IN 2006, AN important milestone was reached when EUROCONTROL released the Civil/Military CNS/ATM Interoperability Roadmap. It was the first serious attempt to provide guidance to ATM planners and procurement organisations on how to go forward with interoperability and technical convergence. This Roadmap has been an essential route-finder for guiding military inputs provided not only to EUROCONTROL short-term implementation programmes such as 8.33 kHz expansion, Mode S, Link 2000+

Ensuring civil/military ATM/CNS interoperability in the Single European Sky (SES) is an essential element of the SES story, and although it presents a continuing challenge, progress is being made on a number of fronts. Julian Moxon talks to Jorge Pereira to find out what it entails and what has been achieved so far.
and CASCADE, but also for helping with the definition of some civil-military provisions that are to be included in a number of SES interoperability regulations.

For medium to longer-term improvements, the main research and development effort to modernise the ATM infrastructure takes place in the SES ATM Research (SESAR) programme, which is the technology component of SES. SESAR has its own implementation timetable, and the original civil-military roadmap is now used as one of the sources of civil-military interoperability requirements.

The current European ATM/CNS network presents a large number of interoperability mismatches between the capabilities of military and civil aircraft. Today’s fighter aircraft, for example, are basically high-speed weapons platforms equipped with sophisticated onboard radar, helmet-mounted displays, navigation and targeting pods, and a range of sensors operating at different wavelengths. The limited space and extreme integration constraints of a fighter cockpit mean there is little or no room available for any additional avionics that would be required to meet civil ATM mandates.

Nevertheless, these modern military platforms have capabilities and performance parameters that are by no means lower than civil mainline aircraft. This opens opportunities for the re-utilisation of military avionics to support ATM requirements – subject to it being technically feasible and without detrimental impact to primary military roles.

This ‘agile capability’ approach, together with a better ‘obsolescence management’ of legacy fleets, will be the cornerstone for future civil-military ATM/CNS systems interoperability, bringing a drastic reduction in the number of retrofit programmes and the avoidance of illogical and duplicated equipage solutions.

Military aircraft have to operate in highly interactive, fast-moving theatres of war, but training, airlift/transport, policing and many other peacetime missions dictate that they need unrestricted access to all airspace – and in some circumstances must also take priority over civil traffic. Today, military aerial activities conducted as Operational Air Traffic (OAT) in most European countries remain under the control of military air navigation service providers (ANSPs). When operated as General Air Traffic (GAT), however, the service is normally provided by civil ANSPs.

Some volumes of airspace are temporarily reserved for training and other military activities that need segregation. This airspace is later released back to the civil airspace users when no longer required for military use. However, with a requirement for considerable additional airspace capacity by 2020 and around 11,600 military aircraft operating in the ECAC (European Civil Aviation Conference) area in what will be a highly automated environment, it is unlikely that a fully functional and seamless SES will be implemented if civil-military interoperability levels are not raised.
Interoperability remains a challenge for many legacy aircraft. In addition, the military face greater difficulties meeting civil ATM mandates because of longer procurement cycles, budget constraints or the absence of a sufficient military requirement justification. Transition arrangements to accommodate State aircraft will, therefore, remain in place for some time.

By the 2020 SESAR implementation target timeframe, military aircraft flying in civil-controlled airspace will have to operate in an environment in which intensive real-time information is shared and flights are planned on the basis of 4D trajectories. Military users will also have to engage in collaborative decision-making, dynamic use of airspace resources, and partial migration of separation assurance to the flight deck.

Civil-military projects

Jorge Pereira, head of the civil-military CNS Unit within the EUROCONTROL Civil/Military ATM Coordination Division (CMAC), says that several important military-related projects are currently underway within SESAR. “It is becoming evident that innovative approaches are needed if we are to reach adequate interoperability levels without massive programmes to retrofit military aircraft with civil avionics. These would entail a significant burden, to which military authorities might not be able to respond positively because of the technical challenges and costs involved.”

Some people tend also to emphasise that these civil capabilities are not directly associated with primary military mission requirements. Others believe that, in the future SES context, military missions can be facilitated only if adequate interoperability levels are implemented.

Pereira considers that SESAR offers “unique, affordable, opportunities to push forward civil-military interoperability by considering a performance-based approach for re-utilising military avionics.” This will have to be accompanied by increased use of more integrated multi-mode avionics, software-defined solutions, supplementary ground systems support, and transitional accommodation of legacy fleets.

