



THE ROADMAP FOR DELIVERING HIGH PERFORMING AVIATION FOR EUROPE

# European ATM Master Plan

Executive Summary for the Military

Edition 2015



# Executive Summary

The Stakeholder Executive Summary for the Military has been developed by the military experts of the group that has produced the European ATM Master Plan Edition 2015. It is an executive summary with the specific Military and Civil-Military Coordination perspective on the Master Plan. In the first part it contains the Executive Summary of the main European ATM Master Plan document.

# Executive Summary

## What is the European ATM Master Plan?

Within the framework of the Single European Sky (SES), the European Air Traffic Management Master Plan (hereafter referred to as ‘the Master Plan’) is the main planning tool for defining ATM modernisation priorities and ensuring that the SESAR (Single European Sky ATM Research) Target Concept becomes a reality. The Master Plan is an evolving roadmap and the result of strong collaboration between all ATM stakeholders. As the technological pillar of the SES initiative, SESAR contributes to achieving the SES High-Level Goals and supports the SES regulatory framework.

The Master Plan details not only a high-level view of what is needed to be done in order to deliver a high-performing ATM system, but also explains why and by when. It therefore sets the framework for the development activities performed by the SESAR Joint Undertaking (SJU) in the perspective also of the deployment activities to be performed by all operational stakeholders under the coordination of the SESAR Deployment Manager and in accordance with the Deployment Programme to ensure overall consistency and alignment.

## Why act now?

ATM is a critical element in the European air transport value chain and key to connecting regions and making Europe a global hub for mobility and prosperity. To ensure the sustainability and competitiveness of aviation, Europe needs to have a clear vision on how to deliver a high-performing ATM system.

Since the 2012 edition of the Master Plan, several significant developments have taken

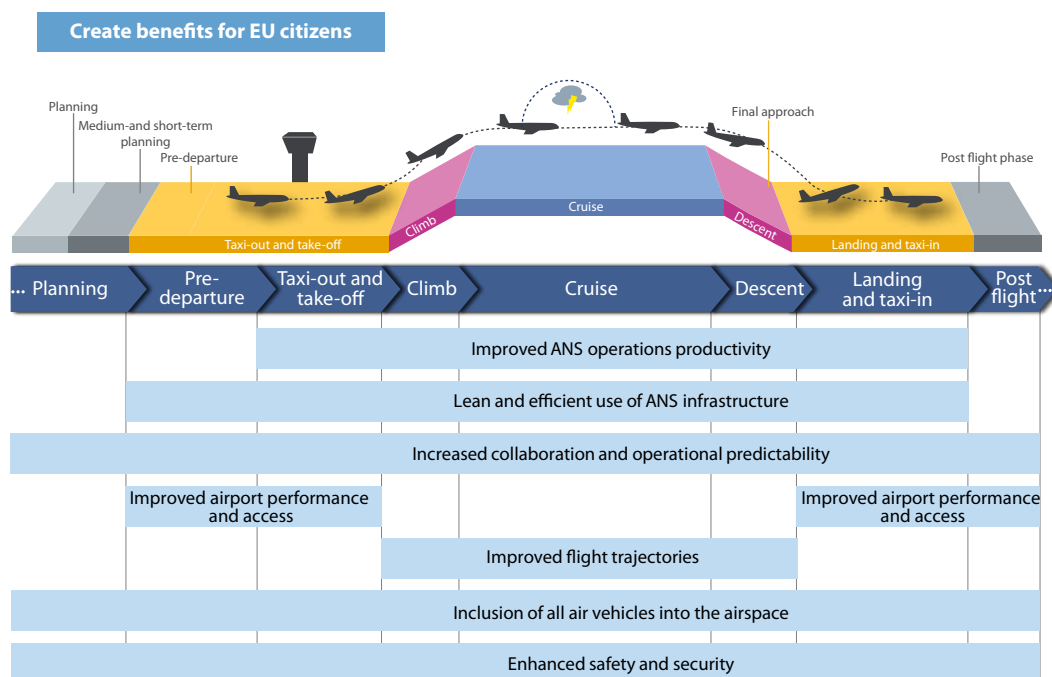
place, such as the availability of the first SESAR Solutions, the start of deployment activities and the significant change to the long term traffic forecast. ATM modernisation therefore needs to reflect a greater focus on increased efficiency and effectiveness while sustaining or even improving the levels of safety and security. At the same time, it must also recognise the need to provide solutions to address critical capacity bottlenecks.

