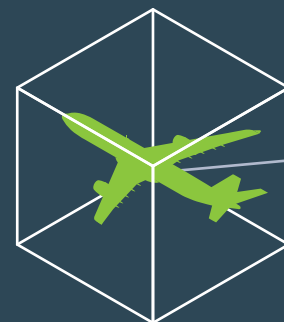# NETWORK COLLABORATIVE MANAGEMENT: MOVING TO DYNAMIC DEMAND AND CAPACITY BALANCING

Keyhole surgery – "minimally invasive surgery carried out through a very small incision, with special instruments and techniques including fibre optics".

To many airspace users the current measures taken by air navigation service providers (ANSPs) and Network Manager (NM) to avoid congested hotspots – where the number of flights planned to pass through a particular airspace sector or airport is greater than the controller's capability to handle them – can often appear unduly invasive to their finely-tuned flight schedules. Using filed flight plan and real-time update information, NM has to delay the take-off times of many flights to avoid a predicted overload. But what if the local demand/capacity balancing (DCB) function in a collaborative management process could surgically target individual flights – a minor rerouting, an altitude cap for example – to prevent the development of congested hot-spots minutes, rather than hours, before they are predicted to occur?

"The SESAR 2020 Project 24 (PJ24) is there to fill the gap, to work towards deployment at a large scale involving each stakeholder in live trials."

Franck Ballerini, Head of the Network Research and Development Unit at EUROCONTROL
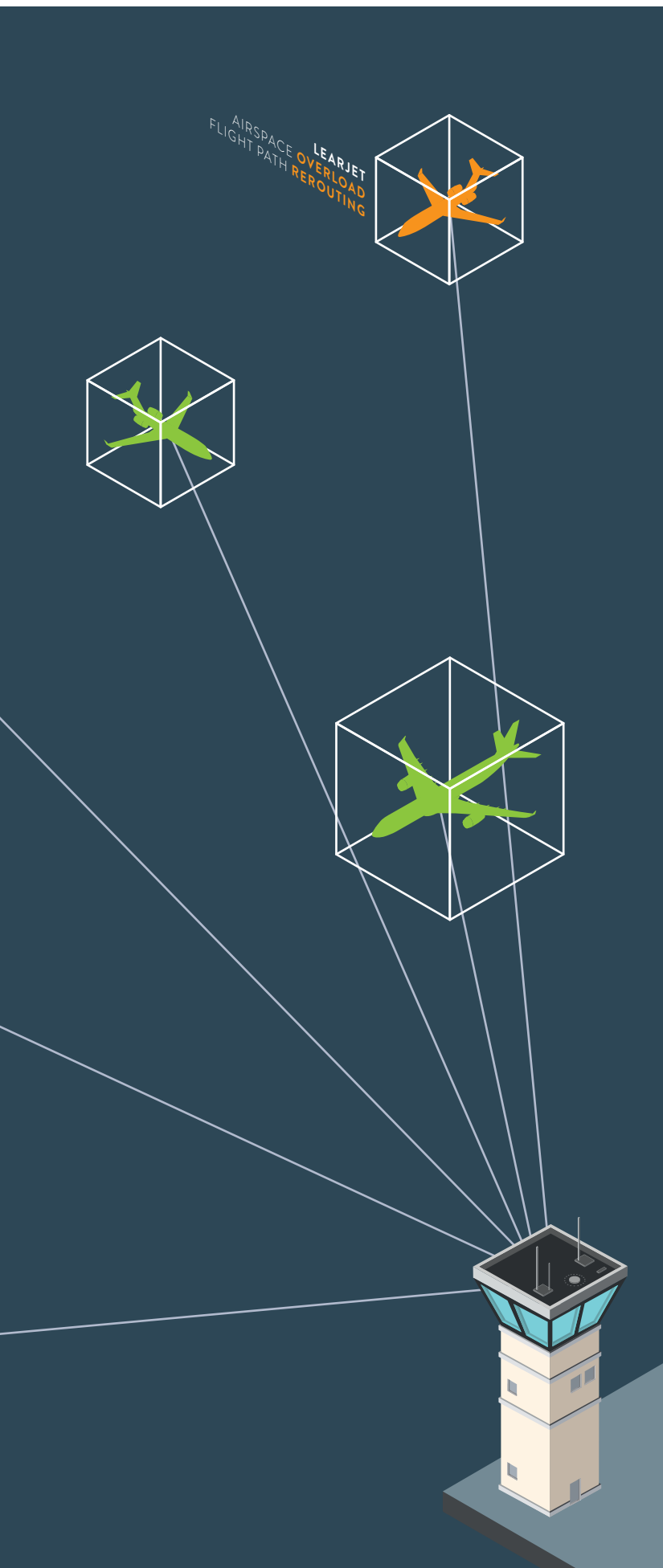
SESAR 1 HAS SHOWN that this "keyhole surgery" approach to balancing demand and capacity is possible – but very complex. By applying short-term air traffic flow capacity management (ATFCM) measures (STAMs), controllers can flexibly introduce traffic-overload prevention measures in response to the actual demand on the system. Via cooperation between controllers, pilots and airport operators it is possible to target individual flights with a STAM measure – such as a minor ground delay, flight level cap or minor rerouting – using locally-preferred solutions, rather than applying a regulation to a group of flights some time in advance.

