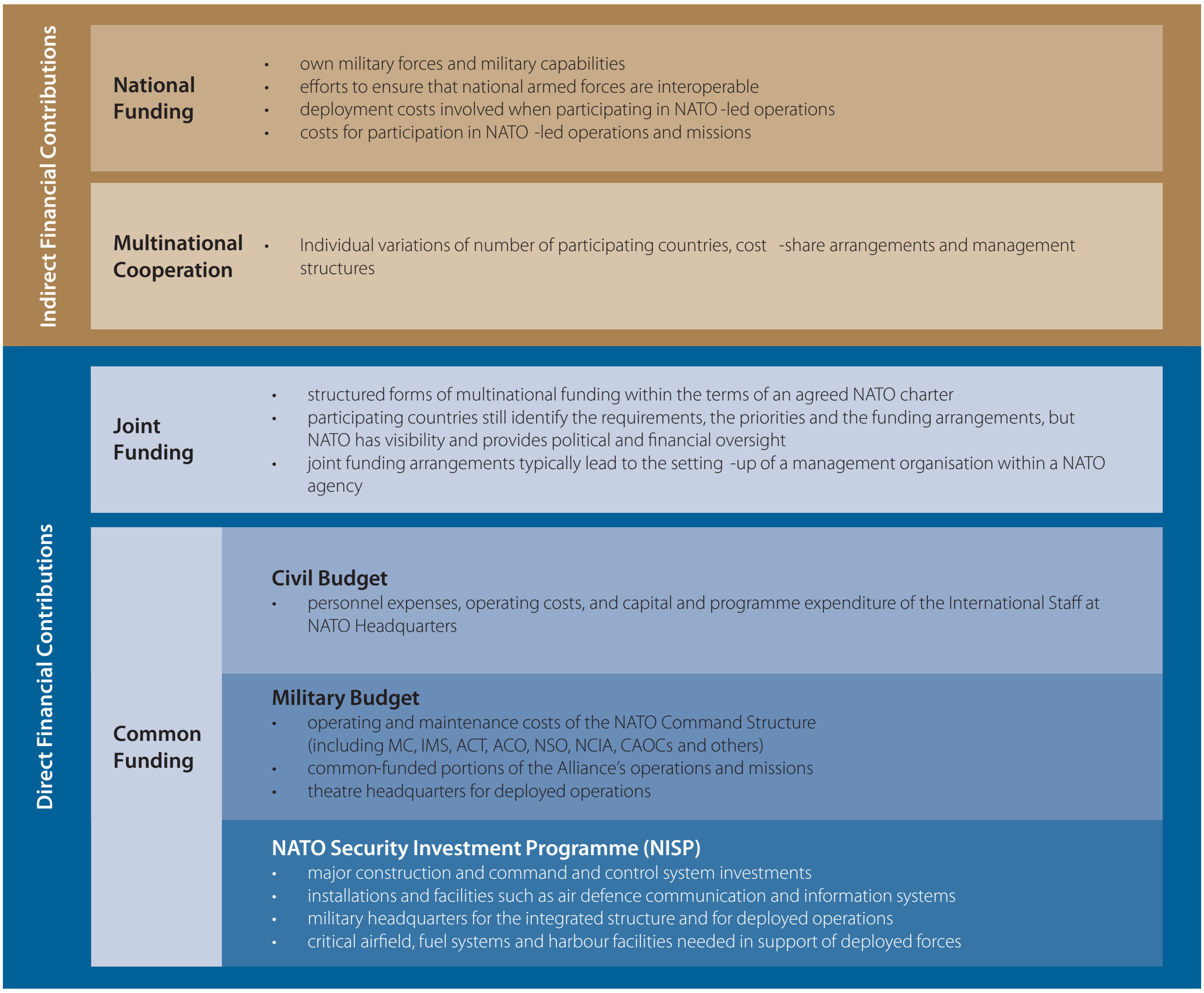
Bilateral or multilateral agreements between nations – which may also include non-NATO countries – can be established in multiple ways outside the umbrella of the NATO Procurement Organisation (NPO). These agreements can be used to share costs for personnel, procurement, infrastructure, maintenance and operations, while still supporting NATO. One example of using a multilateral agreement is the European Air Transport Command (EATC). The EATC is comprised of forces from Belgium, France, Germany, Italy, Luxembourg, the Netherlands and Spain. The EATC was established to improve the effectiveness and efficiency of disparate, national air transport operations by pooling and sharing more than 200 air transport aircraft of various types and putting them under operational control of the EATC. The EATC is not linked to the NCS, though a MNJISRU could (and preferably would) be.

Multinational cooperation offers the benefit of sharing resources and eventually reducing costs amongst the participating nations through increased efficiency. Under multinational cooperation arrangements, nations cede the tactical control fo their assets to the MOU organisation but, ultimately, retain the ability to influence their use though the imposition of caveats or withdrawal of the assets. Depending on the individual arrangements, expenses on personnel, procurement, infrastructure, maintenance and operations can be significantly reduced.

7.1.3 Joint Funding

Joint funding arrangements are structured forms of multinational funding within NATO. The participating

Figure 13 – NATO Funding Models.[1, 2]



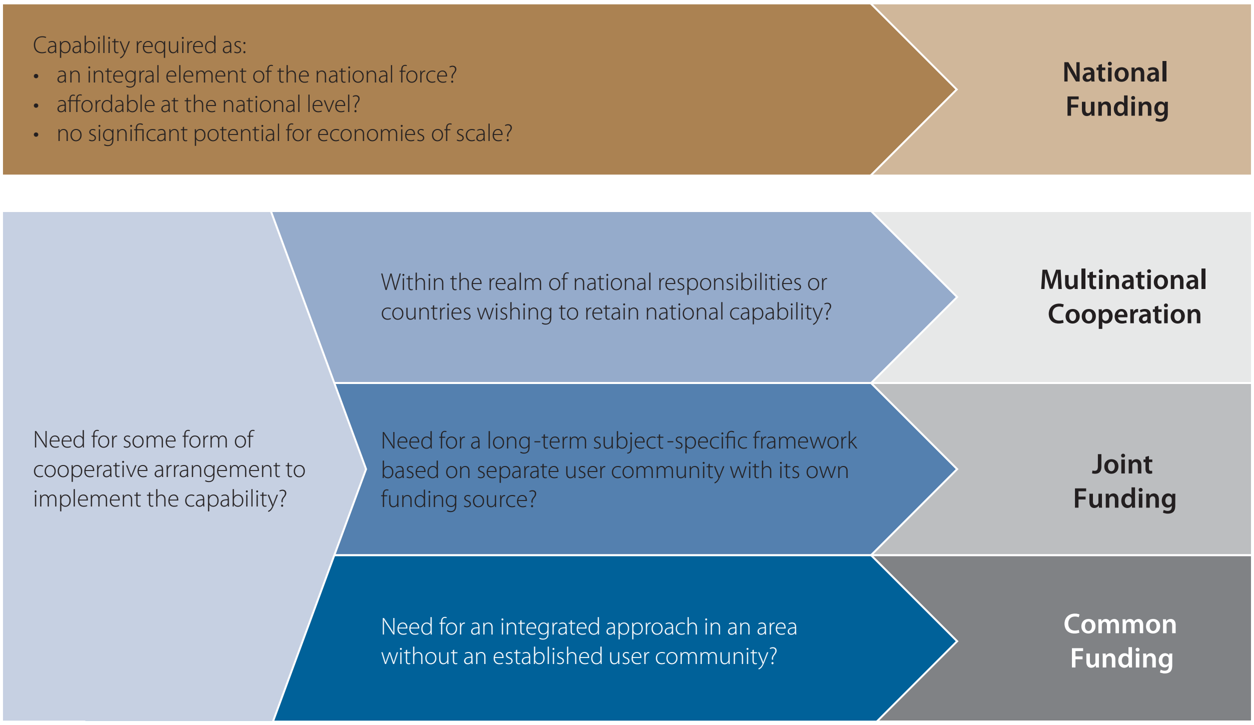
countries still identify the requirements, the priorities and the funding arrangements, but NATO has visibility and provides political and financial oversight. In the past, joint funding arrangements typically led to the arrangement of a management organisation and an implementation agency. Examples of these include the NATO Eurofighter and Tornado Management Agency (NETMA), the NATO Alliance Ground Surveillance Management Agency (NAGSMA) or the NATO Airborne Early Warning & Control Programme Management Agency (NAPMA). As NATO is currently reforming its agencies, future joint funding arrangements will be covered by programme offices within NATO's newly established Procurement Agency.[3, 4]

Joint Funding offers the same basic benefits of sharing resources and costs as Multinational Cooperation. Depending on the specific arrangements, personnel, procurement, infrastructure, maintenance and operations expenses can be reduced. Additionally, jointly funded programmes typically result in NATO-owned capabilities, for which expenditures on infrastructure, maintenance and operations will eventually be funded by NATO Common Funding, i.e. by all 28 Allies, further reducing the cost burden on individual nations.

7.1.4 Common Funding

Common funding arrangements are used to finance NATO's principal budgets where all 28 member countries participate. They include the NATO Civil and Military Budget as well as the NATO Security Investment Programme (NSIP). In contrast to all other funding models, NATO as a whole identifies the requirements and sets the priorities in line with overarching Alliance objectives. Typically, common funding will focus on the delivery of capabilities which are over and above those which could reasonably be expected to be achievable using only national resources. The NATO Air Command and Control System Management Agency (NACMA), the NATO Communications and Information Agency (NCIA), and the NATO Standardization Office (NSO) are examples for NATO common funding arrangements.[5] The over and above rule does not apply to Traditional ISR capabilities and, therefore, they do not meet the requirements to use common funding

Figure 14 – Funding Sources in NATO.[6]



for the acquisition of a NATO/MNJISRU's RPAS. However, once established as a NATO-owned unit, costs for operations and maintenance as well as general unit support could be commonly funded. Commonly funded capabilities are owned by NATO and offer the benefit of sharing the resources and costs amongst all Allies entirely. These can include personnel, procurement, infrastructure, maintenance and operations expenses.

7.2 Considerations for Funding a NATO/MNJISRU

Chapter 6.1 concluded that acquisition costs involved in establishing a NATO/MNJISRU should be shared amongst NATO's European member states. This should be done in order to mitigate the imbalance of defence expenditures with respect to the United States. Costs for the unit's operations, support and maintenance should be shared amongst all Allies. Based on this conclusion, multinational or joint funding arrangements for the initial acquisition of NATO/MNJISRU equipment should be considered as both funding models are suitable for sharing the costs between the participating nations.

Multinational Cooperation has the benefit of high flexibility with regard to the individual arrangements between the participating nations. Nations may share current existing ISR capabilities from their inventory as contributions in kind to set up a basic unit structure in the short term.

Joint Funding offers the advantage of the NATO Procurement Agency's coordinated approach, mutually agreed requirements and eventually a NATO-owned capability. Although this model may not be appropriate for a short-term solution, leveraging ISR capabilities which are already operational and available on the market could shorten the implementation timeframe.

Common Funding. Once established, costs for operations and maintenance as well as general unit support should come from NATO common funding. This has the advantage of sharing the burden amongst all 28 NATO nations and maximizes the cost-effectiveness of a NATO/MNJISRU. The NAGSF could serve as a blueprint to establish the respective funding arrangements.

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5. Ibid. 2.
6. Ibid. 1.

CHAPTER VIII

Operational Considerations for a NATO/MNJISRU

8.1 Introduction

Even the best, most modern ISR technology will not achieve meaningful objectives if the intelligence collection effort is not efficiently planned, coordinated and synchronized. This involves not only the authority to articulate, validate and prioritize collection requirements, but also the allocation of respective tasks to ISR collection assets. A critical component of this Collection Management (CM) effort is the capability to conduct timely Processing, Exploitation and Dissemination (PED) of the data collected in order to inform commanders in their decision-making.