## What’s new in the 2015 edition of the Master Plan?

Mindful of these developments, this edition of the Master Plan:

- introduces a vision for the future European ATM system;
- presents the first wave of SESAR deployment, such as the Pilot Common Project (PCP) <sup>(1)</sup>, and details the Key Features of R & D activities (SESAR 2020);
- provides new deployment scenarios for elements that are sufficiently mature to be brought into the deployment pipeline;
- makes explicit reference to remotely-piloted aircraft systems (RPAS) and rotorcraft as airspace users, as well as to cybersecurity elements within ATM;
- incorporates the results of a more comprehensive military involvement;
- reflects synergies and consistencies with the Deployment Programme and the Network Strategy Plan.

<sup>(1)</sup> Commission Implementing Regulation EU No 409/2013 specified the requirements for common projects. Common projects aim to deploy in a timely, coordinated and synchronised way ATM functionalities that are mature for implementation and that contribute to the Essential Operational Changes identified in the European ATM Master Plan (2012 edition). The first of these common projects is the Pilot Common Project (PCP).



## What is the vision of the 2015 Master Plan?

Building on the 2012 edition of the Master Plan, this edition outlines the vision to achieve ‘high-performing aviation for Europe’ by 2035. The vision reflects the goals captured in the SES II initiative, which calls for ‘more sustainable and better performing aviation’<sup>(2)</sup> and Flightpath 2050 — Europe’s Vision for Aviation<sup>(3)</sup>, which states that in 2050, ‘The European aviation community leads the world in sustainable aviation products and services, meeting the needs of EU citizens and society’.

The vision builds on the notion of ‘trajectory-based operations’ and relies on the provision of air navigation services (ANS) in support of the execution of the business or mission trajectory — meaning that aircraft can fly their preferred trajectories without being constrained by airspace configurations. This vision is enabled by a progressive increase of the level of automation support, the implementation of virtualisation technologies as well as the use of standardised and interoperable systems. The system infrastructure will gradually evolve

with digitalisation technology, allowing air navigation service providers (ANSPs), irrespective of national borders, to plug in their operations where needed, supported by a range of information services. Airports will be fully integrated into the ATM network level, which will facilitate and optimise airspace user operations. Going beyond 2035 towards 2050, performance-based operations will be implemented across Europe, with multiple options envisaged, such as seamless coordination between ANSPs or full end-to-end ANS provided at network level.

Furthermore, it is widely recognised that to increase performance, ATM modernisation should look at the flight as a whole, within a flow and network context, rather than segmented portions of its trajectory, as is the case today. With this in mind, the vision will be realised across the entire ATM system, offering improvements at every stage of the flight.

Reaching the performance ambition will also require a change in the way that solutions are deployed, as well as possible evolutions in the way services are provided. Through a four-phase approach, this change would see the high-level architecture gradually moving from locally specific architecture to a more interoperable, common and flexible service provision infrastructure at regional or network level (see Chapter 2).

<sup>(2)</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions on SES II, COM(2008) 389/2, 25 June 2008.

<sup>(3)</sup> Report of the High-Level Group on Aviation Research, 2011, EUR 098 EN.

