ACHIEVING INTEROPERABILITY IN A FEDERATED ENVIRONMENT AND IN THE CURRENT SECURITY CONTEXT

Lieutenant Colonel Doina ILIE

Defence Staff, Communications and Information Technology Directorate

Joint missions, exercises and deployments have shown that it is crucial to continuously coordinate processes, training, documents and technologies on a multinational basis. Interoperability on the battlefield, be it on land, in the air, in space, at sea and in the cyber and information space, can often be achieved only after many years of technical and procedural preparation. Time that is no longer available when establishing concrete mission networks, as the war in Ukraine is currently showing us. With Federated Mission Networking (FMN), a framework was created and established that allows a significant reduction in this lead time and at the same time a certain degree of national autonomy in the choice of individual communications and information technology solutions.

Keywords: interoperability; capabilities; Federated Mission Networking; communication and information technologies;

INTRODUCTION

Today we find ourselves in an ever-changing security environment, constantly facing new challenges and threats, challenges that are becoming more complex and persistent, both in Europe and beyond, affecting our societies every day. Many of these threats are of a hybrid nature, developed simultaneously and many-sided. Nations cannot face these challenges alone and even for NATO as an alliance they represent a considerable effort. The effort is necessary, but it often far exceeds the resources and means that individual nations can provide.

However, federation as an organisational model and the idea of *"connecting forces"* seem to be a promising way of meeting this challenge. And in a federated working environment interoperability is essential. For forces to work together effectively and quickly, they must be able to communicate and exchange information seamlessly. This can be a challenge in today's security environment, where, as mentioned before, the threat spectrum is constantly evolving and new security challenges are emerging.

Fortunately, there are solutions that can help to achieve interoperability in a federated environment. One such solution is the *Federated Mission Networking (FMN)* approach. FMN is an established way of connecting forces and enabling them to operate effectively and rapidly. It provides a high level of assurance and instant availability, and it can be federated to meet the needs of different missions. A federated way ahead addresses the urgent requirements of now, while also providing the framework for illuminating the way towards identifying the innovation and transformation needed in the medium and long term.

WHAT IS THE FEDERATED MISSION NETWORKING?

Federated Mission Networking (FMN) is an established way that forces can connect, interoperate and operate effectively and rapidly. This is required for the successful accomplishment of a military mission in today's modern era. FMN's aim is to establish a common technical, procedural and training basis among NATO's member and partner states and other organizations in order to have for their forces

interoperability of critical information systems whenever needed for coalition operations.

FMN is not a network; it is a set of standards and practices for interoperation, with a means of optimising effort and reusing resources while benefiting from unrestricted information exchange.

Figure no. 1: FMN Logo

In order to meet certain requirements like comprehensive interoperability, high-level of assurance, instant availability and the ability to be federated, something needed to be done before any mission. The FMN provides the necessary framework for forces to connect and interoperate in a federated environment.

The idea raised during conducting the International Stabilization and Assistance Force (ISAF) in Afghanistan back in 2001. During that time it became apparent that NATO and Partner nations' ability to cooperate in a multi-national mission environment was not what military leaders expected it to be. In order to gain a common operational picture, NATO created a single information domain that was supported by the Afghanistan Mission Network (AMN). The idea being that greater situational awareness facilitates more effective decision making and thus leading to conducting the mission more effectively.

In the following years, the idea of a mission network was taken further. Not only on the technical side, where a generic blueprint for future mission networks was drafted, but also procedurally. The simple idea is to work together – federated – at all times, preparing for possible missions in a networked environment.

FMN is the way that forces are connected and operational effectiveness is rapidly achieved, which are required for the successful accomplishment of a military mission.

FMN is a NATO initiative that aims to make possible connecting forces in operations. Not only for the sole use of NATO Nations, but in a coalition environment in which also Non-NATO Nations (NNNs) are to be integrated as well as other organizations such as the European Union (EU), Non-Government Organizations (NGOs) or other.

Being FMN Affiliates is a commitment to carry out the following activities on an ongoing and systematic basis:

- maintaining and developing the capabilities that are required to activate and operate mission networks in a federated environment – in this way, national procurement programmes become part of NATO's process of implementing FMN capabilities;
- ensuring CIS security and interoperability requirements by participating in technical verification, operational validation, security assessment and accreditation processes and activities, as well as collective training activities;
- activating national capabilities, according to jointly agreed procedures, for a specific instance of the mission network for the operation/mission in which the Affiliate participates in the multinational coalition.