Sönke Mahlich, Leader of the SESAR 2020 Advanced Demand Capacity Balancing PJ09 project, said at the Amsterdam SESAR Showcase event in June 2016 that SESAR 1 trials have shown STAM measures are an effective way to solve hotspots and reduce complexity problems. If STAMs were installed at the top 10 delay-producing ATC centres in Europe, a potential saving of €1 million per day could be achieved. There are, however, important challenges to overcome before they can be introduced throughout the continent – the coordination of workflows between partners is often too slow and complex, for example. Identifying which flight should be targeted for measures to reduce congestion and calculating exactly what measures need to be taken, and for how long, has also proved difficult.

"There are still several technical issues to be resolved," says Franck Ballerini, Head of Unit Network Research and Development, Directorate ATM. "The SESAR 2020 Project 24 (PJ24) is there to fill the gap, to work towards deployment at a large scale involving each stakeholder in live trials."

"SESAR 1 STAM trials have shown the benefits of better cooperation between partners and targeting these fine-tuned measures but we now have to integrate this in the real-time environment," says Pascal Hop, Project Manager of the Cooperative Traffic Management Project in the Directorate Network Manager, and PJ24 Leader. "At the same time collaborative measures are not just about STAMs but also about integrating airport operations and airspace user requirements into dynamic demand and capacity balancing."

PJ24 within the SESAR 2020 portfolio of research projects, which EUROCONTROL is leading, brings together airspace users, airports, ANSPs, industry ▶

and NM to develop more coordinated ways to swiftly identify and resolve potential congestion hotspot areas by applying small changes to individual or small groups of flights. It is one of the fundamental building blocks of next generation ATM technologies for Europe and will close the gap between tactical ATC and more pre-tactical flow control operations and, because of its strategic importance, will be deployed across Europe in accordance with the Pilot Common Project.

All data required for this collaborative network management process (flight trajectories, hotspot prediction, ATFCM measures) will be shared via business-to-business (B2B) system-wide information management (SWIM) and the final architecture will include automated support tools which will detect hotspots and disseminate the information to flow management positions in area control centres. There will be what-if functionalities to evaluate what the effect of STAMs and other proposed measures will be before applying them, taking into account a wide set of factors including weather, airport operations, runway capacity and traffic complexity.