## SESAR's performance ambition



### What is the ATM performance ambition for Europe?

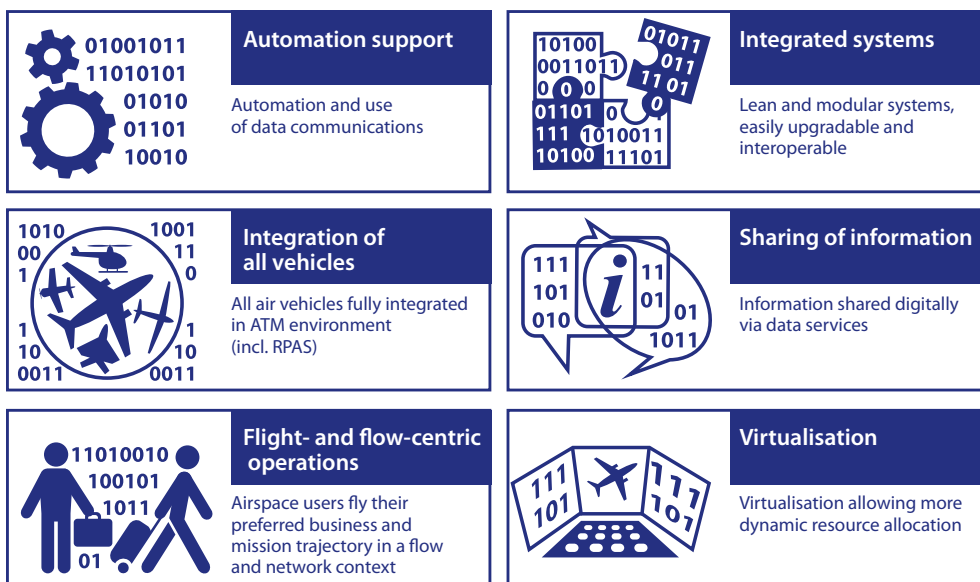
The performance ambition supported by SESAR is aspirational and refers to the performance capability that may be achieved if SESAR Solutions are made available through R & D activities, deployed in a timely and, when needed, synchronised way and used to their full potential. While acknowledging that the performance gains at local level will also depend on local conditions, it shows that significant performance gains can be achieved in Europe in a number of key areas, namely the environment, capacity, cost efficiency,

operational efficiency, in addition to safety and security. The ambitions described are compared to the situation in 2012 and rely on the optimal development and deployment of a series of operational changes through SESAR Solutions (see Chapter 3).

### What is needed to achieve this performance ambition?

The technical evolution of the future system is now closely connected to these performance ambition levels. In order to deliver, SESAR will enable a step change in system capabilities

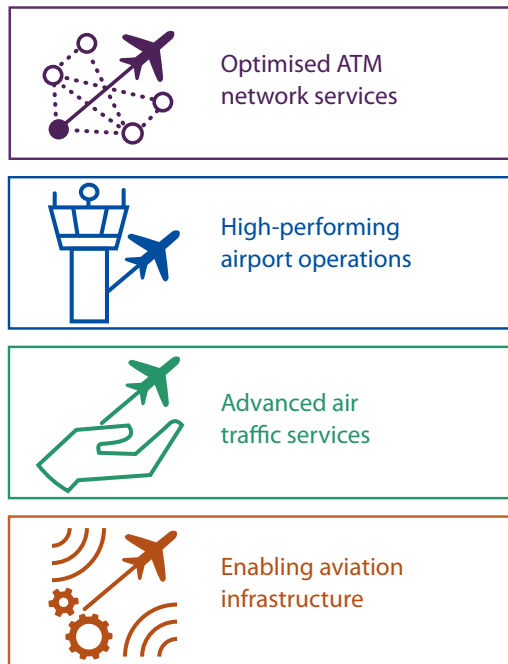
#### What is needed to achieve the performance ambition?



by 2035 with higher levels of automation, digitalisation and virtualisation.

The Master Plan identifies the related changes and groups them according to whether they are already in place, in the pipeline towards deployment, or planned as part of future R & D activities (see Chapter 4).

These changes are categorised according to four areas of ATM (Key Features):