The FMN initiative has today 38 affiliates – all 30 NATO member nations, 7 NNNs and one organisation that happens to be the NATO Command Structure as an Affiliate (NCsaaA). There are also other organisations that have indicated their desire to join the FMN and which, in the meantime, have the status of *"observers"* who can participate in FMN activities but without voting rights.

There are four different roles that define an affiliate participation – in addition to the observer role, affiliates can contribute fully, partially or simply as consumers to the services of other affiliates and help designing the FMN framework. A governance and management structure (FMN Management Group), involving all affiliates, has been established to develop a mission agnostic framework whereby *"episodic"* mission networks can be deployed (the term used is *"instantiated"*) in exercises and operations with all, or a group of affiliates participating and led by anyone of them.

The main goal of the FMN is to make possible a *"Day Zero"* Interoperability among all affiliates. This is to be achieved by means of a federation of networks, where each stakeholder (Affiliate) retains control of their own capabilities (since

their very design and implementation) and affairs while accepting and complying with the requirements laid out in pre-negotiated and agreed arrangements in a collective fashion.
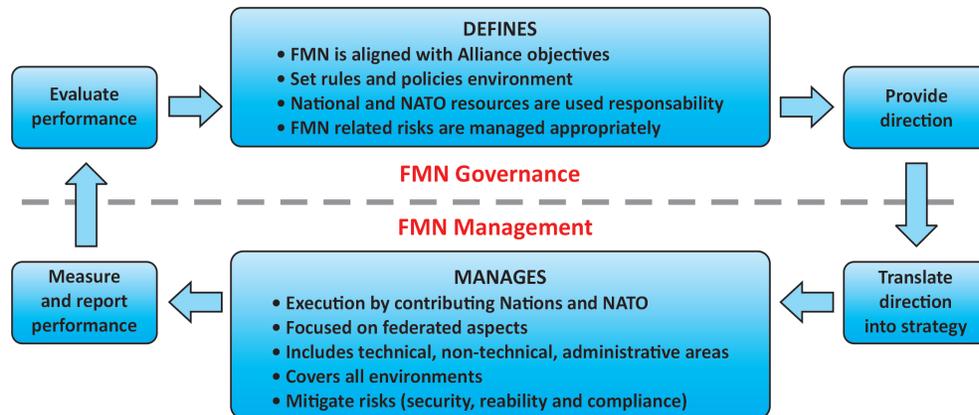

Figure no. 2: FMN Governance and Management Cycle (NFIP, 2015, vol. I)

The FMN is to be *"built on trust"*, which means that all Affiliates rely on the belief that each one is fulfilling their duties accordingly and performing all activities as devised in the corresponding FMN Framework documents.

FMN MISSION

Simply put, the mission of FMN is: Enhanced Operational Readiness & Effectiveness Today and in the Future. In the coming years, FMN will improve command and control (C2) and decision-making in coalition operations through improved secure information exchange and collaboration. It will provide the agility, flexibility, security and scalability needed to manage the emerging requirements of any mission environment in coalition operations. FMN is based on principles such as cost effectiveness and maximum reuse of existing standards and capabilities in order to not to create overburden to the Affiliates by forcing them to procure additional systems or equipment.

FMN VISION

To support this mission, the vision of FMN (SH/CCD J6, 2018) is: Day Zero Interoperable Forces. The FMN vision has two components, one for the current strategic environment (1) and one for the future (2):

(1) *"Operate Together: Exploit our Strategic Advantage"*. FMN Ready Forces enable an environment where the establishment of a Mission Network uses the planned guidance and instructions prepared and maintained by standing FMN structures to enable the rapid plug-and-play of forces arriving in theatre. Shortfalls identified during the planning and operation of these networks, together with lessons learned, are fed back into the governance and management processes of the standing FMN structures. FMN ensures that Affiliate forces communicate, train and operate effectively together from the start.

(2) *"Adapt Together: Effectively Transform Capabilities to Maintain our Edge"*. In an era of constrained resources and a wide range of potential missions, FMN reflects the need for *"federation"* as the means to achieve economy of scale and maximum reuse while achieving the full benefit of information sharing. In order to better prepare for future operations, FMN will enable the rapid deployment of forces by federating capabilities, supporting the efficient use of resources, while also enhancing interoperability and information sharing.