The work on PJ24 began at the start of November 2016. "So far there are four main areas of demonstration exercises: tactical scenario management from a network point of view; tactical capacity management (a more air traffic control focused area); airport network planning integration and the integration of airspace user preferences in coordination processes," says Pascal Hop. "For all four areas we have to find out what the stakeholders would like to see as feasible demonstration activities and at the end will bring them together within an integrated demonstration approach."
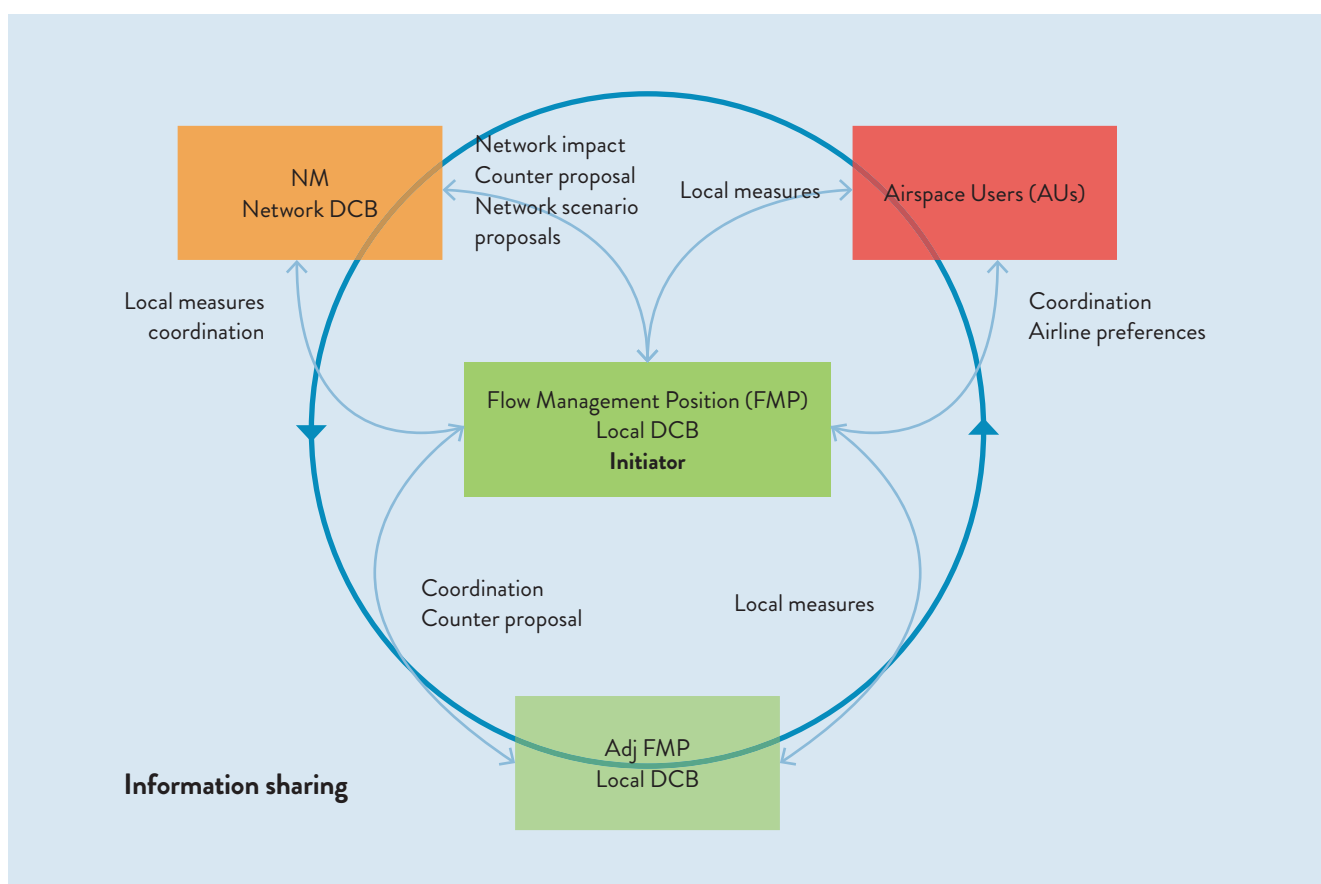
The schedule for the demonstration programme is due to be finalised by the end of March 2017. For ANSPs, an important part of the work will be to coordinate local ATCFM measure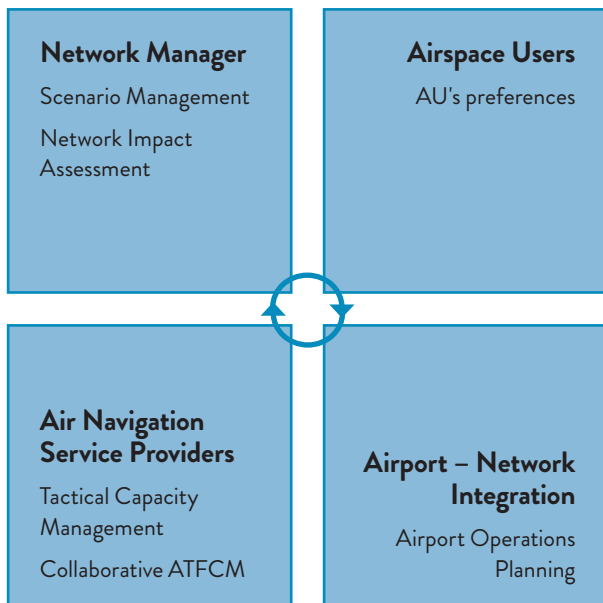s, including identification of potential hotspots, with those of NM; there will be no point in increasing capacity at a local level if this results in greater delays at a network level. This means fine-tuning and enriching, when necessary, the existing associated procedures, data exchange flows and supporting tools. Demand/capacity balancing exchanges will take place closer or even during the real-time operations in the execution of the flights. PJ24 ANSP partners include EUROCONTROL's Maastricht Upper Airspace Centre; DSNA (France), DFS (Germany), NATS (UK), ENAIRE (Spain), Austro Control (Austria) and Croatia Control, and is supported by system providers Thales and Indra.

The project builds on ATFCM development work ANSPs have pioneered individually and within SESAR 1.

