Going regional to see the big picture

When managing ATM operations, how often have you been confronted with:

- airspace design cross-border complexities;
- inconsistent traffic predictions;
- inefficient handling of traffic flows with neighbouring States?

We have found that it helps to consider ATM from a regional perspective, one which involves all partners in a collaborative approach.

A core-competency: knowing your airspace, flights, optimising flows, maximising efficiency across your network

The EUROCONTROL Network Manager developed its core competency by adopting a regional approach.

The Network Manager provides critical centralised support – also known as Network Operations – to the European Air Traffic Services function as exercised by 42 European air navigation service providers (ANSPs) with 65 air traffic control centres.

Network Operations comprise:

- a single, centralised flight plan reception, verification and distribution process (IFPS: the integrated initial flight plan processing system);
- a centralised air traffic flow and capacity management function (ATFM);
- an airspace data management function, including AIS (aeronautical information services) and airspace management, based on military airspace reservation;
- a real-time flight data collection and distribution function (based on airport departure planning information, ATC activation messages and correlated surveillance data), providing common real-time situation awareness across the network for ANSPs and airspace users.

EUROCONTROL has 20 years of successful operational experience in providing these services.

Benefits

The Network Manager’s centralised functions bring concrete operational, economic and safety benefits to European airspace users and air navigation service providers:

- the optimisation of capacity and minimisation of delays (the central ATFM function made a proven contribution to direct en-route delay savings of more than 13% in 2014);
- concrete gains in flight efficiency (flight plan route extension compared to great circle from 4.91% in 2010 to 4.57% in 2014);
- consistently high predictability of demand (flight plans) and actual traffic situation (flight positions);
- simplified flight plan handling for all actors, with access via business to business and clients interfaces, in addition to legacy systems.

Operational concept

Our operational services are provided in collaborative partnership with civil and military air navigation service providers, airspace users and airports.

Service delivery

Our Network operations services are delivered with the highest degree of security and service continuity and include disaster recovery capabilities.

We comply with the European Commission's Single European Sky regulation on Network Functions, under the oversight of EASA, the European Aviation Safety Agency.

The EUROCONTROL Network Manager is also ISO/9001 certified and CMMI level 3 certified.
The Network Manager is well advanced in implementing System Wide Information Management (SWIM) standards to support interoperability and cloud services to give wide access to our services, via business to business and client applications, without geographical constraints.

We have developed multiple industrial partnerships to benefit from cutting edge technologies and improve cost efficiency.

**Added value support services built on regional core functions**

Regional ATFM is an enabler for more specialised functions that benefit all involved in network operations.

These functions include:

- network operations planning
- airspace design, capacity optimisation and simulations;
- integration of airports into ATM network operations;
- support to safety;
- coordination of responses to crises;
- CNS infrastructure management including surveillance services;
- comprehensive performance analysis and monitoring;
- traffic forecasting;
- ATM training and consulting services.

**Our regional experience has global relevance**

Both regional and global ATM cooperation are in EUROCONTROL’s genes. Our experience in setting up common services to enhance Europe’s ATM performance can bring mutual benefits to all regions in the world.

With a view to improving our own performance, in line with the Single European Sky strategy, we would like to see EUROCONTROL’s membership enlarged so that it embraces all States accredited to the (ICAO’s) EUR/NAT office and their adjacent States. A pan-European ATM coordinator is best suited for developing harmonised safety and performance procedures, global interoperability issues and acting as a focal point for ICAO matters.

We support the European Union (EU)’s External Policy, including the EU neighbourhood policy.

We also aim to extend our cooperation beyond our current borders with States or regions which generate significant volumes of traffic into Europe. This extended cooperation will facilitate the development of standards and guidelines, supporting ICAO in its quest for the global interoperability legitimately desired by airspace users.

Our approach fully supports ICAO’s Global Air Navigation Plan which seeks more integrated aviation planning at both regional and State levels; it underlines the increasing importance of collaboration and partnership.

By sharing our experience, our services and tools - while respecting the terms of our mandates -, we can facilitate the setting up of regional ATM capabilities around the world.