Therefore, the establishment of a NATO/MNJISRU needs to provide for both the necessary collection capabilities – which includes PED – and the integrated Command, Control and Communications (C3) arrangements that allow for coordinated, efficient ISR collection tasking. Additionally, when the unit is employed in a NATO operation, it must have the capability for product sharing of the collected data across a coalition environment.

While general command and control (C2) concepts such as OPCOM, OPCON and TACON are addressed in Chapter 9, this chapter will concentrate on those functional authority concepts associated with the direction and management of JISR operations in NATO.

8.2 Integrating a NATO/MNJISRU into NATO JISR Architectures

Most ISR units are 'owned' by individual NATO Nations and committed temporarily in support of NATO operations. Nations may assign OPCON of JISR capabilities to NATO commanders with varying levels of commitment based on national priorities. Providing collection assets to the NATO Commanders, even temporarily, is done to maximise the flexibility of collection operations. Conversely, Nations may retain

OPCON, operate the collection asset on a national schedule, and select the collected data to provide to NATO after the national assessment of the collected data has occurred.

Moreover, ISR units greatly differ in collection capability from one another, as they often cover a specific or limited number of intelligence collection disciplines and the platform may be designed to meet specific military component or service needs.

Therefore, the integration of an ISR unit into the NATO JISR architecture and its efficient employment requires management by the most appropriate component staff and the respective Collection Management (CM) element. This collection management element is normally supported by ISR unit liaison officers familiar with the particular ISR collection platforms and sensors. For maximum efficiency of integration, the collection platforms systems should be interoperable with NATO JISR PED systems and be accredited for operation on NATO communication systems and networks using common ISR management tools and shared data repositories.[1]

Conclusively, legal and authoritative arrangements for a NATO/MNJISRU must ensure its seamless integration into NATO peacetime and wartime JISR architectures.[2] This study assumes that the NATO/MNJISRU will adopt NATO-agreed JISR processes, doctrine, standards and procedures for the management of the joint collection effort, and accept the associated collection management authorities as outlined below.

8.3 Collection Management

Collection Management (CM) is 'a management staff function converting information or intelligence requirements into collection requirements, prioritizing, tasking, requesting or coordinating with appropriate collection capabilities, assets or commands and monitoring results and re-tasking as required. The CM staff executes their functional responsibilities through Collection Requirements Management (CRM) and Collections Operations Management (COM).'[3]

8.3.1 Collection Requirements Management

CRM is the process of developing and prioritizing collection requirements as well as controlling and coordinating ISR collection, processing, exploitation, and reporting. CRM normally results in either the direct tasking of ISR assets over which the collection manager has authority or the generation of tasking requests to commands at a higher, lower or lateral echelon in order to accomplish the joint collection mission. CRM is a joint process normally led at the operational command level and supported by subordinated tactical commands.

In specific NATO operations, the Joint Task Force (JTF) Commander will usually appoint a Theatre Collection Manager (TCM), who is responsible for CRM activities conducted at theatre level for a given operation.[4]

8.3.2 Collection Operation Management

COM is the authoritative ISR asset management element of CM. This includes scheduling of specific collection ISR platforms and the associated post-collection PED. Additionally, in COM, the Intelligence, Operations, and Planning staffs conduct mission integration, issue orders, maintain situational awareness on ongoing ISR missions being performed, as well as handling dynamically changing situations that may necessitate the reallocation of JISR collection assets.

COM authority is usually held at the appropriate command level which executes operational control (OPCON) over dedicated or assigned JISR assets. National JISR capabilities placed under a commander's OPCON will be tasked by the respective CRM staff. When OPCON is retained by the Nations, the collection and exploitation directives, specified in the Collection Task List, are sent as requests by the TCM.[5]

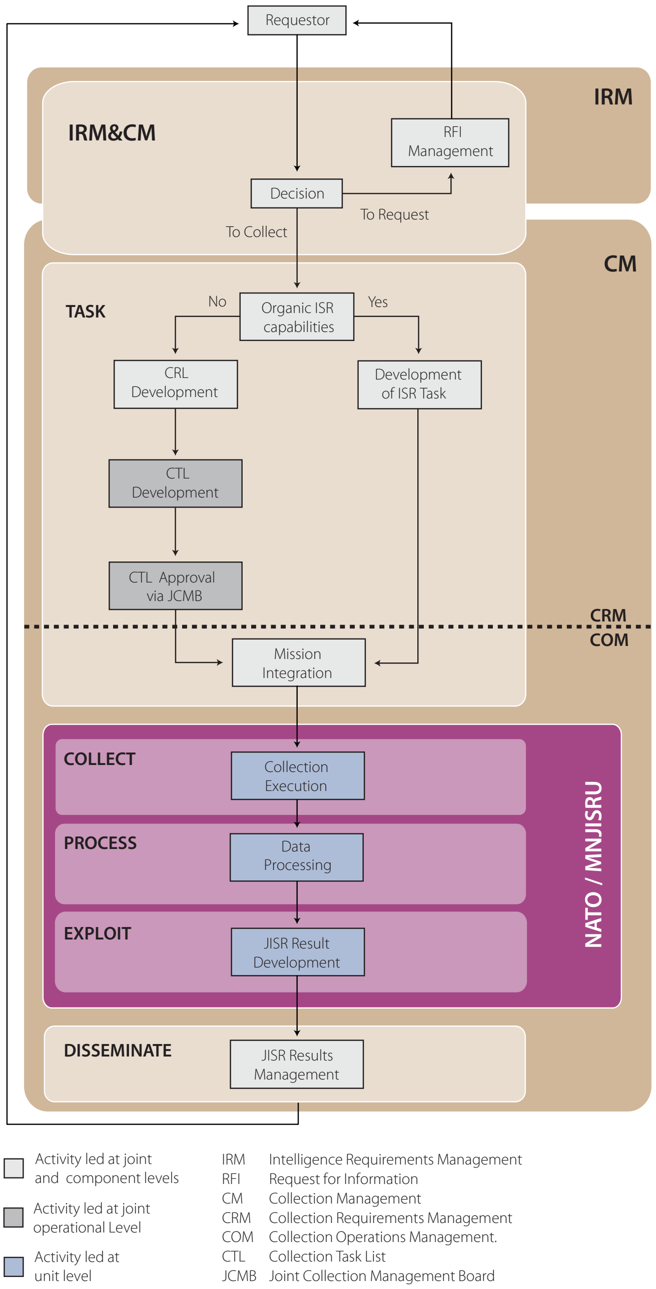
'Meaningful change will not occur until commanders at all levels take responsibility for intelligence. […] Of critical importance to the war effort is how a commander orders his or her intelligence apparatus to undertake finite collection, production, and dissemination.'[6]

Lieutenant General (ret.) Michael T.Flynn, USAF

8.3.3 CM Considerations for a NATO/MNJISRU

These definitions of CM and its elements imply that any NATO/MNJISRU employed in support of NATO, both in peace time or a named NATO operation, must not be regarded as a st and-alone capability. It has to be integrated into the respective JISR structures and mechanisms in order to contribute meaningful ISR.

Figure 15 – The NATO/MNJISRU Notional Integration into a Theatre JISR Architecture / Process.



Therefore, it is imperative that a NATO/MNJISRU fully accepts the appropriate CRM and COM roles and responsibilities in order to both maximize the efficiency of the collection process (scheduling of the ISR platform) and provide post-collection information to NATO Nations and Commands. It would be effective if COM assignment for NATO/MNJISRU collection assets were to occur in combination, with the respective air component's ISR Division assigned OPCON and the ISR unit assigned TACON.

8.4 Processing, Exploitation, Dissemination

8.4.1 General

Once ISR assets have accomplished the collection task through the CM process outlined above, the collected data then undergoes processing, exploitation and dissemination (PED). Through processing and exploitation, the collected raw data is transformed into information that can be readily disseminated to operators for instant use and/or to intelligence analysts for further, more in-depth, analysis. Processing and Exploitation remain distinct from Intelligence Analysis and Production in that collected information only receives a cursory review and has not yet been subjected to a full analysis, fusion and assessment.[7]

8.4.2 Processing

Processing is the conversion of collected data and information into appropriate, readable formats that enable further exploitation, analysis, storage or dissemination. Some JISR assets have a near-real-time data processing capability that can rapidly convert collected data into usable information. Examples of this would include an RPAS with a remote video feed capability to operational level units or troops in the field, who may make tactical decisions from the near-real-time video streamed directly from the RPAS.

8.4.3 Exploitation

Exploitation is the phase in which processed data is correlated, evaluated, and reviewed. It encompasses identifying elements of interest and adding annotations, reports and/or textual references to identified elements of interest. Time, personnel and CIS resources required to conduct exploitation varies depending on the characteristics of the collection assets.[8]

8.4.4 Dissemination

The Dissemination step involves the timely provision of JISR results to those who need it, in the requested format, and through the communication means as specified in the JISR task. Effective dissemination management is needed to ensure requesters have access to the disseminated JISR results that are posted, published, or transmitted.[9]

8.4.5 PED Considerations for a NATO/MNJISRU

Each ISR unit usually has an organic PED element manned with sensor specialists trained to conduct exploitation of data provided by the particular sensor type used on that particular ISR collection asset. In order to add value to the JISR function, a NATO/MNJISRU would have to provide a similar capability. In the event a single platform is selected, this may entail a small pool of specialists. However if the construct of an NATO/MNJISRU involves employing different types of RPAS in a pooling concept, this manpower requirement will be much larger. Manpower requirements are further discussed in chapter 11.

Furthermore, potential synergies and possibilities of mutual cooperation with national, and in particular NATO, PED capabilities should be explored. For example, the NAGSF will have a large pool of organic imagery exploitation analysts who will be predominantly educated in SAR/GMTI. Additional skills to exploit other types of imagery (e.g. EO/IR) might be available or achieved through additional training. The AGS concept of operation explicitly foresees the assimilation of other ISR data for fusion.[10] This implies a potential for the arrangement of a federated, distributed PED architecture, allowing more sustainable operations and improved product quality leveraging for a programme which NATO has already procured. Pending the type and composition of a NATO operation or peacetime arrangements, a similar PED collaboration might be possible with the Distributed Common Ground Systems (DCGS) (a network-centric, global ISR enterprise established by the U.S. Air Force).[11]

'NATO overcame many difficulties to stand up the Afghan Mission Network so coalition members could share intelligence data in Afghanistan…That system…helped to bridge the intelligence gap created by numerous national intelligence networks with different levels of interoperability. It allows the United States and 45 partners in the NATO-led International Security Assistance Force to link up over a common mission network. We learned so much from that network, once it was up, about the true cooperation that can take place without having a whole bunch of liaison officers sitting around a table trying to exchange the data person-to-person because they didn't have the digital means to have a common view of all the data. The Afghan Mission Network was a great step forward…but the lesson out of that was, do we really want to create a mission network from scratch every time we go to a new NATO campaign? And the answer is obviously not.'
Richard Wittstruck, U.S. Army Program Executive Officer for Intelligence, Electronic Warfare and Sensors

8.5 Assessment

No matter which construct is selected for the future NATO/MNJISRU, operational requirements dictate that this unit fulfil all prerequisites for seamless integration into NATO JISR architectures. This must include C2 arrangements regarding both Collection Management and practical employment of the ISR assets. This is clearly stated by various NATO JISR related concepts, doctrine, and directives. These requirements include:

- Preparedness to transfer authority over the employment of organic ISR assets, including PED, to the designated responsible CM functions within a particular supported command structure;
- Provision of an essential PED capability tailored to the platform's collection sensors;

- Compatibility with NATO-agreed standards, procedures, data protocols and information exchange requirements for the dissemination of collected and exploited ISR data;
- Complying with NATO CIS standards, to include software tools and databases for the conduct of ISR Collection Management and dissemination;
- Personnel educated and trained in CM, CRM, COM, and PED in accordance with applicable NATO standards.