FMN CAPABILITIES

As the mission and vision suggest, supporting forces in achieving *"Day Zero Interoperability"* will require a concerted effort by all FMN Affiliates to improve the way they train, plan and operate together while adapting the way they transform their national capabilities to ensure even more effective training, planning and operating together in the future.

Developing the operational capability of FMN Ready forces is about optimising their action to fulfil their mission and support emerging and evolving requirement cycles. This involves:

- investment in FMN-compatible technology and equipment;
- investment in human capital through training, education and partnerships;
- doctrinal development/adaptation, standardisation processes and lessons learned;
- developing FMN capabilities.

Capabilities are to be achieved through an incremental process, following a chain of phases or stages called *"spirals"*, each of them incorporating new capabilities into existing ones. In other words, the technical specifications of the network are developed in spirals where each generation adds functionality to the previous one, thus accelerating the established procurement processes.

The strategic objective of developing FMN capabilities involves ensuring interoperability from the outset. The objectives of the development of FMN capabilities could be broken down into smaller component stages (MCM-0194, 2018), and for each stage a plan is drawn up to achieve the objective over the main time horizons: short, medium and long term.

In the short term, the main objective is to optimise the current mission environments. This can be described as the synchronisation of capabilities already in use in order to mitigate interoperability gaps and reduce the time required for efficient information exchange. Given the resource limitations and time constraints inherent in capability development as well as the complex and unpredictable nature of the modern security environment, it is imperative to harness the potential of capabilities that are already in use in current operations. By examining capabilities in both technical and procedural manner, and by drawing on knowledge gained from past and current operations, agreement can be reached on policy and procedural changes as well as technical and procedural solutions. Achieving this goal in the short term can bring immediate benefits and, more importantly, can foster an environment in which affiliates are more willing to invest the resources necessary to develop future capabilities.

When we talk about medium term, the focal objective is adaptation of existing capabilities. This is the harmonization of current capabilities to enable affiliates to benefit from prior and current investments. Taking into account the speed of strategic defence planning processes, it is necessary to develop changes for existing capabilities in order to more quickly achieve an acceptable level of interoperability. By using commonly agreed-upon standards and specifications, affiliates can create technically feasible modifications for their current systems. When used in concert with strict adherence to procedural change and implementation guidelines, current affiliate capabilities can be adapted and utilized to provide solutions for better coordination and collaboration. Collaboratively developed operational planning processes and standard operating procedures (SOPs) will further ensure more seamless multinational operations.

And finally, in regards to the long term, the objective is to achieve Interoperability by Design. This can be defined as the alignment of FMN capability development with the affiliates' defence planning processes. By building national and organizational capability development on a common set of agreed-upon standards and specifications, the creation of innately interoperable systems can deliver desired end states for a range of future mission environments. These opportunities can be leveraged by every affiliate, regardless of their chosen level of ambition, and can provide the framework necessary for the future of multinational operations.

THE CHALLENGES AND THE BENEFITS OF FMN

Achieving interoperability between forces has always been a challenge, but it is even more difficult in the current security context.

There are a number of challenges that need to be overcome in order to achieve interoperability. They include: cultural differences; linguistic barriers; differences in doctrine and procedures; politics and egos. These challenges can be overcome, but it requires a lot of hard work and the cooperation of all involved.

NATO defines interoperability as *"the ability for Allies to act together coherently, effectively and efficiently to achieve tactical, operational and strategic objectives"* (NATO AAP-6, 2010). Interoperability is vital to success and is a strong prerequisite for maintaining its competitive military advantage.

Interoperability must be brought into usual military practices, by adding it to the whole spectrum of doctrine, organization, training, materiel, leadership, personnel, facilities (DOTMLPF); this will enable strategy-led, resource-informed, funded capabilities with clear responsibilities through-life and interoperability by design.

In the AAP-6 definition for interoperability and further elaborated in the NATO Interoperability Policy, there are three main dimensions of interoperability in NATO: People (e.g. language, terminology, training); Process (e.g. doctrines, procedures); Technical (e.g. hardware, systems). These are complementary to each other and conditioned by national and international provisions. In many cases weaknesses in one can be mitigated by strengths of the others.

Developed, agreed, implemented, tested, used and maintained standards that cover all dimensions are essential to achieve interoperability. The principle of *"consistency"* and *"coherency"* of interoperability from this policy states that: interoperability shall be achieved through a constant and comprehensive coordination of interoperability and standardization aspects between all relevant stakeholders.