This exchange of experience and assets, built up over the years with EUROCONTROL’s Member States, will promote state-of-the-art ATM across the globe.

Building on our track record of developing and operating regional ATM functions, we can enter into cooperative arrangements with air navigation service providers outside the European Civil Aviation Conference (ECAC) area providing direct and concrete benefits both within and external to the European ATM network.

**Our vision includes the establishment of regional network operations capabilities around the globe.**

Contact: nm.pfr.usr@eurocontrol.int
The scope of our services encompasses operational functions, such as:

- European AIS (aeronautical information services) Database (EAD) services;
- Flight Plan Management;
- Air traffic flow management (ATFM) in a Network Collaborative Framework – supported by a set of Collaborative Decision Making (CDM) processes and tools;
- Flight Data services;
- a full set of support services ranging from airspace design to communications, navigation surveillance (CNS), training and safety support.

These services can be established separately or combined progressively for building regional ATM functions, starting with Flight Plan Management.
Facts and Figures about ATFM...

- we played a central part in solving the European ATM en route delay crisis in the late 1980s;
- we are capable of handling peak traffic of +35,000 daily flights;
- we have made a direct contribution in achieving the Single European Sky targets for ATFM delays since 2012; in particular, we made a direct contribution of more than 10% to delay savings;
- we are pivotal in the safe and efficient handling of major network disruptions (Icelandic volcanoes in 2010 and 2011; the 9/11 security event, etc.)
- we have had scores of +90% satisfied or very satisfied users at every satisfaction survey we have conducted since 2004

... about IFPS (the integrated initial flight plan processing system)

- we handle more than 60,000 messages for some 27,000 flights each day;
- we support more than 500 airlines and 65 ACCs (air traffic control centres);
- 95% flight plans are processed automatically;
- our average response time is less than 30 seconds;
- The IFPS is operated and maintained by the EUROCONTROL Network Manager which is – ISO9001 and CMMI Level 3 certified.

... and about resilience and reliability

- we have executed the IFPS and ATFM functions for more than 20 years without any major technical failure;

EXAMPLES OF ACHIEVEMENTS

Reduced Vertical Separation Minima (RVSM): an ambitious project for halving separation minima in Europe was delivered in 2002. Smooth project management by EUROCONTROL ensured that all aviation partners played their part. Today, EUROCONTROL oversees the safety of RVSM for 48 States.

ICAO Flight Planning 2012: EUROCONTROL was mandated by ICAO to coordinate the implementation of the flight planning changes which took place in November 2012 in all 56 States in the EUR/NAT region. Successful and timely implementation.

Airport CDM: EUROCONTROL supported A-CDM implementation in 17 major European airports, ensuring full coordination with NM Network Operations via real-time exchanges of airport information.

CCAMS project: in 2012, EUROCONTROL set up a Centralised Code Assignment & Management System (CCAMS) service which now benefits more than 50% of Europe’s air traffic.

Flight Efficiency Initiative - Jane’s Award 2014: EUROCONTROL launched an "opportunity" tool helping airspace users fly the most efficient and environment-friendly route possible. This initiative – which received the Jane’s Award 2014 – is currently available to all interested airspace users.
**EUROPEAN AIS DATABASE (EAD) SERVICES**

*Safer and more efficient with the central management of aeronautical data*

EAD is the world’s largest aeronautical information management (AIM) system. It is a EUROCONTROL solution providing a centralised reference database of quality-assured aeronautical information and, simultaneously, a fully integrated, state-of-the-art AIS (aeronautical information services) solution.

**Value proposition**

- EAD is a safer, faster, more accurate and cost-effective solution than previous non-harmonised methods of AIS data collection and delivery;
- A "one stop shop", it gives instant access, no matter where you are in the world, to the most up-to-date global digital aeronautical information, NOTAM (Notices to Airmen), Pre-flight Information Bulletins (PIBs);
- It facilitates cost-sharing through regional approaches.

**What is in there?**

EAD lets aeronautical information providers – including AIS organisations from civil aviation authorities, ANSPs and military administrations – enter and maintain their data in a central repository.