1. Final Draft Joint Intelligence, Surveillance and Reconnaissance Operational Design (NR)', Supreme Headquarters Allied Powers Europe (SHAPE), 15 Jul. 2015, Information extracted is unclassified.
2. 'NATO Joint Intelligence, Surveillance, and Reconnaissance (JISR) Concept (MC 0582/1) (NR)', North Atlantic Treaty Organization (NATO), 31 May 2014, Information extracted is unclassified.
3. 'Allied Joint Doctrine for Joint Intelligence Surveillance and Reconnaissance (AJP 2.7) (NU)', Study Draft 2, North Atlantic Treaty Organization (NATO), Aug. 2015
4. Ibid.
5. Ibid.
6. 'Fixing Intel: A Blueprint for Making Intelligence Relevant in Afghanistan', Matt Pottinger, Michael T.Flynn, Paul D. Batchelor, Center for a New American Security, 4 Jan. 2010, [Online]. Available: http://www.cnas.org/publications?field_pub_type_tid=All&field_topics_tid=720&field_author_tid=1375. [Accessed 11 Aug. 2015].
7. Ibid. 3.
8. Ibid. 3.
9. Ibid. 3.
10. 'NATO Alliance Ground Surveillance Concept of Operations and Employment', North Atlantic Treaty Organization (NATO) (NR), 13 Nov. 2013, Information extracted is unclassified.
11. 'Global Integrated Intelligence, Surveillance, & Reconnaissance Operations', United States Air Force Doctrine Document 2-0, 6 Jan. 2012.

CHAPTER IX

Governance Considerations

Governance of a NATO/MNJISRU is closely linked to the respective model chosen for funding the unit. Multinational funding arrangements will most likely lead to a respective governance approach while NATO joint funding will most likely lead to a NATO-owned and governed organization.

The unit's command and control may differ depending on which governance model is chosen. The respective governance models also differ when it comes to force generation and availability for a NATO mission and how national caveats may apply and are addressed.

This chapter outlines the governance considerations regarding a multinational unit based on multinational cooperation, and a NATO unit based on joint funding or common funding. As a purely national unit does not offer any benefits in terms of funding and cost sharing, this option is not discussed.

9.1 Command and Control

9.1.1 Full Command

Full Command is the military authority and responsibility of a commander to issue orders to subordinates. It covers every aspect of military operations and administration and exists only within national services.[1]

Personnel assigned to a either a multinational or a NATO unit will always remain under the Full Command of the contributing nation. This implies the inherent right to withdraw personnel from missions and tasks which are in opposition to national caveats.

9.1.2 Operational Command

Operational Command (OPCOM) is the authority granted to a commander to assign missions or tasks to subordinate commanders, to deploy units, to reassign forces, and to retain or delegate operational and/or tactical control as the commander deems necessary.[2]

A multinational unit is typically not under OPCOM of a NATO commander unless a Transfer of Authority (TOA) message has been formally issued. The details of the TOA for the respective mission first have to be negotiated and agreed upon. This may take a considerable amount of time. In contrast, a NATO unit is always under OPCOM of a NATO commander. This is why a specific TOA is not necessary in this case.

9.1.3 Operational Control

Operational Control (OPCON) is the authority delegated to a commander to direct forces assigned so that the commander may accomplish specific missions or tasks which are usually limited by function, time, or location; to deploy units concerned, and to retain or assign tactical control of those units.[3]

Once a NATO commander has OPCOM over either a multinational or a NATO unit, OPCON can be further delegated for either governance models.

9.1.4 Tactical Command and Tactical Control

Tactical Command (TACOM) and Tactical Control (TACON) are subordinated levels of authority over a unit which has already been assigned to a NATO commander. Therefore for the purpose of this paper, this situation needn't be discussed.

9.2 Force Generation

In advance of a NATO-led operation or mission which has to be approved by all 28 NATO nations represented in the North Atlantic Council (NAC), a Combined Joint Statement of Requirements (CJSOR) as an output of the operational planning process is produced. This document states the manpower and materials needed to achieve the desired objectives. NATO member nations as well as partners can then voluntarily assign available resources to fulfil the requirement and set up the unit force structure. However, these contributions are subject to the nations' overall capacity, taking into account prior commitments, force size, structure, and activity level. The final decision on whether to contribute troops and equipment is often bound by the ratification of the respective national parliaments.[4]

Both the multinational and the NATO owned unit structure have the advantage of an established force structure which is readily available to support the force generation process. However, a multinational unit must first obtain approval and ratification of the individual contributing nations before it can be assigned to a NATO-led operation or mission. This may result in only partial contributions or no contribution at all if ratification cannot be achieved for the multinational unit.

The Concept of Operations and/or Employment (CONOPS/CONEMP) of a NATO owned unit typically provides regulations about tasking and approval to participate in a NATO-led operation or mission. As these are formally agreed prior to mission execution, no further ratification is required and the unit can be expected to be readily available at all times.[5]

9.3 National Caveats

While national contributions to NATO operations are expected to operate under the Alliance's chain of command, the provision of forces by NATO and partner countries is sometimes conditional on factors such as geography, logistics, time, rules of engagement or command status.[6] These conditions will result in reduced flexibility for NATO commanders in tasking assigned forces, national withdrawal of personnel for certain parts of a mission, or, in the worst case, no national participation in an operation at all.

9.3.1 Personnel

The personnel in both governance models will always be under the Full Command of the contributing nations. Therefore, the risk of personnel being limited or withdrawn as a result of conflicting national caveats are a factor for both types of units. Depending on the number of participating nations, this may have a severe impact on the overall contribution to a NATO-led mission. As more nations participate in a NATO/MNJISRU, the more likely a withdrawal of personnel can be mitigated.

9.3.2 Equipment

Depending on how an NATO/MNJISRU Memorandum of Understanding (MoU) is drafted, nations may elect to retain ownership of their contributed hardware. This may especially be the case for weapons and aircraft. Conversely, contributed material may be possessed by the unit as common hardware. If a conflict in national caveats result in the withdrawal of personnel, it can be expected that nationally owned equipment will also be withdrawn from the mission. Conversely, commonly owned material can be expected to be subject to some sort of mutual agreement before it can be used in support of certain contentious missions. In both cases, national caveats may impair the overall capability of the unit to contribute to a NATO-led operation or mission.

Equipment and material of a NATO-owned unit is by definition possessed by NATO itself therefore are not subject to any national caveats. Hence, it can be expected that a NATO-owned unit would be better able to cope with the impact of national caveats as long as the personnel necessary to operate the equipment are provided by more than one nation.

9.4 Assessment

Preferably, NATO should have OPCOM over a NATO/MNJISRU at all times to ensure a seamless force generation process for any given mission. The CONOPS/CONEMP should anticipate detailed arrangements to allow for a quick and smooth TOA and provide procedures to mitigate potential withdrawals of personnel and equipment if national caveats apply. Furthermore, the MoU should foresee an appropriate set of predefined mission scenarios, such as collective defence, conflict prevention, intervention, stabilization operations, evacuation operations, or emergency response and humanitarian aid to facilitate national ratification procedures if they are required.

1. 'NATO Glossary of Terms and Definitions (AAP-06)', Edition 2014, NATO Standardization Office (NSO), 2014.
2. Ibid. 1.
3. Ibid. 1.
4. 'Troop Contributions', North Atlantic Treaty Organization (NATO), 7 Jan. 2015. [Online]. Available: http://www.nato.int/cps/en/natohq/topics_50316.htm. [Accessed 14 Jan. 2015].
5. 'Alliance Ground Surveillance (AGS) Concept of Operations and Employment (NATO Restricted)', Supreme Headquarters Allied Powers Europe (SHAPE), Oct. 2013. Extracted information is unlcassified.
6. Ibid. 4.

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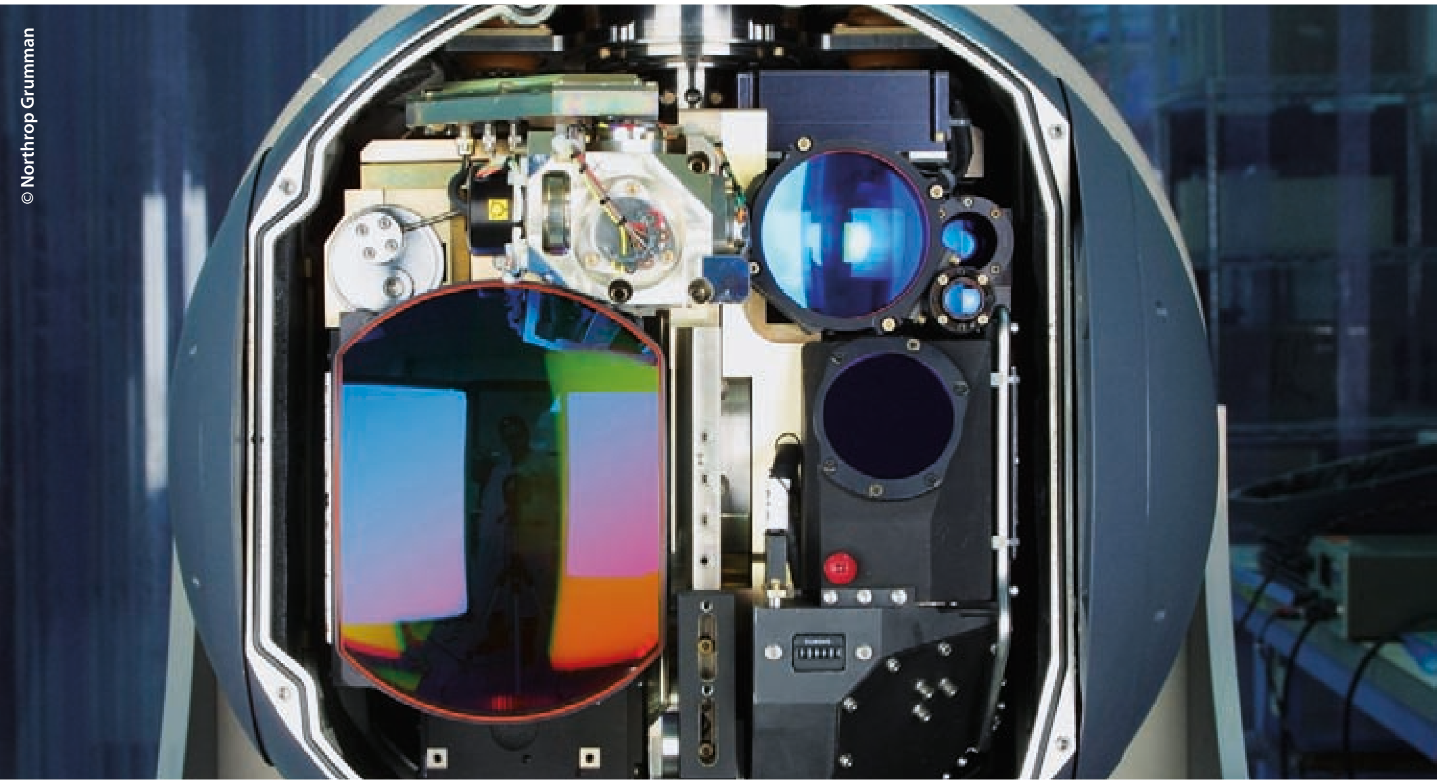


CHAPTER X

Technical Considerations

Chapter 6 outlined the requirements for a NATO/MNJISRU. These capabilities can be provided by a variety of currently available RPAS platforms. Many nations have pursued the development of both Small Tactical (STUAS) and Medium Altitude Long Endurance (MALE) RPAS. Research programs such as the UK's Scavenger are in progress to determine near term solutions to national MALE RPA capability shortfalls.

'The two MQ-1 Predator UAS, which executed 145 strikes against dynamic targets, were among the most effective platforms of the operations. It is an absolutely fundamental capability […] If we have had 30 or 40 armed drones, we would have done what we needed.'
General Vincent Tesniere, FRA
Deputy JFACC Operation Unified Protector

Currently, a variety of MALE RPAS platforms exist within NATO, although not in sufficient numbers. This chapter gives an overview on some of the RPAS deemed worth considering for use in a NATO/MNJISRU, as they are already in service within NATO Nations or near-term acquisition is planned. The platforms discussed in this chapter are ordered by Maximum Take-Off Weight (MTOW) and not ranked in order of any preference as each listed RPAS already fields the requirements for EO/IR imagery and Full Motion Video as outlined in chapter VI.