BENEFITS OF FMN FOR INTEROPERABILITY

Interoperability is the way which we can use to better shape the strategic environment (Pehin, Mahony, Germanovich, Lane, 2020) because it gives commanders the flexibility to achieve strategic objectives using the most appropriate means, and one of these means is the FMN. The Federated Mission Networking is an established way through which forces can connect, interoperate and operate effectively and rapidly. In today's modern era, this is required for the successful accomplishment of a military mission.

In addition to flexibility, interoperability allows much more efficient use of resources, which is exactly what the FMN initiative brings, by pooling and using complementary skills, technologies and know-how. Also, the FMN initiative is mainly based on maximum re-use of existing and planned capabilities. FMN specifications are mostly interoperability requirements that focus on qualitative rather than quantitative aspects. They become quantitatively dimensioned requirements once they are addressed by each affiliate in an operational context.

The FMN initiative puts interoperability at the forefront of capability development. Realising the operational benefits of federation requires a change in the way that the business of *"interoperability"* is performed by FMN Affiliates. Persistent networking between FMN Affiliates shall enhance the interoperability in the three dimensions applicable in an operational environment: people (representing the operator's needs), processes (to support decisions) and technology (offering tools to support decision-making and Command and Control).

In other words, the main goal of FMN capabilities development is to ensure interoperability from the design phase, at all levels – strategic, operational, tactical and across all dimensions – technical, human and procedural. At FMN everything revolves around the interoperability of FMN Ready Forces – whether on land, at sea, in the air, in space or cyberspace. The overall objective for the interoperability resulting from FMN is to provide multinational force commanders with the effective command and control capability from Day Zero.

The FMN is largely based on existing NATO standards and interoperability specifications. The solutions contained therein open up the possibility for nations not only to address NATO standards in a systematic way, but also to reuse them as ready-made solutions in operational areas that may be outside NATO or not under NATO's responsibility.

And the method used by the FMN for capability development, the so-called spiral development, in timelines that are clearly time-bound, allows for coordinated multinational capabilities to be developed in a spiral, including the necessary processes, but also training, education, documentation and technology, which are then immediately available to the commander. The added value for developing one's own national capabilities is that the process becomes much more transparent and we can also see at the national level which interoperability standards are actually used by other nations.
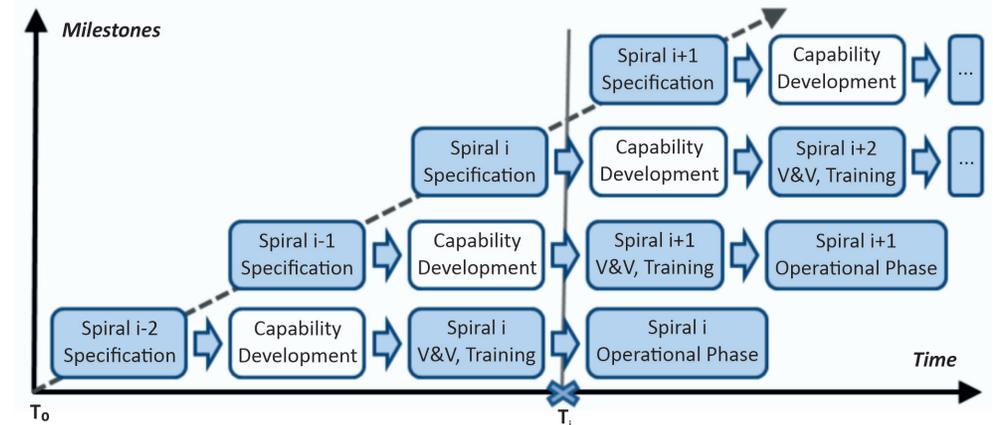

Figure no. 3: Multiple Overlapping Spirals (NFIP Vol. I)

Nations have conducted multinational operations for decades, but coordination and synchronization of multinational forces can challenge even the best operational commanders. FMN capabilities and procedures have propelled interoperability into the Information Age; from integrated core services to seamlessly shared situational awareness, FMN has already proven itself to be the best way to achieve effective joint multinational interoperability.

CHALLENGES OF FMN

In order to achieve interoperability in a federated environment, several challenges need to be overcome. One of the biggest challenges is ensuring that all systems are compatible and can communicate with each other. This requires a high level of assurance and testing to ensure that systems will work as intended.