At the same time, EAD enables data users – such as aircraft operators and private pilots – to retrieve and download AIS data from the system in real-time.

**EAD Solutions and Workflow**

These advantages have allowed EAD to grow beyond its original European geographic context. Currently, eight states outside the ECAC (European Civil Aviation Conference) area have decided to join EAD, including Canada, New Zealand and the Philippines. Discussions with seven more states are currently underway.
Centralising flight plan management regionally contributes substantially to improving both the consistency and predictability of flight demand information. It simplifies operations and reduces overall transactional costs for both air navigation service providers and airspace users.

It is also a preliminary step in building a regional ATFM capability, optimising capacity and flight efficiency.

Having a central view of flights in a region offers additional opportunities for exercising “safety/security watch” functions and for achieving economies of scale when delivering support to airspace users.

**Value proposition**

- Accurate picture of demand across a region;
- A single flight profile agreed with airlines and shared between all ATM actors;
- Opportunities for identifying more efficient and environment-friendly routes;
- A key initial step before setting up an ATFM function at regional scale.

**What is in there?**

- Integrated Initial Flight Plan Processing System (IFPS) and Operations: a central system collecting initial flight plans and processing related messages then distributing them to ANSPs – via AFTN/SITA or IP/VPN connections – supported by fully redundant infrastructure and disaster recovery mechanisms. Assistance to airspace users includes route finding;
- Safety/security watch: alerting function on flights that are banned from operating or which are being monitored for safety/security reasons;
- Callsign Similarity Service (CSS): support to airlines and ANSPs for preventing call sign confusion;
- Arrival slot monitoring (AMON): identifies inconsistencies between flight plan and airport slots;
- Demand Data Repository (DDR): traffic modelling system to anticipate future demand based on schedules, airport slots, historic flight plans, forecast growth.
AIR TRAFFIC FLOW AND CAPACITY MANAGEMENT (ATFM)

Regional ATFM through a collaborative approach

A centralised ATFM service optimises the availability and use of capacity across an ATM network; it minimises the impact of any constraints on airspace user priorities while ensuring that there are no excessive loads on ATC capacities at airports and en route.

The Network Operations ATFM concept is a fully collaborative activity between operational actors; it is a centralised operational coordination function working together with local flow management functions located at Air Traffic Control Centres, airports and airspace users.

The service is a fully integrated process, beginning with the strategic dimension and moving through pre-tactical to tactical with post-operations reporting and performance measurement.

Value proposition

ATFM brings down ATM en route delays and reduces congestion risks when traffic increases. It also facilitates the management of ATM performance at a regional level, optimising the use of ATM resources and delivering the service levels required by airspace users for flight efficiency and punctuality.

- Regional or multi-centre ATFM allows capacity and flight efficiency opportunities to be captured across an entire network.
- ATM resources are optimised, thanks to routing and other scenarios built at a regional level for addressing all events that may affect traffic, air traffic control and airports.
- A common view of the operational situation at planning and execution levels is accessible to all actors involved, based on a common ATFM system. This improves the predictability of ATM operations and enables the Network Manager to provide an efficient and coordinated response to disruptions and crises, so contributing to safety.
- Collaborative Decision Making (CDM) processes support all stages of ATFM, ensuring that a proper balance is maintained between local and regional operational priorities. It involves airspace users so as to minimise the impact of ATFM measures on flight efficiency.

What is in there?

- Enhanced Traffic Flow Management System (ETFMS) and Operations
  ETFMS calculates the traffic demand in every sector and airport in the area of operations, using the flight plan information received from the aircraft operators via the Integrated Initial Flight Plan Processing System (IFPS), airport departure planning information and real-time flight position updates.
  Potential excess demands for capacity are constantly displayed by the Network Manager and the local Flow Management Positions (FMP). Together, they decide which ATFM measure is the most appropriate according to agreed CDM processes. The measure is then communicated to airspace users and all relevant ATC units.