10.1 Airworthiness Considerations

Considering the history of UAS in the last decades, it becomes clear that national airworthiness requirements were not a driving factor in their development. Currently, none of the UAS discussed in this study are certified for operating in non-segregated airspace and they all usually require a waiver for any individual flight outside military-owned airspace. A NATO/MNJISRU which pools and shares currently fielded UAS will have to find suitable arrangements with the host nation to deal with that problem. In the long term, NATO should strive for a certifiable UAS to utilize its capabilities to the maximum extend.

10.2 Survivability Considerations

Current RPAS were never intended to operate in contested environments. Development over the last decades was mainly focused on incorporating improved sensors for better air-to-ground imagery and higher fuel efficiency for extended loiter times. Survivability considerations such as signature reduction, warning receivers, countermeasures, high airspeeds and manoeuvrability were not a design priority. These shortfalls make current systems highly vulnerable to threats directed against them.

Discussing suitable options to enhance RPAS survivability is outside the scope of this study. This topic is extensively addressed in the 2014 JAPCC white paper 'Remotely Piloted Aircraft Systems in a Contested Environment'. A NATO/MNJISRU using currently existing platforms should address these issues in its CONOPS/CONEMP, whereas a future NATO-owned platform should incorporate some sort of defensive capabilities from the start.

Figure 16 – Tactical UAS and MALE RPAS in NATO.

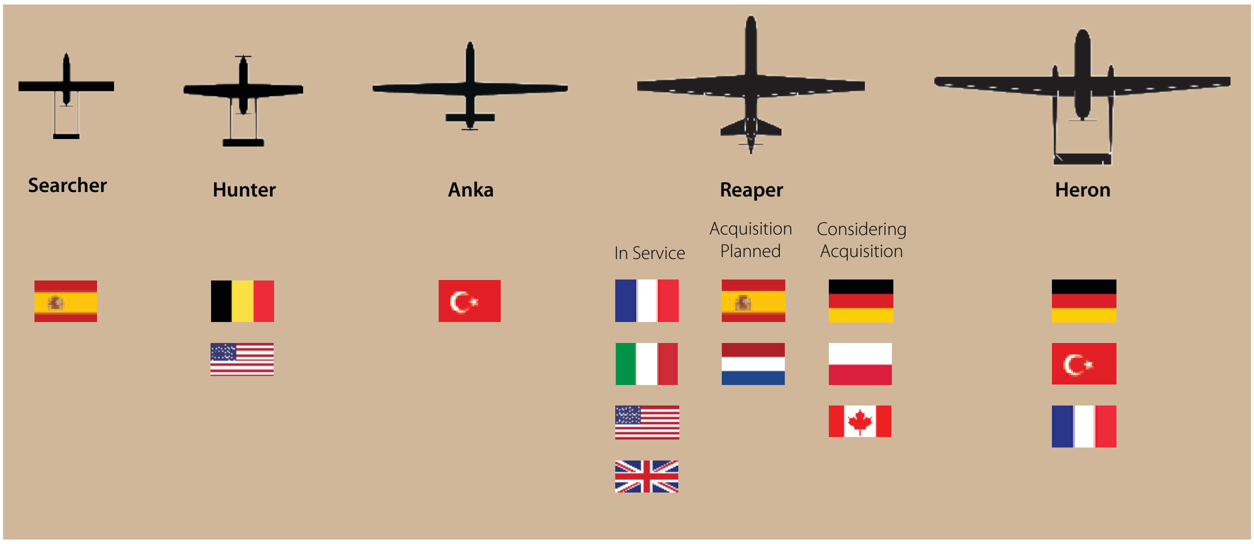


Figure 17 – Israeli Aerospace Industries Searcher Mk II.

10.3 Israeli Aerospace Industries Searcher Mk II

The Israeli Aerospace Industries (IAI) Searcher Mk II is actually considered a Tactical UAS but is capable of operating inside the lower portions of the MALE RPAS altitude regime. It has been in service since 1998 and is an improved version of the 1989 Searcher I. The main configuration changes are extended-span wings with modest sweepback and a rotary engine with a three-blade propeller. The Searcher Mk II can be configured for tactical surveillance or as a communications relay aircraft. Several payloads can be carried simultaneously.

Airframe. The airframe consists of a shoulder-wing monoplane with a pusher engine and a twin-boom tail unit, built largely of composites. Attached is a non-retractable tricycle landing gear.

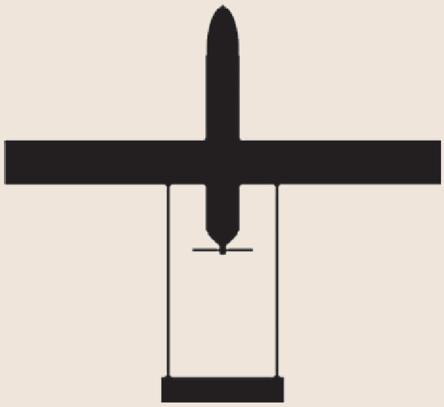
Mission Payloads are comprised of normal EO/IR payloads with LRF and a single real-time data and video downlink. Payloads also include SAR, providing the Searcher Mk II with a night/all-weather capability. IAI also offers other payloads depending on the customer's choice, such as COMINT and ESM.

Guidance and Control. The Searcher MK II can be controlled from a variety of GCSs, which command, control, track and communicate with it and/or its payload via direct LOS datalink, dual real-time command uplink, single real-time data and video downlink and airborne or ground-based data relay for BLOS missions. The Searcher Mk II has a GPS-based airborne mission controller mode with real-time manual interrupt capability and an automated return-home mode in case the datalink is lost. The Searcher Mk II is compatible with other IAI Malat ground stations, avionics and datalinks. Three system operators man the GCS, using computer-driven panels and other units installed in the control station bays. The GCS is housed in a shelter accommodating four such bays and, optionally, a mission commander's desk.

Launch and Recovery. The aircraft supports automatic wheeled take-off or can be launched by a pneumatic catapult or booster rocket. It also supports automatic wheeled landing to an arrester hook and cable.

Searcher Mk II[1]

Manufacturer
Israeli Aerospace Industries



In Service	**Acquisition**
ESP	n/a

Mission profile
Intelligence, Surveillance, Reconnaissance, Target Acquisition

General Aircraft Data

Length	Wingspan	MTOW	Capacity
5.85 m	8.55 m	939 lb	220 lb

Powerplant

LIMBACH L 550 E AVGAS engine (50 hp)

Data Link/Range

LOS (108 nm)
BLOS (135 nm)

Guidance/Tracking

INS/GPS

Performance

Maximum Speed
105 kts

Loitering Speed
60 kts

Endurance
15 hr

Max Ceiling
20,000 ft

Payload

Sensors
EO/IR/LRF
SAR
COMINT/ESM

Weapons
n/a

Other Information

IAI offers additional payloads at custmor's choice

Figure 18 – Israeli Aerospace / Northrup Grumman Hunter.

10.4 Israeli Aerospace Industries / Northrop Grumman MQ-5B Hunter

The RQ-5 has been in service since 1990 and is based on an IAI air vehicle originally known as the 'Impact'. It was designed by Northrop Grumman for the U.S. Army to meet their short-range requirements. The latest version is the MQ-5B, which was upgraded to include a multi-mission weapon-carrying capability as well as improvements in payload, endurance and altitude. Although it is classified as a Tactical UAS, these enhancements push the operating ceiling into the MALE RPAS altitude regime.

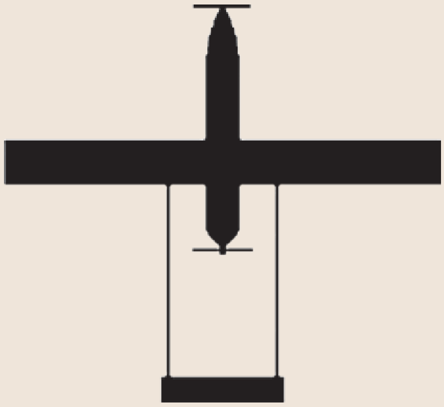
Airframe. The airframe is built of low-observable composites and consists of a high-wing monoplane with a robust pod-and-twin-tailboom and a fixed tricycle landing gear. It has one tractor and one pusher engine to improve the aircraft's survivability.

Mission Payloads. Basic sensor payloads are TV/FLIR an airborne data relay system. A modular building block approach enables these sensors to be replaced by alternative packages, such as VHF/UHF communications relay, SAR/GMTI, LD/LRF, radar jammer, COMINT, SIGINT, and communications jammer. The MQ-5B is also capable of carrying Viper Strike laser-guided missiles or Textron BLU-108 sub-munitions underwing.

Guidance and Control. The MQ-5B can be pre-programmed or remotely controlled. Total systems operation is readily attainable with only minimum field user training and from deployable truck-mounted GCS. Control from the cockpit of an AH-64 Apache helicopter has been demonstrated.

Launch and Recovery. The aircraft supports automatic wheeled take-off from unprepared strips. It also supports automatic wheeled landing to an arrester hook and cable and a parachute for emergency recovery.

MQ-5B Hunter[2]



Manufacturer
Israeli Aerospace Industries
Northrop Grumman

In Service
BEL
USA

Acquisition
n/a

Mission profile
Intelligence, Surveillance, Reconnaissance, Target Acquisition, Targer Designation, Weapons Emplyment

General Aircraft Data

Length	Wingspan	MTOW	Capacity
7.01 m	10.44 m	1,951 lb	260 lb

Powerplant

2x Northrop Grumman JP-8 Heavy fuel engine (55 hp)

Data Link/Range

LOS (108 nm)

Guidance/Tracking

INS/GPS

Performance

Cruising Speed
80 kts

Loitering Speed
60 kts

Endurance
21 hr

Max Ceiling
20,000 ft

Payload

Sensors
EO/IR/LRF
TV/FLIR
SAR/GMTI
COMINT
SIGINT

Weapons
GBU-44

Other Information

Modular payloads include ESM/ECM payloads as well

Figure 19 – Turkish Aerospace Industries Anka.

10.5 Turkish Aerospace Industries Anka

The Anka is primarily manufactured to meet the reconnaissance and surveillance requirements of the Turkish Armed Forces. It was designed and developed by Turkish Aerospace Industries (TAI) and has been in service since 2013. An improved version referred to as Anka-S is scheduled for delivery during the period 2016 to 2018.

Airframe. The airframe consists of a graphite/epoxy monocoque fuselage with high-wings, V-tail and a pusher engine. It has a retractable tricycle undercarriage. The wing and tail surfaces are detachable for storage and transportation. Ice protection for the wing and tail leading edges is optional.

Mission Payloads. ISR payloads include EO/IR/LRF and SAR/ISAR/GMTI with an onboard recording capability and provisions for SIGINT and communications relay equipment. The Anka-S is also expected to include a weapon-carrying capability and improved high-definition (HD) EO/IR sensors.

Guidance and Control. The Anka provides redundant vehicle management due to a segregated mission systems architecture. The flight control system has multiple automated flight modes. The Anka is optionally capable of operating BLOS via SATCOM and is controlled from a standard ACE III type shelter GCS, which is compliant with NATO STANAGs. The GCS is equipped with dual command and control consoles, as well as simulation and playback capabilities. Payloads are controlled and sensor data/image/video is distributed in real time. The system is expandable with a Transportable Image Exploitation Station, Radio Relay, and Remote Video Terminals.

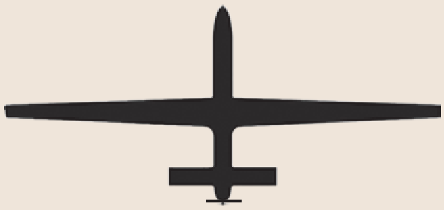
Launch and Recovery. The aircraft supports automatic or conventional wheeled take-off and landing.