To simplify the complex interoperability situation, Pereira says that military transport aircraft, which have plenty of space for new equipment, are being handled differently from fighters. “We believe that in the long term, all military transport-type aircraft should converge to having equipment similar to civil aircraft,” he says. By 2012, for example, around 85 per cent will have been fitted with VHF 8.33 kHz radios and 60 per cent with Mode S-capable transponders.

For fighter aircraft, however, the level of compliance with civil ATM requirements is, by definition, much lower. The preferred option is therefore to use their existing avionics – but on a performance-driven basis. “They would have to demonstrate equivalent performance levels to those applicable to civil aircraft,” says Pereira. “We will look at the available avionics and see if we can demonstrate or get enough compliance for a determined service/capability level. SESAR programme results will tell us to what extent this approach is feasible,” he says. “There are a lot of types and variants of fighter aircraft out there, and a ‘one size fits all’ solution will not be available. As a consequence, we will have different fleets with different capability levels. This will not be a problem if backwards compatibility is ensured and if the minimum requirements, in terms of airspace and airport access as well as safety, are guaranteed.”

EUROCONTROL is approaching the civil-military interoperability challenge in three ways: consolidating operational concepts, contributing to systems interoperability, and developing collaborative decision-making processes. In March 2010, the SESAR Joint Undertaking approved four military-specific projects aimed at preparing the path to meeting “interoperability and performance levels for the seamless integration of military flights in the future SESAR cooperative environment.” Pereira says the go-ahead represents “a considerable step forward in the recognition and allocation of resources to civil-military interoperability initiatives within the SESAR programme.” The projects are:

› interoperability of business trajectory and mission trajectory
› military data link accommodation
› ADS-B In/Out for military aircraft
› civil-military data link interoperability

More than 100 existing projects within SESAR have a strong civil-military dimension, and within them EUROCONTROL is working with industry to integrate military requirements. Activities include defining the concept of operations and associated architecture, developing studies and prototypes, validation platforms, and cost-effective deployment scenarios.

Once the SESAR Target Concept is realised, it is expected that an underlying network-centric ATM/CNS structure called system-wide information management (SWIM) will ensure overall consistency of all infrastructure improvements. “There will be a wider network-enabled infrastructure interconnecting a wide variety of stakeholder systems, including military ground and airborne technical enablers as nodes. This kind of ‘ATM Internet’ will provide the real-time seamless information-rich environment that will be the perfect glue to consolidate and give coherence to civil-military systems interoperability,” says Pereira.

A challenge remains, however, in that some military systems have very specific security and interoperability requirements. Considerable attention is, therefore, being paid to identifying the best options for military systems to be considered within the SWIM-based environment.

EUROCONTROL is aware that achieving civil-military interoperability means a considerable change in terms of culture as well as operating realities. Even though significant challenges remain, the technical contributions needed to accommodate military requirements within the future SES are well under way.
EUROPE’S AIRSPACE, ESPECIALLY that portion above the Benelux region, is arguably the most congested and complex on the planet. With travel again on the increase, and hundreds of transatlantic flights routed through local upper airspace every day, and four major European terminal areas in the vicinity, the key area covered by the Maastricht Upper Airspace Control Centre (MUAC) has to manage complex and potentially fast-changing air traffic management (ATM) situations that take into account the various requirements of airspace users – including the management of military, as well as civil, expectations.

Operational since 1972, MUAC provides ATM services covering Belgium, Luxembourg, north-west Germany and the Netherlands. “We manage traffic in the upper airspace only, but 80 per cent of it is either climbing or descending – we’re dealing with traffic to and from the four major hubs of Amsterdam, Frankfurt, London and Paris,” says Peter Hendrickx, head of the operational and airspace systems section for EUROCONTROL at MUAC, who describes his role as “translating between the operations room, the technical department and industry.”

One consequence of the multinational MUAC brief is that there needs to be intimate collaboration, maximum interoperability and complete transparency between the various national authorities involved – Belgocontrol in Belgium, the Deutsche Flugsicherung centre at Langen in Germany, LVNL in the Netherlands – and their military counterparts. “With regard to the German airspace controlled here in Maastricht, the military and civil controllers are co-located here in MUAC and our German partner uses the very same system our controllers use, seeing the same picture we do. Belgium and the Netherlands still have their own units with their own systems providing ATM to military traffic,” Hendrickx explains.