- Operational Collaboration interfaces
  A comprehensive set of tools supports the CDM processes and transactions between all actors involved in ATFM. These include the Network Operations Terminal and Portal (NOP), plus client applications which display a common network situation together with customised collaboration functions.
  The NM B2B (business to business) and data distribution services allow airspace users and ANSPs to obtain all available real-time ATFM data (flight profiles, measures, etc.).
Flight Data Services consist of the reception, processing and transmission of real-time data flows (based on airport departure planning information, ATC activation messages and correlated surveillance position reports) between all operational stakeholders across the network.

Constantly refreshed 4D flight information feeds the Flight Plan Management and the Air Traffic Flow Management (ATFM) functions. This accurate information stream not only enables the ATFM system to operate at optimum efficiency, but also provides a single source of essential information for air navigation service providers (ANSPs), airports and airspace users.

Value proposition

- gives an accurate picture of the real-time traffic situation across a region;
- provides a single trajectory that can be shared between all ATM actors;
- enables the closing of the gap between ATFM and ATC, permitting short-term ATFM measures and cross-border sequencing (e.g. extended AMAN – arrivals manager tool) to be applied;
- enables the full integration of airport and network operations;
- completes the ATFM value chain.

What is in there?

The enhanced flight data are made up of the different flight profiles, taking into account the latest information received through the flight and flow management services, ATC system activation messages, correlated position updates from surveillance data, and airport departure planning messages derived from local Airport CDM (Collaborative Decision Making) systems. Aircraft position reports derived from ACARS (aircraft communications addressing and reporting system) can also be integrated, together with data from distant ANSPs.
EUROCONTROL supports states, civil aviation authorities, air navigation service providers (ANSPs) and airports to achieve safe, performant and environment-friendly air traffic operations. EUROCONTROL’s experts address issues from concept design to diagnostic planning, implementation, operations and performance measurement.

**BRIEF OVERVIEW PER DOMAIN**

**Airspace and Route Design, Capacity Assessment**
- Airspace design; evaluation, analysis and display of air traffic, civil/military airspace and TMA scenarios, using comprehensive modelling techniques;
- Capacity and flight efficiency optimisation from network to local level; controller workload and capacity analysis, using comprehensive modelling techniques;

*Example services and tools:* SAAM (System for Assignment and Analysis at a Macroscopic level) simulation tool, CAPAN (Capacity Analysis)

**Support to safety**
- Development of a safety approach to ATM operations that focuses on five key areas: identification of ATM network operational safety risks; operational safety improvements; improving safety nets; support to Safety Management Systems (SMS) and safety culture; reducing the human contribution to ATM risk;

*Example services and tools:* RAT (Risk Assessment Tool), ASMT (Automatic Safety Monitoring Tool)

**Support to CNS Infrastructure Management**

The evolving needs of ATM – driven by traffic densification and increased global competition – also have a strong impact on CNS infrastructure. New capabilities are required: the optimisation of CNS resources from a regional perspective, the migration to new technologies, the setting up of more stringent service levels.

To serve European ATM, EUROCONTROL has developed a continuum of skills and services, ranging from strategy, to technical solutions and operations of common CNS resources:

- **Strategy:** developing technological transition plans to modernise the CNS architecture and harmonise it at regional level for improved operational performance (e.g. ADS-B/WAM, common IP Networks and VoIP), based on regional cooperation and including the expert support to the drafting of related ICAO standards;
- **Mitigating infrastructure risks:** height monitoring by setting up a RVSM Monitoring Agency; management of channel saturation risks
- **Technical solutions:** ARTAS integrated Surveillance Data Processing System (SDPS)
- **Operations:** Function optimising the regional use of aeronautical radio spectrum: the Radio Frequency Function (RFF);

*Example services and tools:* ARTAS (ATM Surveillance Tracker and Server System), SDD (Surveillance Data Distribution System), SASS (Surveillance performance measurement tool).
Optimising Airport ATM Performance

- Runway/airport capacity utilisation studies including: simulations, assessing environmental impact, managing the implementation of CDO, developing advanced wake vortex related procedures, etc.
- Support to Airport CDM awareness and implementation projects;
- Improved throughput on departure and arrival runways through the revision of current ICAO wake vortex separation minima and procedures.