Anka[3]

Manufacturer
Turkish Aerospace Industries

In Service
TUR

Acquisition
n/a



Mission profile
Intelligence, Surveillance, Reconnaissance, Target Acquisition, Targer Designation, Weapons Emplyment

General Aircraft Data

Length	Wingspan	MTOW	Capacity
8.00 m	17.40 m	3,703 lb	507 lb

Powerplant

Thielert Centurion 2.0
Heavy fuel engine (155 hp)

Data Link/Range

LOS (108 nm)

Guidance/Tracking

INS/GPS

Performance

Cruising Speed
140 kts

Loitering Speed
88 kts

Endurance
24 hr

Max Ceiling
26,000 ft

Payload

Sensors
EO/IR/LRF
SAR/ISAR/GMTI
SIGINT

Weapons
Cirit Missiles (planned)
L-UMTAS (planned)

Other Information

BLOS SATCOM optional

Figure 20 – General Atomics MQ-9 Reaper.

10.6 General Atomics Predator B / MQ-9 Reaper

Efforts to develop the next generation of the Predator (Predator B) design, able to fly higher and faster and carry significantly more payload, began in 1998. The USAF MQ-9 designation was allocated in January 2002 and the name Reaper was announced in September 2006.

Airframe. Of generally similar appearance and construction to its predecessor, the airframe is a low-wing monoplane built of advanced composites comprising a slender fuselage with a V-tail and ventral fin. Each wing incorporates three underwing hardpoints for external stores. The tricycle landing gear retracts into the fuselage to reduce drag and clear the viewing field for the optical sensors.

Mission Payloads. The MQ-9 Reaper can carry multiple mission payloads, including EO/IR with LD/LRF, SAR, maritime multimode radar, ESM, SIGINT, and weapons, including AGM-114P Hellfire missiles, GBU-12 laser-guided bombs and GBU-38 500 lb Joint Direct Attack Munition (JDAM). Mixed loads of the aforementioned weapons is possible.

Guidance and Control. The General Atomics GCS allows direct real-time control of the aircraft and can be located on any land base, in an aircraft or on board a ship. Missions can be pre-programmed and flown in fully automated mode. For both real-time and automated missions, the pilot operator is responsible for landing the aircraft following mission completion. Using a Remote Video Terminal (RVT), the MQ-9 provides real-time imagery directly from the aircraft not only to the GCS but also to personnel in the field, on ships or in the air.

Launch and Recovery. The MQ-9 requires conventional wheeled take-off and landing and does not offer an automated launch and recovery mode.

Predator B/MQ-9 Reaper[4]

Manufacturer
General Atomics Aeronautical Systems, Inc.

In Service
ITA
FRA
UK
USA

Acquisition
DEU (considered)
CAN (considered)
ESP (planned)
NLD (planned)
POL (considered)

Mission profile
Intelligence, Surveillance, Reconnaissance, Target Acquisition, Targer Designation, Weapons Emplyment

General Aircraft Data

Length	Wingspan	MTOW	Capacity
10.97 m	20.12 m	10,498 lb	3,848 lb

Powerplant

Honeywell TPE331-10

Data Link/Range

LOS (150 nm)
BLOS (4,600 nm)

Guidance/Tracking

INS/GPS

Performance

Maximum Speed
240 kts

Loitering Speed
180 kts

Endurance
27 hr

Max Ceiling
50,000 ft

Payload

Sensors
EO/IR/
SAR
SIGINT/ESM
COMM RELAY

Weapons
Hellfire Missiles
GBU-12
GBU-38

Other Information

The new variant, Predator B ER, extends the aircraft's endurance from 27 hours to 34. In 2016, the aircraft is expected to evolve again, when its wingspan will grow from 66 feet to 79 feet to hold additional fuel for up to 42 hours of endurance. GA-ASI also offers a certifiable version MQ-9.

Figure 21 – Israeli Aerospace Industries Heron.

10.7 Israeli Aerospace Industries Heron

Heron is the English export name for the UAS. To the Israel Air and Space Force it is known as the Shoval (Trail). Existence of the Heron was revealed on 18 October 1994 with news of its first flight.

Airframe. The Heron has an all-composite airframe which is built on a high-wing monoplane with very high aspect ratio wings fitted with full-span slotted flaps. It has a twin-boom tail unit with inward-canted fins and rudders and is propelled by a pusher engine. The tricycle landing gear is fully retractable to reduce drag. The wings, booms and tail unit of the Heron were also used in the Hunter II derivative of the Northrop Grumman/IAI RQ-5A.

Mission Payloads. The Heron provides multiple ISTAR payload capabilities, such as EO/IR with LD/LRF, SAR/GMTI, and others depending on customer's choice.

Guidance and Control. The Heron provides fully digital avionics which are interoperable with the Northrop Grumman/IAI Hunter system and adapted for similar compatibility with the IAI Searcher. The Heron can be operated in a fully automated or remotely piloted mode, either in LOS or BLOS using its multiple SATCOM datalinks. Israel and Thales recently completed NATO-compliant standard datalink testing with the Heron ensuring interoperability with NATO.

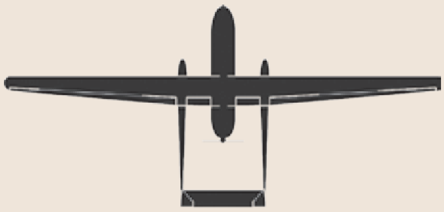
Launch and Recovery. The aircraft supports automatic or conventional wheeled take-off and landing.

Eitan Heron[5]

Manufacturer
Israeli Aerospace Industries

In Service
DEU
TUR
FRA

Acquisition
n/a



Mission profile
Intelligence, Surveillance, Reconnaissance, Target Acquisition, Target Designation.

General Aircraft Data

Length	Wingspan	MTOW	Capacity
8.50 m	16.60 m	2,425 lb	1,102 lb

Powerplant

Rotax 914 F (98.6 hp)
four-cylinder four-stroke engine

Data Link/Range

LOS
BLOS

Guidance/Tracking

INS/GPS

Performance

Maximum Speed
125 kts

Loitering Speed
80 kts

Endurance
40 hr

Max Ceiling
30,000 ft

Payload

Sensors
EO/IR/LRF
SAR
MPR
ELINT/COMINT
ESM

Weapons
n/a

Other Information

Also in service outside NATO (AUS, IND, ISR)

10.8 Assessment

Only a fraction of the 28 NATO nations have actually fielded or planned to acquire MALE RPAS, resulting in a lack of sufficient numbers of ISR systems which can survey broad areas of interest, positively identify and precisely locate military targets in real time whilst providing a high degree of PED interoperability.

In the spirit of the Wales Summit's Pooling & Sharing initiative, any of the UAS discussed in this chapter would meet the requirements as stated above. However, the RQ-5 Hunter and the Searcher Mk II

UAS may present a challenge due to their reduced payload size and lower range and altitude regimes when compared to the larger models.

Because of these limitations, this study would exclude the RQ-5 Hunter and the Searcher Mk II UAS from the list of potential platforms for a NATO owned and operated unit. All of the larger systems discussed are a valid option, although the MQ-9 Reaper would currently provide the most payload and armament versatility as well as anticipated future upgrades for improving its capabilities and airworthiness.

1. 'Jane's Unmanned Aerial Vehicles and Targets, IAI Searcher', IHS Aerospace, Defence & Security, 5. Jan. 2015
2. 'Jane's Unmanned Aerial Vehicles and Targets, Northrop Grumman/IAI MQ-5 and RQ-5 Hunter', IHS Aerospace, Defence & Security, 6. Jan. 2014
3. 'Jane's Unmanned Aerial Vehicles and Targets, TAI Anka', IHS Aerospace, Defence & Security, 18. Feb. 2015
4. 'Jane's Unmanned Aerial Vehicles and Targets, GA-ASI MQ-9 Reaper', IHS Aerospace, Defence & Security, 28. Oct. 2013
5. 'Jane's Unmanned Aerial Vehicles and Targets, IAI Heron', IHS Aerospace, Defence & Security, 30. Sep. 2015

CHAPTER XI

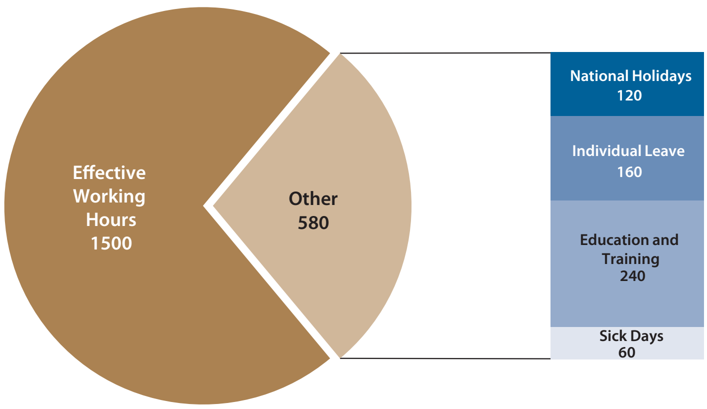
Considerations Regarding Manpower Availability, Personnel Planning, Education and Training

A NATO/MNJISRU must include highly qualified personnel from a variety of career fields, such as RPAS pilots, sensor operators, Computer Information Systems (CIS) and Satellite Communications (SATCOM) specialists, Imagery Analysts, Intelligence Officers, Ground Service Personnel, Aircraft Configurators and aircraft maintenance. Not all of these required personnel can be expected to be always readily available. Some of them are platform-specific (pilots, operators and maintainers), whereas others are platform-independent (those required for the Processing, Exploitation and Dissemination (PED) process). This chapter provides considerations regarding obtaining and sustaining highly qualified personnel to achieve full operational capability (FOC) and support future readiness.

11.1 Manpower Requirements

Depending on the Level of Ambition (LoA), the quantity of personnel required can vary significantly. Operational deployment for a short period may be conducted with a 12 hour shift rotation, whereas sustainability in longer engagements typically requires a three-shift system to conduct 24/7 operations. Considering a complete 24/7 ISR coverage of a dedicated area, additional personnel may be required for transit of the relief RPA until the RPA currently on station can

Figure 22 – Annual vs. Effective Working Hours.



Annual Working Hours per Post	
365 days x 24 hours	**8,760 hours**
Effective Working Hours per Person	
52 weeks x 40 hours	2,080 hours
National Holidays, Leave, Training etc.	- 580 hours
	1,500 hours
Required Personnel per Post	
Annual Working Hours	8,760 hours
Effective Working Hours	: 1,500 hours
	5.84

Figure 23 – Required Personnel per Post.

be replaced (cf. Figure 24). For home-based personnel conducting Remote Split Operations (RSO), national working hour regulations may also have an impact on personnel availability and further raise the requirements for filling posts on a 24/7 basis.

To sustain 24/7 operations throughout the year, it can be expected that a single post has to be filled with at least 6 personnel.

11.2 Platform-Independent Personnel

11.2.1 Manpower Availability

To fill the platform-independent personnel posts, nations could theoretically reach back to their existing military forces or civilian staff if applicable. Furthermore, manpower requirements may be significantly reduced if potentially overlapping processes between the NAGSF and a future NATO/MNJISRU such as intelligence analysis, production and dissemination will be conducted using a joint approach.

11.2.2 Personnel Planning

Bidding, filling and rotation of posts for platform-independent personnel can follow the established NATO processes. However, it should be ensured that, except for 'national modules' as discussed in the next chapter, the NATO/MNJISRU should follow a fully integrated approach down to the team level. This is to ensure personnel redundancy in case national caveats result in the loss of mission essential personnel.