A changing operational picture
The extent of current and future collaboration and information exchange between civil and military air traffic controllers has been a story of gradual change and implementation, according to Hendrickx.

Tim Mahon reveals how EUROCONTROL’s own air traffic control (ATC) centre at Maastricht ensures that civil and military operations are carried out in a collaborative and cooperative manner.

Managing civil/military interoperability at MUAC
“In order to safely guide military combat aircraft between the bases and the military areas, inevitably requiring crossing civil airways in this complex and busy airspace, the questions are simple: where are our aircraft, and what are their intentions? We think we have had the basics of what we now do here in place since the early 1970s, but there have been some subtleties and changes that required a very thoughtful approach to manage the overall picture,” he says.

The initial step – identification of aircraft and their locations – was relatively easily managed. Then came the issue of trying to determine intent – at first, of vertical movement, but now also horizontal – which was somewhat more complex. “Until 2008, the system in Maastricht has been route-based, and the biggest material change we have undergone has been in the implementation of the Flight Data Processing System (FDPS), a trajectory-based system that lies at the very heart of the centre,” Hendrickx says. “With this we can dynamically update the operating picture and, therefore, know the projected horizontal path with much greater accuracy.”

This dynamically updated picture – in all dimensions – is now available to military controllers as well. “For the last two years, the military controllers have been able to see everything we know. Eight minutes before an aircraft enters their particular block of airspace we send them the initial data and, from that point on, all change messages are routed to them in real time,” Hendrickx points out. “The military are now aware of the intentions of the civil flights, allowing them to guide the military traffic safely between them, as well as the details of the Maastricht controller in contact with the civil pilot. Such information is vital in case critical information needs to be exchanged between the military and civil controllers,” he adds.

Also, feeding the overall picture is the Civil Military Coordination Tool (CIMACT), a system displayed at the various air defence sites in the individual nations, used by the military to process individual aircraft identities. This is a separate system which is continuously fed with data from the FDPS, says Hendrickx, who adds that the French military also uses CIMACT. Because some French airspace – almost completely surrounded by military areas – is delegated to MUAC, such commonality and interoperability provides far less opportunity for misunderstanding or unfortunate incidents.

**Virtual centres**

Having established a benchmark for cooperation and seamless interoperability with FDPS and the various military systems, the civil-military collaboration arena is by no means static and further work continues.
“With the FDPS we can dynamically update the operating picture, and know the projected horizontal path with much greater accuracy”

Since 2010, MUAC has been in discussion with the Royal Netherlands Air Force to determine the next steps. “We aim to be able to share even more data with them. Actually, we aim to share mutually all data,” says Hendrickx. “We will deploy a ‘virtual centre’ at the military sites of the Dutch armed forces so that they will have exactly the same picture as our controllers. This is guaranteed, because the remote picture will be built by servers (FDPS, Track Server, STCA) physically residing in MUAC and also serving the operations room in MUAC. This means we will be able to bring the system to the people, as opposed to what we have tried unsuccessfully in the past, which was bringing the people to the system.

“Although the Dutch military operators will be 200 kilometres remote from the system, they will be seamlessly integrated – this will be an enormous improvement in safety,” Hendrickx confirms, adding that the short-term conflict detection will continue to be conducted at MUAC.

The greatest contributor to incidents that might lead to accidents is almost always misunderstanding of voice communications, according to air safety experts. The existence of a common picture of airspace congestion and evolution, shared between civil and military operators in real time and distributed as widely as possible across the area of responsibility, obviates almost all chance of such misunderstanding having a detrimental effect, according to Hendrickx.

The salutary experience of the immediate aftermath of the 9/11 terrorist attacks, when North American airspace shut down in an astonishingly short space of time, has provided ATM planners with much food for thought. There is no direct relationship, according to Hendrickx, between those events and what has transpired at MUAC in civil-military cooperation; the lessons learned have been more in the form of ensuring security of airspace, rather than any direct operational influence.

Hendrickx believes the current situation represents “about as far as we can go right now. Next steps in flight plan data exchange will have to come through SESAR: Flight Objects exchanged over the SWIM Network. In the work packages related to this capability, MUAC is a prominent and active contributor.” However, for non-flight-plan related data, there is work ongoing with Belgium and the Netherlands, for example, to determine how best to take advantage of the common systems and how to implement the local and regional airspace (LARA) management tool, a EUROCONTROL initiative designed to enhance civil-military ATM performance by sharing the planning and current status of the military areas in real time.