Example services and tools: PIATA (Performance Indicator and Analysis Tool for Airports), RECAT, A-CDM.

ATM Training development

- Assessment of training requirements, development of training programmes, courses, event plans and assessment methods.

Products: Training Courses (ATM, CNS and Network Operations)
One of our main activities is to deliver quality training in air traffic management (ATM) to various actors in the aviation community.

At the EUROCONTROL Training Institute in Luxembourg – and on other sites upon request –, we provide a wide range of training services – from general introductory courses on ATM concepts to advanced operational training, building on more than 40 years of expertise. This also includes a full set of Network Operations training courses.

Value proposition

We have extensive experience both in traditional training and in other forms of knowledge transfer, such as e-learning, the development of common training material and the establishment of harmonised training objectives, partnerships and license agreements – all aimed at international and multicultural audiences.

At the pan-European level, we support EUROCONTROL’s network management functions, the implementation of the Single European Sky and the SESAR programme by delivering specially tailored training activities.

What is in there?

We provide training for air traffic controllers, aircraft operators, flow management personnel, air traffic management and aviation experts. Our training programme covers:

- air traffic management (ATM);
- Network Operations;
- Communications, Navigation and Surveillance (CNS).

Our syllabus includes:

- ATM (General ATM Organisation, Airspace Management, Safety Management);
- Human Performance (Data Processing, Air Traffic Safety for Electronics Personnel);
- Network Operations (ATFM – Air Traffic Flow Management, Flight Plan Management, Flight Efficiency, Airport Integration);

Accessing our Training Portfolio

The current training portfolio and individual course delivery dates are always available online through the EUROCONTROL Training Zone
https://trainingzone.eurocontrol.int
ATC services need to be able to manage surveillance data flexibly and well. In order to do this, their data management systems must be capable of:
- accommodating increasing levels of traffic;
- facilitating data sharing in multi-centre environments;
- smoothly integrating the latest technologies.

EUROCONTROL's ARTAS-based (ATM Surveillance Tracker and Server System) surveillance offering is built on a distributed and modular architecture that facilitates progressive implementation. It harmonises the surveillance infrastructure on a regional level, so enabling reduced traffic separation minima to be easily integrated.

Over the years, EUROCONTROL has demonstrated its commitment to developing international standards which facilitate seamless integration (e.g. ASTERIX, the All-purpose Structured EUROCONTROL Surveillance Information Exchange) and support the implementation of the latest technologies, in alignment with ICAO's regulations.

The surveillance services:
- accelerate the adoption of Wide Area Multilateration (WAM) and ADS-B (Automatic Dependent Surveillance) strategies;
- contribute to good operational performance by building a seamless surveillance picture from harmonised surveillance layers;
- increase cost efficiency, thanks to economies of scale as well as reduced operating costs.

What is inside?
- **ARTAS**: the multi-sensor tracker ARTAS is at the core of EUROCONTROL's surveillance processing chain. It creates a seamless surveillance view derived from multiple radars/sensors/SDPS (Surveillance Data Processing System) and distributes the relevant surveillance information to a community of user systems.
- **SDDS**: SDDS (Surveillance Data Distribution System) forms the communication node of an intelligent logical network for the distribution of surveillance data and optimises the use and sharing of available surveillance information between all users.
- **SASS-C**: SASS-C (Surveillance Analysis Support System) verifies and analyses the surveillance infrastructure's performance in a multi-sensor environment; it supplies periodical monitoring of the system's efficiency and monitors the operational radar and trackers' performance compliance with nominal requirements.