11.2.3 Education and Training

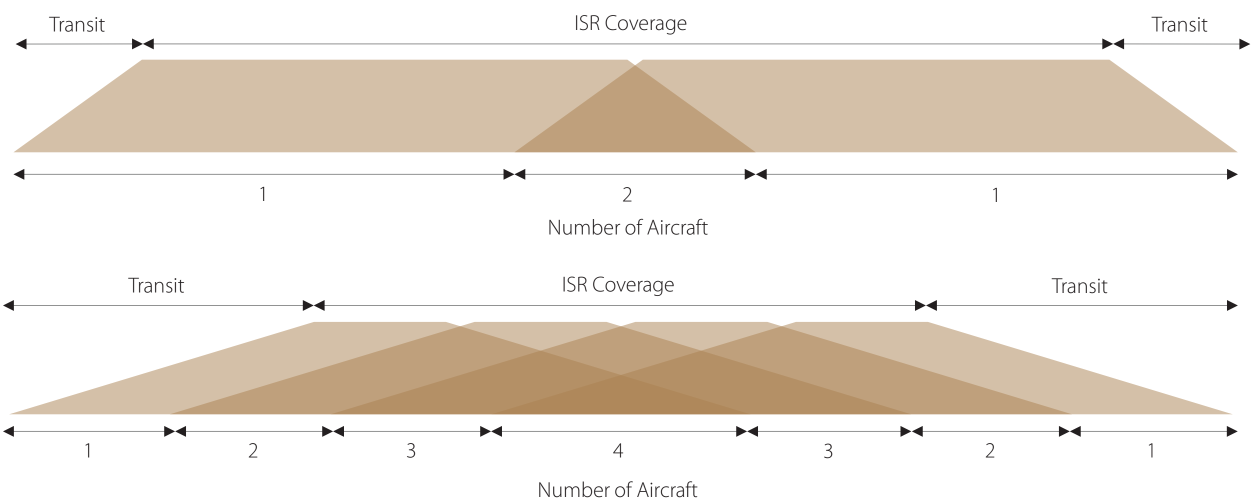
Platform-independent personnel can be expected to have a broad experience level in their respective domain. Hence, little or even no training at all is expected to be required to integrate them into a NATO/MNJISRU, though on-the-job training will certainly occur.

11.3 Platform-Specific Personnel

11.3.1 Manpower

Platform-specific personnel will represent a challenge to the operational capability of a future NATO/MNJISRU, as these personnel are typically only available from a limited number of nations that operate the respective platforms. Certain non-combatant tasks, such as aircraft maintenance, may be outsourced to contractors on either a temporary or permanent basis to fill mission critical personnel gaps. Some manufacturers also provide contracts for civilian aircrews. This could be an alternative for missions that don't require combatant status such as for disaster relief or unarmed surveillance for non-targeting purposes.

Figure 24 – Transit Impacting Crew Rotations and Time on Station.



11.3.2 Personnel Planning

Appointing platform-specific personnel requires a more sustainable approach and longer-term planning than appointing other personnel. Contributing nations should consider appointing aircrew and maintenance specialists for longer periods, aiming at twice the normal rotation timeframe. Even if these personnel are 'taken out of a hide', the contributing nation would eventually benefit, as these personnel will acquire irreplaceable experience operating in this unique multinational environment.

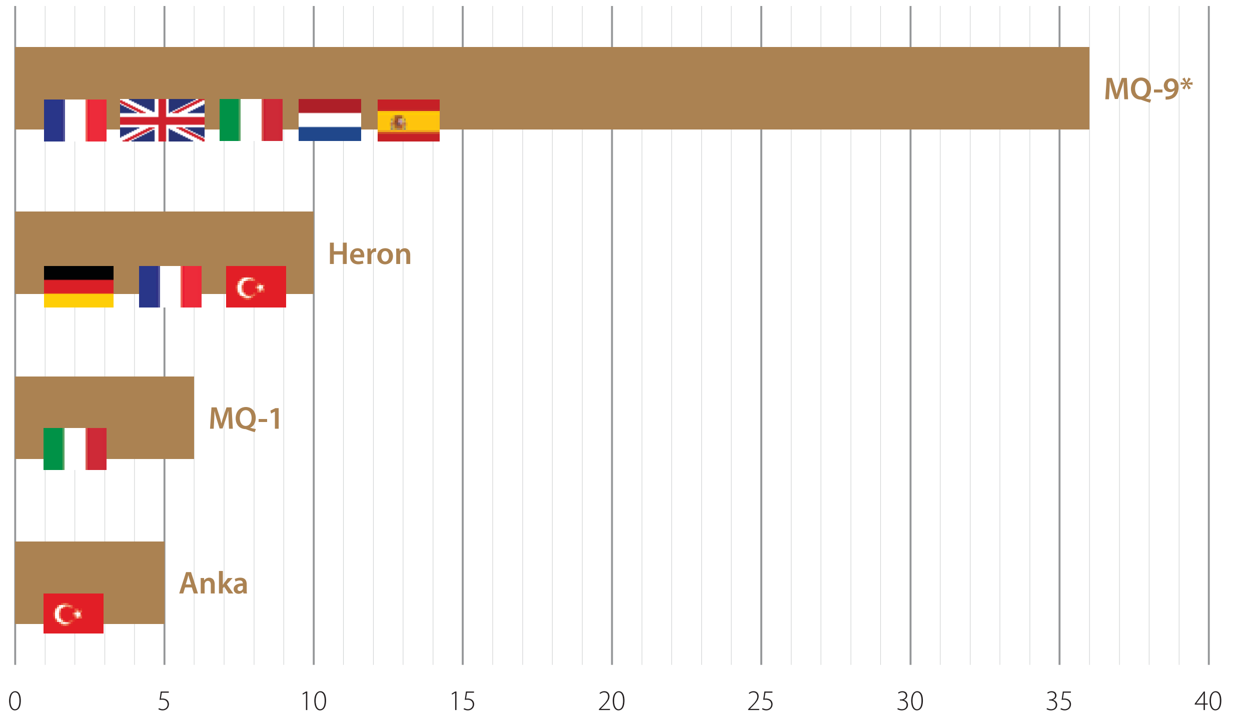
11.3.3 Education and Training

Although supportive of the idea of an NATO/MNJISRU, not all nations may be capable of appointing qualified and trained personnel for a specific platform. Hence, these personnel should be expected to go through additional training to get them mission ready. A NATO/MNJISRU could be augmented with a dedicated training element using a flight simulator or other type of a virtual training environment to qualify aircrew or other key personnel, such as imagery analysts. This could also mitigate platform-specific personnel shortfalls as discussed in previous sections.

11.4 Assessment

Manpower requirements are mainly driven by the unit's Level of Ambition for ISR coverage. To complement and interoperate with the NAGSF, a similar manpower approach should be adopted so that the NATO/MNJISRU can cover the same operations schedule as the AGS system. Additionally, national working hour regulations which impact the availability of home-based personnel should be addressed in the MoU as well as in the CONOPS/CONEMP of the unit. Shortfalls in the availability of qualified platform-specific personnel should be mitigated by establishing longer rotation cycles and augmenting the unit with an organic training element. To eventually save manpower and, therefore, costs, it should be considered to outsource non-combatant tasks such as aircraft maintenance and to share personnel with the NAGSF where feasible, e.g. in the PED domain.

Figure 25 – Numbers of MALE RPAS in NATO (U.S. National fleets not included).



* Including Planned Acquisitions

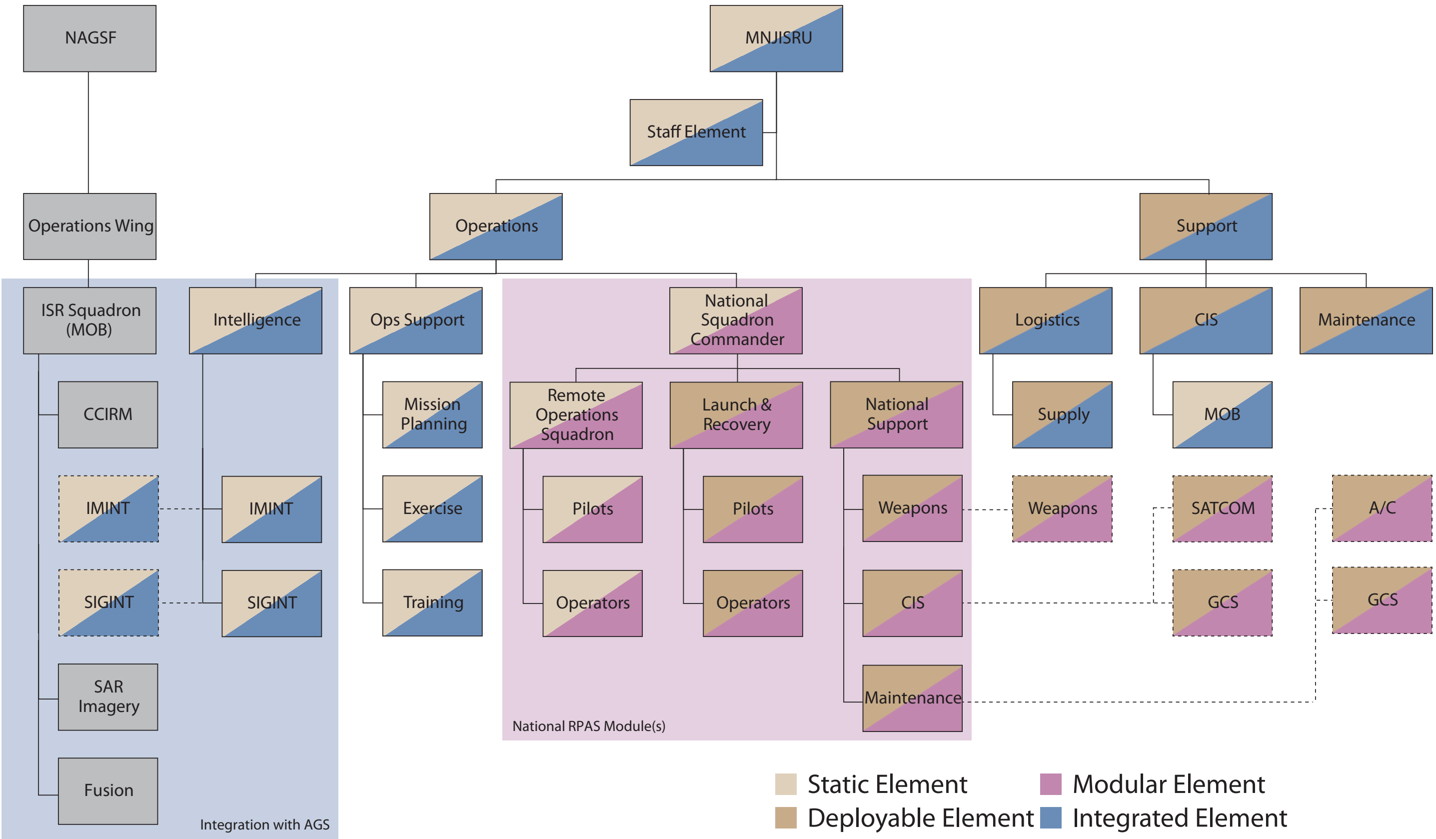


Figure 26 – Modular Approach with the Multinational JISR Unit.

CHAPTER XII

NATO/MNJISRU Structure Considerations

The previous chapters outlined the financial, operational, and governance considerations, all of which have influence on the structural considerations examined in this chapter. However, these considerations are independent from the preferred RPAS type, as the recommended NATO/MNJISRU structures should be suitable for any of the previously discussed platforms.

12.1 Basic Structure Considerations

12.1.1 Deployability

Although MALE RPAS have a long endurance and can usually operate Beyond Line of Sight (BLOS), their use is optimised when the transit time to their mission area is short. This typically requires at minimum the deployment of a launch and recovery crew as well as ground service and maintenance support element (the mission control element can typically remain based in the home country). Therefore, a future NATO/MNJISRU must contain static as well as deployable elements.

12.1.2 Modularity

Depending on the funding model chosen, especially in the initial phase of the unit's set up, nations may provide existing MALE systems as contributions in kind rather than funding the acquisition of new platforms. This will require a unit structure that is flexible enough to support different types of RPAS platforms at the same time.