Another challenge is making sure that all systems are available at all times. This requires careful planning and execution to make sure that systems are up and running when they need to be.

But, in order for forces to be able to successfully accomplish a military mission in today's modern era, comprehensive interoperability, high-level of assurance, instant availability and the ability to be federated are required and the FMN is the best way to achieve these requirements.

Every military leader wants to achieve interoperability with coalition partners likely during the planning and execution of any multinational Joint Operation. Few however are able to articulate what this kind of interoperability means, how it can be achieved and how the resulting capabilities could be optimally used for strategic, operational and tactical planning.

At the Fourth FMN Seminar 2022, the FMN operational champion, General Zanelli, based on the gained experience from previous operations, came to the conclusion that: *"Commanders must be able to provide clear orders and intentions"* and *"the FMN interoperability initiative can give Commanders that ability"*. During his speech, General Zanelli spoke directly to the operational community, urging them to use FMN-compliant capabilities in operations and to advocate for their implementation in their nations. General Zanelli challenged Commander's on the need for interoperability by stating, *"When we look at SACEUR's vision for the Defence of Europe, we need a force that can deploy at the speed of relevance. Critical to this is the ability to communicate: to be able to plug in and fight with any nation in the alliance"*. He reminded Commanders that FMN is not just a communicator's business but that they as Commanders must take responsibility for interoperability and the communications infrastructure.

THE WAY AHEAD FOR THE FEDERATED MISSION NETWORKING

MG Schloesser – FMN Management Group Chair – in his closing remarks at the Fourth FMN Seminar 2022, reminded the participants that Federated-Mission-Networking is not just three words but that they form the pillar for building interoperability; technical, procedural and human. He stated that, *"FMN provides the ability for connecting forces across all mission types and across all domains. It is the way to exchange valuable C2 information during coalition operations"*.

General Schloesser reinforced the FMN Vision of Day Zero interoperability and once again stressed that FMN is an operational enhancer. MG Schloesser quoted Admiral Bauer's statement, *"FMN is needed now more than ever"*.

The world continues to add complexity without regard to our readiness or ability to adapt to these changes. The strategic objective of FMN capability development is to create *"interoperability by design"*; but this can only succeed if we proactively look forward to the standardization of future capabilities, while persistently adapting current capabilities. It has already been initiated the development of the future C2 interoperability by capitalising on cyberspace and multi-domain operations (MDO).

The federated part of FMN does not only allow the singular exchange of information, but also the exchange and re-use of services across borders and demarcations in a trusted and secure environment, a clear advantage to the *"competing"* aspect of MDO, not only in saving resources but also in the ability to afford a continuous and flexible system of capabilities and services that are able to give a blended response to conventional, asymmetric and hybrid challenges, all deliverable across multi-national and military services.

FMN has proved its benefits in recent years and will evolve in ways fostering the challenges of MDO driven by the operational and political needs. Any future multinational operations in the NATO-related environment will no doubt be conducted using integrated FMN processes.

FMN does not only support current NATO initiatives like MDO, NATO Warfighting Capstone Concept (NWCC) or The Concept for the Deterrence and Defence of the Euro-Atlantic Area (DDA), but, all of these initiatives cannot be executed efficiently without properly implementing FMN compliant products, principles and processes, because all of these initiatives are highly dependent on the ability to collect, share and utilize information – which is exactly the fundament of the FMN.

Also, FMN provides another advantage to the employed business processes by the evolutional way it is set up, it therefore provides a way to handle the progress needed in overcoming the digital challenges.

CONCLUSIONS

Interoperability is the key to success in any mission. In order to achieve interoperability, FMN plays a critical role in allowing for rapid connection and communication between forces. The current security context makes interoperability even more important, and FMN is the best way to ensure success.

FMN is a NATO interoperability initiative which provides a framework for establishing necessary connectivity among coalition partners and in this way they can operate effectively and rapidly. In today's modern era, this is what is required for the successful accomplishment of any mission.

NATO is facing now a set of security challenges of unprecedented complexity and of potentially increasing gravity. The current security environment demands a fresh approach, built on policy that encourages NATO nations to connect much more closely and flexibly, among themselves, with the NATO command structure, and with partners.

Enabling and empowering the Alliance's constituent parts, in a persistent federated approach, is the way to tackle complexity, uncertainty, the rapid acceleration of change, the need for a persistent 360-degree perspective on threats, and the requirement for new levels of strategic understanding and awareness as well as innovative approaches to partnerships.

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