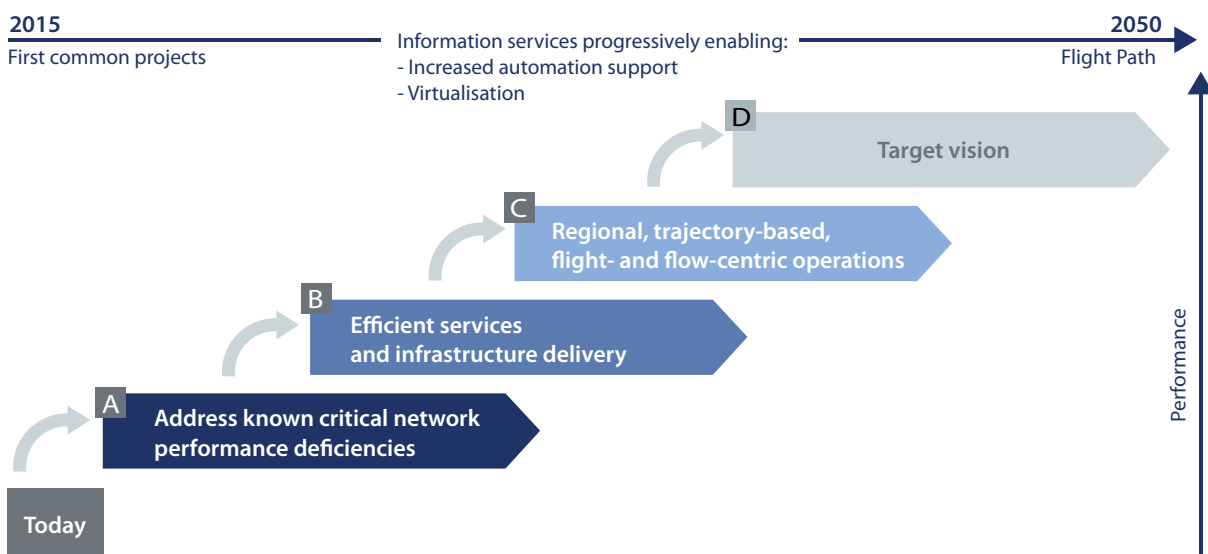
Further operational changes relating to RPAS and cybersecurity are also featured in the Master Plan. Key to success is the ATM workforce, which the Plan underlines as an integral part of the overall ATM system, and as the most critical source of its performance, safety and resilience. As in past and present operations, ATM performance will remain the result of a well-designed interaction between human, procedural, technological, environmental and organisational aspects.

### What is the timeline for deployment?

The operational changes are enabled through improvements to technical systems, procedures, human factors and institutional changes supported by standardisation and regulation.

The Master Plan includes roadmaps of the identified changes, ensuring that their deployment is planned in a performance-driven and synchronised way (e.g. between ground and air deployments) to maximise the benefits gained. The Master Plan also gives targeted dates for deployment; however, these are subject to further considerations after validation and proper identification of supporting business cases.

### Four-phase approach to improvements



## Delivering expected benefits

## Direct and quantifiable benefits for European ATM and aviation

- **ANS productivity:** reduced en-route and TMA costs per flight
- **Operational efficiency for airspace users:** reduced fuel burn and flight time
- **Capacity:** reduced delays, increased network throughput and throughput at congested airports
- **Environment:** reduced CO<sub>2</sub> emissions
- **Safety and security:** high standards

## Benefits for EU economy and society

- Industrial leadership in ATM and aviation at the forefront of innovation
- A more competitive EU aviation industry in the global aviation landscape
- Increased mobility with a lower environmental impact
- Significant contribution to EU GDP and job creation
- High standards in terms of safety, security and social standards

## What are the expected costs and benefits?

The realisation of the vision will not only bring significant direct and quantifiable performance gains to ATM and aviation, but it will also mean benefits for the EU economy and society in general, as described.

In terms of cost savings, the Master Plan estimates important improvements in several areas, depending on how SESAR is deployed. Two options are put forward: on the one hand an optimised deployment scenario with greater integration of the ATM infrastructure, and on the other hand a local deployment scenario.

It is estimated that cost savings and the value of all performance benefits would amount to annual recurring benefits ranging potentially from EUR 8 billion to EUR 15 billion per year in 2035, compared to a scenario where SESAR would not be deployed. These savings imply higher levels of coordination on how and where to invest, as well as the early application of standardisation and harmonisation of procedures. More critically, these savings also rely on the deployment of infrastructure with a long-term horizon which is optimised at network level, amounting to a total investment in the range of EUR 18 billion to EUR 26 billion in the period up until 2035 (see Chapter 6).