Value proposition
- Reliable and seamless surveillance view from multiple radars/sensors/SDPS
- Supports ATC operational efficiency (e.g. enabling reduced traffic separation minima; accelerating the adoption of WAM and ADS-B technologies)
- Better quality of service – thanks to an integrated self-monitoring performance tool
- Flexible and fast set-up thanks to a modular architecture – this facilitates industrial partnerships
- Inexpensive integrated operations (e.g. delivering economies of scale for multi-centre environments; fostering standardisation; sharing civil and military infrastructure)
- Investments protected, thanks to the ASTERIX interoperability standard
- Benefits from the functional evolution of a widely installed base
Introduction

Airports are a crucial component of the overall aviation network performance as the disruption of operations at an airport can often generate major reactionary delays.

Our focus is on helping airports take advantage of the ‘network approach’ in solving operational issues, achieved through sharing information with network partners.

We strive to integrate airports with the ATM network and support them in improving their performance from a network perspective. In particular, we concentrate on minimizing delays by managing adverse conditions and other events that are likely to having an impact upon the network.

How do we achieve this

- We facilitate the means of connecting airports into the overall ATM network through the deployment of Airport Collaborative Decision Making (A-CDM) to the larger and medium sized airports. This is complemented by the ‘Advanced Tower’ integration for smaller airports.

- An exchange of pre-tactical and tactical information concerning adverse weather and other potentially critical events, thereby enabling improved, cooperative decision making between airports and the Network Manager Operations Centre (NMOC).

- Maintaining Strategic information relating to airports within the ‘Airport’s Corner’ data base, ensuring that airport plans and events are known and accounted for in network planning.

- Helping ensure an optimised airport performance within the network through the promotion of concepts such as RECAT-EU, TBS, CDO, A-SMGCS, etc. the widespread deployment of which aggregate and multiply their benefits.

- When requested, we also initiate cooperative action plans, through which the concerned airport’s performance can be assessed and agreed, with cooperative improvements put in place.

Value Proposition

- Enable optimised airport performance within (and as contribution to) the overall ATM Network.

- Help to ensure a collaborative and cooperative environment between all airport stakeholders as well as their network partners.

- Provide solutions that reduce delay and environmental impact whilst improving resilience and increasing capacity.

- Ensure a seamless interface between airports, terminal and en-route airspace.
ASMT detection modules

- **Proximity** - infringements of separation minima between aircraft
- **Altitude Deviation** - detection of aircraft that do not comply with the cleared flight level (e.g. Level Bust)
- **Airspace Penetration** - detection of unauthorized penetrations of a segregated airspace
- **Rate of Closure** - infringements of vertical and horizontal distances occurring with the Rate Of Closure exceeding a specified value
- **Short Term Conflict Alert** for predicted infringement of separation minima, triggered by the reception of an STCA message series from the ATC system
- **Area Proximity Warning** for predicted infringement of segregated airspace
- **Airborne Collision Avoidance System Resolution Advisory** - Collision Avoidance System (TCAS) following the detection of a threat from another aircraft. Triggered by the reception, through the Mode-S downlink data, of an ACAS Resolution Advisory message generated by an aircraft Traffic.

**Uses for ASMT**

ASMT supports users in monitoring safety performance of the overall ATM safety. The information obtained can help ANSPs gain a broader and more objective perspective of the current safety issues, such as strategic conflict management, separation provision, acceptable risk level, identification of hazards, quality and reporting level. ASMT recorded data can contribute to improvement actions in the following domains:

- SMS efficiency
- Airspace / airways structure design & sector configuration
- Local procedures review
- Operational analysis of the impact of traffic distribution / Sector charge on safety
- Regulation / flow management
- Alert equipment and operational techniques

**Outcomes**

ASMT users are gathering and storing an impressive set of safety data, on which to base their safety decisions. Safety decisions are typically informed by the following ASMT outcomes:

- Geographical and density maps of safety occurrence distribution (fig 1 and 2)
- ‘Time based’ series and trends to monitor variations in safety levels (fig 3 and 4)
- Correlation between metrics: risk of collision and flight level, risk of collision and geographical position (fig 5 and 6).