12.1.3 Interoperability

To complement the AGS system, a future NATO/MNJISRU should support STANAG-compliant sensor data and communication protocols as well as the coordinated employment of AGS' wide area surveillance and

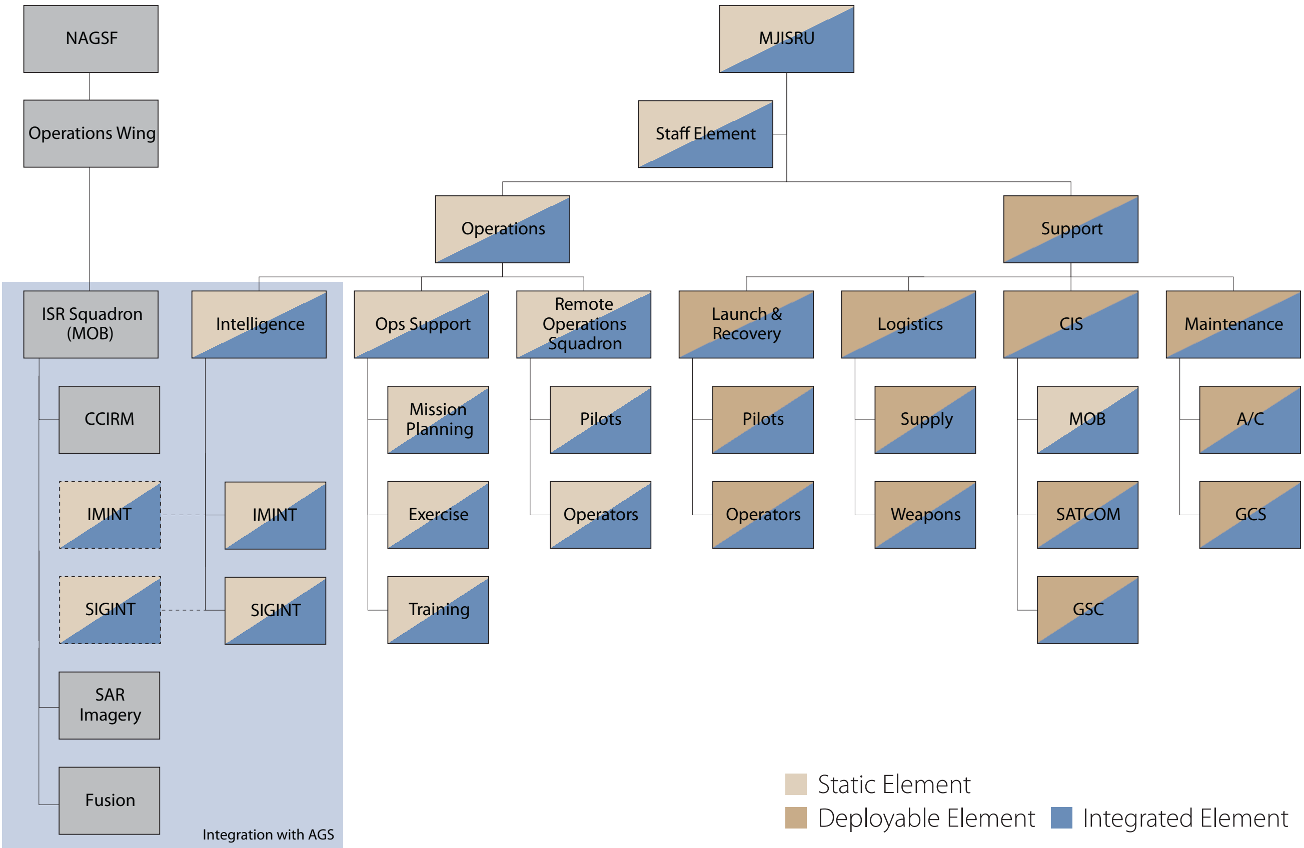


Figure 27 –Integrated Approach with the NATO JISR Unit.

sensors. Additionally, both units should closely link their static elements to benefit from close integration and cooperation. One option could be the physical co-location of both units' Mission Control and PED elements.

12.1.4 Commonality

The basic elements of a future NATO/MNJISRU should follow the generic setup of currently operational or planned RPAS units within NATO. This setup should be adjusted only to enhance interoperability with the AGS. Thus, most job descriptions should be congruent with the contributing nations' existing unit structures, which will facilitate assignment of qualified personnel.

12.2 Multinational JISR Unit Structure Draft

As discussed in the previous chapters, nations may contribute organic assets as contributions in kind for the initial set up of the Multinational JISR Unit. Therefore, the structure of this unit should permit different RPAS platforms from a variety of nations. The proposed draft structure as depicted in Figure 26 addresses this option by adding national contributions as 'National RPAS Modules'. Each module would be manned with national equipment and personnel only and could come directly out of existing national force. A national squadron commander would retain OPCOM over each individual RPAS Module and ensure compliance with its national Rules of Engagement (RoE) and respective caveats. The complete withdrawal of a single National RPAS Module would inevitably limit the capabilities of the Multinational JISR Unit in general, but it would still remain operational as long as other National RPAS Modules are available.

12.3 NATO JISR Unit Structure Draft

A JISR Unit based on NATO joint and/or common funding would result in a NATO-owned force. This unit's draft structure should seek a completely integrated approach down to the team level as it is depicted in Figure 27. It is assumed that a NATO-owned

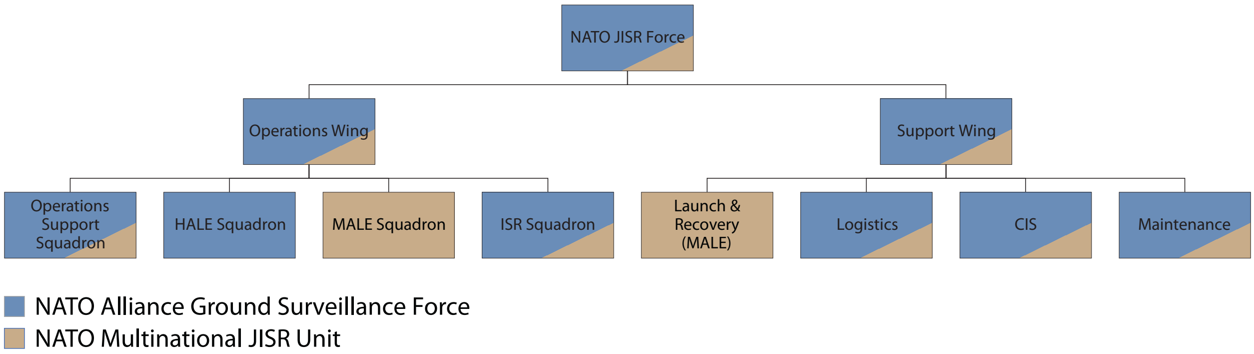


Figure 28 – Fully Integrated NATO JISR Force including AGS and the NATO/MNJISRU.

unit would be equipped only with a single type of RPA. This would result in shared ground control stations and maintenance which would reduce the deployment footprint.

12.4 Integration with NATO AGS

To successfully augment and reinforce the AGS system's capabilities, parts of the NATO/MNJISRU's structure should be co-located and eventually integrated into the existing AGS structure. There are several options with regards to integration ranging from partial to full. One example of partial integration is included here, as is a brief look at full integration.

12.4.1 Partial Integration: Fusion of PED Personnel

Correlation and fusion of AGS sensor data and products with a NATO/MNJISRU's sensor data and products would enable the development of a more comprehensive situational awareness. The AGS CONOPS/CONEMP explicitly foresees ingestion of other sensor types such as ESM, FMV and EO/IR with its organic SAR/MTI sensor data. The easiest way to accomplish this goal would be to augment the existing AGS ISR Squadron with EO/IR imagery and FMV analysts to process and fuse the NATO/MNJISRU's sensor data within the NATO AGS PED process. (cf. Figure 26 and Figure 27)

12.4.2 Full Integration with AGS

The complete fusion of a NATO JISR Unit with the NAGSF would offer the best capability-to-cost ratio and thus provide the most benefit for NATO. Assuming both units would be under governance of a single commander, personnel for general unit support as well as the supporting staff element could be expected to be significantly reduced. (cf. Figure 28)

CHAPTER XIII

Flexibility Considerations

As outlined in Chapter 6.6, the structure of a NATO/MNJISRU should principally offer commanders the flexibility to conduct a wide variety of operational applications, including peacetime operations such as Search and Rescue, border control, International Law Enforcement, or Humanitarian Crisis Response. In addition, although the primary focus is on ISR, a kinetic engagement capability could significantly enhance the unit's mission utility.

13.1 Modular Sensor Packages

Almost all RPAS discussed in this study are multi-purpose and offer a variety of payload options such as EO/IR, SAR/GMTI or ESM. To exploit the RPAS' potential capabilities to the maximum extent, NATO should strive for acquiring all different sensor packages available. The preferred RPAS platform should then allow for a modular exchange of these sensor packages to tailor the RPA for the given mission. Additional personnel for the PED portion of the unit may be required to analyse specific sensor data, but these costs are negligible compared to establishing another dedicated unit to provide the respective sensor information.

13.2 Optional Armament

All MALE RPAS discussed previously offer more than simple ISR capabilities. These platforms can also provide laser designation or, when so equipped, the option to employ kinetic weapons. This does not necessarily imply that every mission will be armed, but it gives commanders the flexibility to tailor the RPA to the anticipated threat level and mission set. Detailed arrangements regarding target designation and weapon employment will be required in the MoU as well as in the CONOPS/CONEMP to ensure that participating nations can opt in or out of this capability. However, the option to conduct armed overwatch in support of ground troops and quick reaction times for an air-to-ground engagement in case of a Troops in Contact (TIC) situation is invaluable. Hence, disregarding the potential kinetic capabilities of a future NATO owned RPAS would be militarily negligent.

CHAPTER XIV

Conclusions

This study's aim was to determine if the creation of a NATO/MNJISRU could complement NATO's existing and future programmed ISR capabilities while addressing a defined critical ISR capabilities gap and would be therefore justifiable. Furthermore, this study's aim was to analyse if a NATO/MNJISRU would be feasible and how a potential near- and long-term solution could be achieved.

14.1 Complementing NATO's Existing ISR Capabilities

NATO has consistently identified gaps in the Alliance ISR capability, including both capacity and PED processes. AWACS and AGS are currently the only NATO owned and operated systems which provide organic ISR to the Alliance.

AWACS provides NATO with a full Recognized Air Picture. However, its role as an airspace control and Air Battle Management asset will usually take precedence, therefore AWACS will typically not provide a substantial contribution to ISR on the ground.

AGS will enable the Alliance to perform persistent surveillance over wide areas in any weather or light condition, but it is not designed to provide Electro-Optical (EO) / Infrared (IR) imagery required for tracking, positive identification and engagement of individual targets.

Conclusively, utilizing the AGS system to the fullest requires handing over detected targets to other ISR assets, which should be provided by a NATO/MNJISRU equipped with MALE RPAS.

14.2 Feasibility of a NATO/MNJISRU

This study identified the principal requirements to make the creation a NATO/MNJISRU feasible.

Common Will. The sustained political will to support NATO's Smart Defence principle is essential to not only initially create a NATO/MNJISRU but also to be successful in the long term. The declared objectives of the 2014 Wales Summit, such as reversal of declining defence budgets, emphasizing multinational cooperation, as well as enhancing and reinforcing NATO's ISR capabilities, mesh well with the creation of a NATO/MNJISRU. This is a strong indication that there is common political will to create a NATO/MNJISRU.

Common Funding. Initial acquisition and funding may require a multinational or joint funding approach as outlined in chapter 7. Based on the analysis of the study, once the unit is established, costs for operations and maintenance as well as general unit support should come from NATO common funding. This funding model would align with the principles of the NATO Smart Defence Initiative by sharing the financial burden amongst all 28 NATO nations. This would not only leverage the political will to create a NATO/MNJISRU but also strongly support the sustainability of the unit in the long term.