## Why is the Master Plan important for global interoperability?

Aviation is a global industry and interoperability together with global harmonisation are key for its safe and sustained growth. The EU-US Memorandum of Cooperation (MoC) provides the framework for SESAR and FAA's NextGen coordinated approach in particular with regards to the International Civil Aviation Organisation's (ICAO) harmonisation efforts. This latest update of the Master Plan is timely as it will serve to contribute to the update of the ICAO's Global Air Navigation Plan (GANP) and the Aviation System Block Upgrades (ASBUs) in 2016.

## The Master Plan: a shared and maintained strategy for the evolution of European ATM

The Master Plan is a regularly updated plan (every 2-3 years) which involves all stakeholders. It represents the strategy for the performance-driven evolution of the European ATM system for institutional as well as industrial players.

The Master Plan's successful implementation is a key enabler for high-performing aviation in Europe, providing increased connectivity, supporting sustainable economic growth and promoting European industrial leadership at a global level.

# Stakeholder Executive Summary for the Military



# Executive Summary for the Military

## Introduction

The European Union's Single European Sky (SES) initiative aims at achieving, in the foreseeable future, improved efficiency, increased capacity, enhanced aviation safety, diminished environmental impact of flights and reduced unit costs of Air Navigation Services (ANS). The military recognises and acknowledges the importance of SES/SESAR for tomorrow's aviation. A lot of progress has been achieved since the statement on SES by Member States in 2004, enabling the military over the last decade to contribute to the goals set for SES. In order to safeguard the integrity and security of States, the defence community has considerably improved its representation, in order to be heard as a harmonised voice representing the military as: Airspace Users, Air Navigation Service Providers (ANSPs), Airport Operators, regulators, supervisors as well as policy makers.

The European Air Traffic Management Master Plan Edition 2015 (hereafter referred to as "the Master Plan") coincides with a proactive participation of the military community to the Master Plan Update Campaign through a newly coordinated approach among the European Defence Agency (EDA), NATO and EUROCONTROL, along with national technical contributions to projects of military relevance via the Military Engagement Plan for SESAR. Both have represented a unique opportunity for military authorities to pragmatically voice their needs and to gather at the same time, opportunities offered by new technologies and procedures which will be deployed in the forthcoming years for the modernisation of the European ATM system.

This document provides decision-makers with an executive view aimed at facilitating the adoption of the ATM Master Plan as the main driver for the future development of ATM in Europe.





## Civil-Military Partnership

Civil and military aviation face challenges which are similar to some extent, whether economic, financial, technological or operational in nature, or related to safety and security. All stakeholders have to overcome the same hurdles and are therefore increasingly required to work together as partners, taking into account each other's objectives and constraints. It is thus vital for SESAR deployment that the future ATM system accommodates both civil and military needs. This approach shall ensure optimum airspace allocation for all Airspace Users while preserving the capability of the military to safely operate across national and European airspace, either nationally or collectively, including within the most dense and complex areas and airports of Europe. In other words, the aim is to achieve SES objectives and to enhance military mission effectiveness at the same time. Civil and Military stakeholders should engage in the cooperative development of harmonised solutions at the lowest possible cost for both sides, common mitigation actions including standardisation certification processes and low-cost interoperable technical solutions.

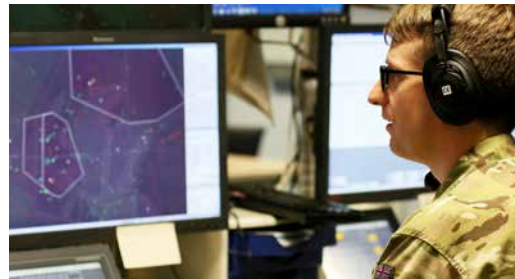
## Operational

The European security and defence community (States) continues to emphasise the vital requirement for military forces to have unconstrained and safe access to airspace for training purposes, air policing and air defence missions; as well as the need to safeguard the ability of the military to deploy/project forces to theatres of operations from and within the European airspace when required. Developments in the wider European security and defence environment and recent events in the close proximity of the European Union are increasingly pointing out the need for synergies between internal and external security. The military operational relevance consists, in broad terms, of: airspace utilisation, including mission trajectory, interoperability, technological convergence and ATM security.