"DSNA has already conducted successful trials at three en-route centres of a Collaborative Advanced Planning concept, which anticipates possible hotspots a few hours in advance, shares the situation with partners, and, through collaborative decision-making, finds and agrees optimum solutions combining airspace user priorities, preferences and ATM capabilities," says Morad Hripane of DSNA and a Project NCM (Network Collaborative Management) Work Package Leader. "This will provide direct input to the Project solution. Because developments are moving very quickly in the ATFCM domain, other tools are currently under development at DSNA (such as "what if?" planning tools) and we can now propose new functionalities that could enrich the demonstration and increase operational benefits. The ATFCM system evolution, enabled notably by SWIM, is happening all over Europe and other ANSPs are also proposing new functionalities. In this context it is important that all stakeholders share their views and this project seems to be the right place for that."

For airports, information on target times for arrival and departure, as well as taxiing and turnaround times

NM Network DCB

Airspace Users (AUs)

Network impact
Counter proposal
Network scenario proposals

Local measures

Local measures coordination

Coordination
Airline preferences

Flow Management Position (FMP)
Local DCB
Initiator

Coordination
Counter proposal

Local measures

Adj FMP
Local DCB

Information sharing

Network Manager Scenario Management Network Impact Assessment	Airspace Users AU's preferences
Air Navigation Service Providers Tactical Capacity Management Collaborative ATFCM	Airport – Network Integration Airport Operations Planning

captured by the airport operations centre, and other measures, will be consolidated within NM's network operations system. More accurate data on flight punctuality will reduce the amount of flight planning buffers needed to cope with uncertain capacity loads, increasing airport capacity by up to 5.3%, reducing reactionary delays and saving airspace users up to 3% on their fuel bill, according to Sönke Mahlich. London Heathrow, Madrid, Barcelona, Alicante, Palma de Mallorca and Split airports are representing airports in this work.

"The quality of the data used for network planning purposes will be significantly enhanced with the provision of more accurate data directly from airport operators and airspace users," according to PJ24 Work Package Leader Gustavo Cuevas, of Madrid-based aeronautical research agency ISDEFE, a programme partner. "In addition, data from all airports (or groups of airports) that generate any significant levels of traffic will be used as inputs into the planning process so a complete and accurate picture of expected traffic situations can be established.

"An overview of network capabilities are obtained by linking airport ground capacities obtained via the continuous update of the airline operations centres – through the concepts of A-CDM, Airport Surface Traffic Management, Departure Management, Advanced Tower, Extended Arrival Management and Airport Operations Centre (APOC) with the Network via the Network Operations Portal (NOP)," he adds. "The planning process from strategic through pre-tactical until tactical operations

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Gustavo Cuevas
PJ24 Work Package Leader, ISDEFE

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Pascal Hop, Project Manager of CTM and PJ24 Leader at EUROCONTROL

is adapted to allow for a constant quality management cycle including post-operational analysis, which is consistent with the application of the gate-to-gate and air-to-air concept."

Cooperation between stakeholders

EUROCONTROL IS UNIQUELY PLACED to lead this work as much of the demonstration will be based on the NM system. This will act as a central node to the network collaborative management process, exchanging information with the demonstration platforms of partners – such as local flight data processing systems, flight operations and airport operations centres – to show how the collaborative management of the network can be achieved and how dynamic and timely exchange of flight progress information, both in the planning and operational phases, can best be organised.

The overall demonstration will consist of a series of sub-demonstrations following the four overall functionalities and will address the enhanced demand/capacity balancing processes from the perspectives of NM, the ANSP or functional airspace block (FAB), airspace user preferences and their input into the network operations (through NM) and airports, with the integration of airport operation centre information into NM's hub via the network operations portal.

The work programme is challenging due to the number of different stakeholders working together to build consistent and innovative solutions to improve the operations. Demonstrations, however, are based on concepts built by operational teams, speeding the implementation process.

"Operational teams are confident and very involved in the concept," says Gustavo Cuevas. "The required tools to support the concept are very flexible and can be easily and quickly modified by the operational teams. The development is made in an agile mode – the objective is to quickly develop and implement the concept to demonstrate the benefits in live trials."

"By 2019 we are aiming to see a demand/capacity balancing environment not based on large rudimental measures but targeted and fine-tuned, on a flight by flight basis," says Pascal Hop. "This will reduce controller workload, improve flight efficiencies and, ultimately, better use capacity within the network. The ultimate customer, in terms of our demonstration, will be the airspace user. But this is a highly cooperative process, and integrating all the planning systems of stakeholders will bring benefits for every stakeholder." ∎