Common Ownership. As a direct result of using the NATO common funding model, the NATO/MNJISRU's equipment and material will be procured and owned by NATO itself and therefore would not be subject to any national caveats. This will significantly contribute in ensuring the unit's full operational capability.

Common Platform. All MALE RPAS require personnel trained and qualified for that specific platform. The more nations share a common RPAS platform, the more likely it is that personnel for a NATO/MNJISRU could be provided without requiring additional training. Analysis of currently available systems across NATO which best meets the requirements for complementing the AGS system reveals that the most prolific platform, both in numbers and in number of nations who operate or plan to acquire the system, is the General Atomics MQ-9 Reaper series. However, a future NATO-owned and commonly funded JISR platform could be any of the discussed RPAS or a not-as-yet developed platform.

Common Training. Not all nations interested in participating in a NATO/MNJISRU may currently be capable of appointing fully trained and qualified personnel for a NATO/MNJISRU's specific RPAS platform. Therefore the unit should be augmented with a dedicated training element equipped with a flight simulator or some other type of virtual training environment for qualifying and maintaining currency of aircrew and other key personnel, such as imagery analysts. This could also serve as a central NATO 'MALE RPAS School' for the benefit of all participating nations.

Common Post Sharing. The analysis indicated that some degree of personnel redundancy will be required. This is due to the impact invocation of certain national caveats may have on the availability of some mission essential personnel. Hence, a NATO/MNJISRU should use a fully integrated approach down to the lowest level possible to ensure that personnel necessary for operations are available from more than one participating nation. As 24/7 operations require multiple shifts of personnel, there is opportunity for participating nations to share identical posts (and therefore required skill sets). This means if a withdrawal of personnel from one nation for a sensitive operation occurs due to invocation of a national caveat, the sudden shortfall can be more easily mitigated.

Common JISR Architecture. The NATO/MNJISRU needs to be structured to provide seamless integration into both NATO peacetime and wartime JISR Architectures. This requires consideration of C2 arrangements regarding both Collection Management and practical employment of the ISR assets. Concurrently, the question of retaining national OPCOM over the assets also requires careful consideration. Potential synergies and possibilities of mutual cooperation with national and, in particular NATO PED capabilities should be fully explored. The NAGSF concept of operations may provide a useful blueprint in providing the basis for such a joint endeavour. The PED process should be seamlessly integrated with the existing AGS PED and further introduced to the NATO JISR structure with minimal investment in manpower (imagery analysts) and resources.

Common Basing. To complement the AGS system's capabilities, the NATO/MNJISRU ideally should be physically co-located with the existing AGS structure in Sigonella, Italy, so that both units benefit from close integration and cooperation. This could also leverage the AGS's operations and training, as regulations for flying RPA in the local Italian airspace are already in place.

14.3 Creating a NATO or MNJISRU

Analysis has shown two viable constructs which could be enacted by NATO to address the MALE ISR shortfall. Creating a Multinational Joint ISR Unit, embracing the concept of Pooling and Sharing and maintaining connectivity with each national strategy and procurement process, is perhaps a more achievable goal in the near term. However, more fiscally efficient across the Alliance and potentially more operationally efficient from the JFACC's perspective would be NATO's procurement of a sole platform solution and the subsequent generation of a NATO MALE Joint ISR squadron. These two options are not necessarily exclusive and could be implemented in phases with the potential end state of a Joint ISR Wing containing both a MNJISRU squadron comprised of disparate national platforms and a NATO owned squadron in this same wing which contains the single platform capability.

For the creation of a MNJISRU, the unit should be set up in a multinational construct using RPAS provided by the participating nations as contributions in kind. Once this unit is fully operational, a dedicated Programme Office within the NATO Support and Procurement Agency (NSPA) should be established to manage the acquisition of NATO-owned MALE RPAS platforms. The currently existing AGS Implementation Office (AGSIO) could serve as a blueprint and the lessons learned during the AGS planning, acquisition and implementation phases should be exploited. After this office is established, the Multinational JISR Unit could then either be transformed into a NATO JISR Unit which then operates equipment entirely owned by NATO or remain as a separate and distinct squadron under a Joint ISR Wing. This methodology is elaborated further below.

14.3.1 The Multinational JISR Unit

The most effective way to initially stand up a JISR unit in support of NATO capability requirements is by drafting an MOU that leverages the multinational cooperation of willing participants. This is because it will not require the timespan of a dedicated procurement programme managed by the NSPA to get the unit started.

Based on a Memorandum of Understanding (MoU), such a Multinational JISR Unit can consist of as many nations as are willing to participate. The required equipment would be provided by the contributing nations and integrated into the Multinational JISR Unit as purely national modules. Any interfly between national modules would be subject to bi-lateral MOUs and require ITAR compliance (U.S. platforms only), though such interfly would enhance the overall effectiveness of the organisation.

Each nation providing MALE platforms to this MJISR unit would be responsible for the national element of the squadron composition as elaborated in Chapter 12 and in Figure 26. A critical component of this national element is the technical interface between the MALE platform and the JISR process for PED. This process is challenged when replicated across multiple types of MALE platforms and warrants further testing and evaluation in Joint ISR exercises such as the Unified Vision series.

National modules would additionally allow nations to opt in or out of missions depending on their national caveats. The national modules would consist of the national RPAS platforms and Ground Control Stations as well as the platform-specific personnel such as aircrew, maintenance and possibly weapons support. The MoU must describe the OPCOM arrangement of the Multinational JISR Unit and how the Transfer of Authority under a NATO commander would be arranged.

14.3.2 Programme Office Set Up

Once the Multinational JISR Unit described above is operational, has established Tactics, Technics and Procedures (TTP) and has garnered sufficient experience to refine the requirements for a future NATO-owned RPAS, a programme office within the NSPA should be created to manage the acquisition of that RPAS. Funding for these activities should employ a NATO Joint Funding arrangement using the AGS system as a blueprint model. As many NATO nations have already acquired or are considering acquisition of the General Atomics MQ-9 Reaper, this platform should be the preferred system for equipping a NATO JISR Unit, as it offers the currently largest pool of available manpower and expertise in NATO.

14.3.3 The NATO JISR Unit

After completion of the acquisition phase, the Multinational JISR Unit could be restructured to a NATO JISR Unit and tailored to work in coordination with the AGS or it could remain as a separate squadron under the same ISR Wing. NATO should hold OPCOM over new unit, command relationship with the MJISR portion would remain the same. Since it should be fully integrated down to the team level, national modules would be no longer necessary. However, keeping other RPAS platforms as contributions in kind within dedicated national modules may still be an option for the unit's augmentation. NATO common funding will cover the costs for operations, maintenance and general unit support. Eventually, this unit should be part of an ISR Wing within a combined NATO JISR Force that consists of components supporting both the AGS and the NATO JISR Unit. This would facilitate correlation and fusion of both platforms' sensor data as well as rapid transition from surveillance and detection via the AGS' SAR/GMTI to tracking, identification and engagement of targets through the EO/IR, FMV or, depending on the chosen platform and mission configuration, weapons employment capabilities of the NATO JISR Unit's RPA.

14.4 Final Remarks

The creation of a NATO/MNJISRU, which not only helps mitigate NATO's identified ISR shortfalls but also helps reduce the capability and defence expenditures imbalance between the United States and the European NATO countries, is justifiable and feasible. This study has presented eight recommendations revolving around the establishment of common factors to facilitate the creation of a NATO/MNJISRU. However, the most important factor is the common political will of the NATO nations, which will permit them to move beyond the words of the Wales Summit Declaration to action.

'War is ninety percent information.'
Napoleon Bonaparte

ANNEX

Acronyms and Abbreviations

A2/AD	Anti-Access / Area Denial
AAP	Allied Administrative Publication
ACO	Allied Command Operations
AEW	Airborne Early Warning
AEW&C	Airborne Early Warning & Control
AGS	Alliance Ground Surveillance
AGSIO	Alliance Ground Surveillance Implementation Office
ATOL	Automatic Take-Off and Landing
AWACS	Airborne Warning & Control System
BLOS	Beyond Line of Sight
C2	Command and Control
C3	Command, Control and Communications
C4	Command, Control, Communications and Computers
CAOC	Combined Air Operations Centre
CAS	Close Air Support
CIS	Computer Information Systems
CJSOR	Combined Joint Statement of Requirements
CM	Collection Management
CMA	Collection Management Authority
COIN	Counter-Insurgency
COMINT	Communications Intelligence
CONEMP	Concept of Employment
CONOPS	Concept of Operations
CRM	Collection Requirements Management
CSAR	Combat Search & Rescue
CTL	Collection Task List
DCGS	Distributed Common Ground System
DIRLAUTH	Direct Liaison Authority
EATC	European Air Transport Command
EDA	European Defence Agency
ELINT	Electronic Intelligence
EO	Electro-Optical
EO/IR	Electro-Optical / Infrared
ESM	Electronic Support Measures
EU	European Union
EW	Electronic Warfare
FOB	Forward Operating Base
FOC	Fully Operational Capability
FMV	Full-Motion Video

GCS	Ground Control Station
GMTI	Ground Moving Target Indication
GPS	Global Positioning System
HALE	High Altitude Long Endurance
HAW	Heavy Airlift Wing
HD	High Definition
HQ	Headquarters
IAI	Israeli Aerospace Industries
INS	Inertial Navigation System
IOC	Initial Operational Capability
IPB	Intelligence Preparation of the Battlespace
IR	Infrared
IRM	Intelligence Requirements Management
ISAR	Inverse Synthetic Aperture Radar
ISR	Intelligence, Surveillance and Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
ITAR	International Trade in Arms Regulations
JFACC	Joint Force Air Component Command
JFC	Joint Force Command
JISR	Joint Intelligence, Surveillance and Reconnaissance
JTF	Joint Task Force
LD	Laser Designator
LOA	Level of Ambition
LOS	Line of Sight
LRF	Laser Range Finder
MALE	Medium Altitude Long Endurance
MNJISRU	Multinational Joint Intelligence, Surveillance and Reconnaissance Unit
MOB	Main Operating Base
MoU	Memorandum of Understanding
MPR	Maritime Patrol Radar
NAC	North Atlantic Council
NACMA	NATO Air Command and Control System Management Agency
NAEW	NATO Airborne Early Warning
NAEW&C	NATO Airborne Early Warning and Control
NAGSF	NATO Alliance Ground Surveillance Force
NAGSMA	NATO Alliance Ground Surveillance Management Agency
NAMO	NATO Airlift Management Organization
NAPMA	NATO Airborne Early Warning & Control Programme Management Agency
NATO	North Atlantic Treaty Organization

NCIA	NATO Communications and Information Agency
NCS	NATO Command Structure
NETMA	NATO Eurofighter and Tornado Management Agency
NPO	NATO Procurement Organisation
NSIP	NATO Security Investment Programme
NSO	NATO Standardization Office
NSPA	NATO Support and Procurement Agency
OPCOM	Operational Command
OPCON	Operational Control
OUP	Operation Unified Protector
P&S	Pooling and Sharing
PED	Processing, Exploitation and Dissemination
PGM	Precision Guided Munitions
RAF	Royal Airforce
RAP	Recognized Air Picture
ROA	Remotely Operated Aircraft
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
RSO	Remote Split Operations
RVT	Remote Video Terminal
SAC	Strategic Airlift Capability
SACEUR	Supreme Allied Commander Europe
SAR	Synthetic Aperture Radar
SATCOM	Satellite Communications
SD	Smart Defence
SIGINT	Signals Intelligence
STANAG	Standardization Agreement
STUAS	Small Tactical Unmanned Aircraft System
TAI	Turkish Aerospace Industries
TACOM	Tactical Command
TACON	Tactical Control
TCM	Theatre Collection Manager
TIC	Troops in Contact
TTP	Tactics, Technics and Procedures
UA	Unmanned Aircraft
UAO	Unmanned Aircraft Operator
UAP	Unmanned Aircraft Pilot
UAS	Unmanned Aircraft System
UNSCR	United Nations Security Council Resolution
USAF	United States Air Force
UV14	NATO Exercise Unified Vision 2014

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