## Airspace Utilisation

Through close civil and military cooperation, the Flexible Use of Airspace (FUA), today already contributes to significant performance gains for the European ATM Network. Thus, one of the ATM areas to be considered, by the military, is the **Advanced** Flexible Use of Airspace (AFUA) concept. Its aim is to further enhance cooperative planning through the evolution of procedures, airspace organisation, coordination processes, system support and performance evaluation. Building on the enhanced Collaborative Decision Making (CDM), the AFUA concept may be summarised as the cohesive coordination of the common airspace resources up to network level, through a proactive partnership between all ATM actors. This will ensure that both civil and military needs are addressed, that airspace utilisation is optimised and that performance objectives are achieved. AFUA implementation represents a prerequisite for other ATM developments like direct routing airspace (DRA) and free route airspace (FRA) and consolidation of the mission trajectory concept.

Integration of military operations into the ATM network through the concept of mission trajectory will ensure access to airspace and airports. For reasons of sovereignty and security, priority can be demanded when required. The integration of military operations into the ATM network will be assured in conformity with the requirements defined by the military authorities according to the level of priorities established by each State through its national coordination processes. The main operational change underlying the mission trajectory concept is the sharing of information on trajectories amongst the entire ATM community, from the planning to the execution phase. It will require an improvement of interoperability between civil and military ground and airborne systems e.g. enhanced information sharing through an improved Operational Air Traffic (OAT) flight plan and the ability to access harmonised Aeronautical Information repositories, in their respective standards.



## Interoperability, Technological Convergence and ATM Security

Interoperability is required in both civil-military and military-military domains. The required improvement of interoperability between civil and military systems (ground and airborne segments) shall be implemented as far as practicable at the lowest possible cost and from a security perspective, with due regard to national policies on security (including cyber-security) which are complementary to ATM policies. Potential mitigation measures shall always be an integral part of all implementation planning processes. It is fundamental to address the civil-military dimension of spectrum coordination, technical standardisation and certification. Infrastructure interoperability on the basis of solutions/synergies that enable the maximum level of reutilisation of existing military capabilities should be further developed. Such technological convergence should be viewed from national and collective defence as well as security perspectives. Harmonised ATC procedures, upgrade of systems, gateways between ground communication networks and legacy networks, SWIM interoperability and security military-related needs are areas which remain subject to development. Areas under consideration in the context of research initiative include: definition of SWIM technical infrastructure profiles for civil-military interoperability; interfaces for ground-ground Internet Protocol (IP) connectivity; development of alternative independent non cooperative surveillance technologies; military transport aircraft systems for 4D trajectory management functions and advanced navigation. Additionally and by way of example, military expertise in cybersecurity could facilitate the establishment of a joint civil-military “Total System Approach” in ATM security.

## Performance

Comparable to the concept of operating environment, this version of the Master Plan introduces the notion of the Military Operating Environment (MOE) to analyse the contribution of civil-military coordination and interoperability solutions to Mission Effectiveness and overall network performance. The military approach is to be “as civil as possible” while remaining “as military as necessary” for its aviation and ATM operations. As an example, a large portion of operations at airports, in TMAs and en-route are directly comparable. However, the purpose of military flight operations is substantially different. The military largely share civil performance requirements when providing Air Navigation Services to General Air Traffic. For specific civil-military performance requirements the notion of Mission Effectiveness is used and a document on the civil-military performance framework was approved by the Civil Military Interface Standing Committee (CMIC) in 2015 and used as initial reference

## Deployment

Roadmaps of all the ATM Technology Changes per stakeholder group are provided in the Master Plan showing a synchronised view (e.g. between ground and aircraft-based deployments) needed to ensure that their deployment is planned in a performance-driven and fully coordinated way to maximise the benefits for all stakeholders. These Essential Operational Changes might become future Common Projects (CP's).

## Military Impact Assessment

It is important to note that the deployment actions embedded in the Master Plan deployment packages are not binding for military authorities. A qualitative impact assessment was performed for each deployment package/ deployment scenario (Military Impact Assessment of ATM Master Plan Deployment Packages and Deployment Scenarios Edition 1.0 18/06/2015).

## Opportunities and Enablers

The principles to be observed when implementing civil-military interoperability solutions shall include the need to minimise derogations and exemptions related to ATM/CNS equipage requirements. Alignment of military procurement processes and implementation cycles are important to support a more seamless integration of military operations on the basis of the SESAR Key Features, including the concept of mission trajectory.

If the levels of integration need to be enhanced, alternative equivalent enablers or equipage derogations/exemptions might still be necessary due to late equipage of residual accommodation of legacy aircraft.

The military support Communications, Navigation and Surveillance (CNS) infrastructure rationalisation and the implementation of new functionalities and/or technologies for more integrated CNS systems supporting new concepts and considerations like economies of scale, spectrum efficiency, etc., so that pooling of resources can become a reality, and old technologies and systems can be decommissioned. However, this rationalisation will require consideration of overall resilience/ redundancy, contingency planning and the full involvement of the military authorities in the decision-making process.

To support the mission trajectory concept, harmonised aeronautical information and improved OAT flight plan integrated in network and local systems, extension to flight object sharing, including 4D profile, real-time synchronisation of air and ground trajectories, ground-ground coordination of initial Reference Mission Trajectory (RMT), connectivity to SWIM and utilisation of future datalink services are planned as enablers. In summary, trajectory-based operations will need a more cooperative military aircraft, able to exchange air-ground data (time constraints, Aeronautical Information Services (AIS), uplink of Airspace Management (ASM) data, etc.), able to operate within Performance-Based Navigation (PBN) and FRA structures and to be subject to new separation modes.

Performance of military CNS equipment may sometimes exceed that of civil systems. Therefore, it is important that the notion of performance equivalence and the associated reutilisation of existing military capabilities is further developed. The military community is pursuing mechanisms to demonstrate CNS performance technology equivalence. Moreover, a reformulated wide concept of “most capable, best served” should be commonly recognised and applied. There should be equal access to EU-funding for civil and military projects, suitably prioritised especially where there are negative cost benefit assessments for stakeholders.

### Business View SESAR 1

The military airspace user costs take the civil ‘per unit’ costs and the military fleet (large aircraft, light trainers, fighters) into account. The military also has a large helicopter fleet, but since costs stemming from SESAR upgrades are not available for civil rotorcraft, they are also unavailable for the purpose of military. While military ground investment costs have not been calculated, it is clear that system integration with civil ANSPs at national or regional level will decrease costs for the military. However, the costs for eventually upgrading military ATM systems, multinational air command and control systems and national air defence systems to SESAR requirements is assumed to be similar to the cost of upgrading a civil ATM system.

Military benefits are not monetised within the Cost Benefit Analysis, but benefits can be expected if the following high-level military operational and system needs are met:

- unrestricted access to airspace aimed at safeguarding the integrity of national airspace and the provision of support to civil authorities in connection with national security;
- unconstrained training to ensure the readiness of military forces (as well as police and customs) to perform the activities required and to test systems or operational concepts;
- accessibility to civil and military aerodromes;
- accessibility to common ATM information, data repositories and networks;
- light- and cost-efficient transit to operating and training areas;
- ensuring that national airspace is accessible for national and international forces including cross-border operations and access to cross-border ATM resources;
- infrastructure sharing and rationalisation;
- processes and mechanisms supporting performance-based certification so that an equivalent level of performance of the military system against SESAR ATM/CNS requirements can be achieved.

Military stakeholders can expect to see benefits related to capacity, cost efficiency, operational efficiency, flexibility, access and equity, inter-operability and (national) security.

### Data Capturing and further military SESAR participation

A military data capturing exercise was conducted to support the Master Plan. A questionnaire was built in close cooperation between EDA, EUROCONTROL and NATO, in order to get a comprehensive picture of military ATM/CNS ground capabilities, currently available to allow States to provide ANS in the airspace under their responsibility. However, it highlighted that the engagement of States at a more detailed level is required to develop validated cost estimates for future Master Plan updates and better understanding of the current Pilot Common Project (PCP) implications, their understanding of a State's current military ATM architecture, and of its military operational imperatives and policy, regarding SESAR participation.



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