(See reverse for figures)

**Added value & opportunities for users**

ASMT users are gathering and storing an impressive set of safety data, on which to base their safety decisions. Safety decisions are typically informed by the following ASMT outcomes:

- Automatic recording and storing of all relevant data
- Easy access to recorded data providing immediate understanding of the situation by means of a quick replay tool
- Contribution to performance monitoring, feeding into operational and technical Key Performance Indicators.
Geographical and density maps of safety occurrence distribution (figures 1 and 2)

Time-based series and trends to monitor variations in safety levels (figures 3 and 4)

Correlation between metrics: risk of collision & flight level, risk of collision & geographical position (figures 5 and 6)
A single desktop application "NEST" is used by the EUROCONTROL Network Manager and ANSPs for airspace structure design and development, for capacity planning and post operations analysis, for strategic traffic flow organisation, for scenario preparation for fast and real-time simulation and for ad-hoc studies at local and network level.

NEST offers an intuitive, planner-orientated interface with a low barrier to entry for new users. It is a powerful scenario-based modelling engine, capable of running a broad range of complex, operationally-relevant analysis and optimisation functionalities.

It can be used locally for Area Control Centres (ACC) or airports and globally for strategic planning at network level. NEST can process and consolidate large quantities of data spanning multiple years, but also allows user to drill down to analyse and observe 10-minute periods of data.

**Modelling**

NEST is scenario based: users can make changes to the reference scenario to model an unlimited number of different options. Future projects can be selected and combined as required using the in-built layer system.

**Features**

- Historic and forecast demand.
- 4D trajectories, actual or regenerated according to shortest, cheapest or optimum routeings.
- Editing of 3D airspaces, sector capacities and configurations, route network, restrictions, and flight level constraints.
- Built-in generic workload calculations.
- Traffic volumes monitored for regulation refined by adjusting captured flows.
- Modelling scenarios such as degraded operations at reduced capacity.
- Optimising sector opening schemes.
- Identification of bottlenecks and related causes.
- Modelling of free route operations.

**Analysis**

Visualise 4D trajectories according to various filters; e.g. crossed sectors, aircraft operator.

Graphs illustrate and compare airspace loads, entry rates, occupancy counts, conflicts, traffic mix, complexity, saturation, overload, delays etc.

Global indicators including route length extension, fuel consumption, capacity baselines, ATFM delay, route charges, CO₂ and NOx emissions.

All analysis data can be exported in the form of customised reports which can also be fed into external tools or templates for further analysis.

**Visualisation / Presentation**

NEST provides a suite of data visualisation features including tables, charts and fully integrated capabilities for creating 2D/3D presentations and 4D time-based animations. A "real 3D" stereo mode is also provided for use with stereoscopic technologies (polarised screen and glasses).

**Import / Export**

Scenario data can be exported and imported to and from standard IT applications.

**Use case overview**

- Free Route Concept
- Flexible Use of Airspace (FUA)
- Terminal Airspace development
- Strategic network operations planning
- Functional Airspace Blocks (FABs) studies
- Special event planning (Olympics, Football championships)
- Contingency plans
- New local and network versions of the ATS route network.
- Fast and real time simulation scenario preparation
- Pre-validation of SESAR Concepts
- Environment studies
The EUROCONTROL CAPAN Methodology has been widely used since the early 1990s to determine ATC Sector capacity – based on controller workload - through a fast time simulation.

The CAPAN Team (CAPAN@eurocontrol.int) uses a customized version of the Reorganised ATC Mathematical Simulator (RAMSPlus) as the fast time simulation engine.

The Methodology:
Each CAPAN study is performed in close coordination with operational controllers at the ACCs/TMAs concerned, to determine the workload of simulated controller positions for a given traffic sample. The capacity of the sector is reached when the workload reaches a threshold of 70% over a 1 hour period.

Features
- Highly detailed ATC Operations Simulation.
- Highly customisable controller task list, adaptable to all ATC systems and working environments.
- Detailed results analysis at ACC, Sector and Controller Position levels.
- Statistical average results of between 10 and 20 simulation runs.
- Can be used in conjunction with NEST and other EUROCONTROL Tools.

Data Requirements
CAPAN requires several types of data and the active involvement of ATC Operational Staff:
- Airspace, Flight Plan and Aircraft Performance data
- ATC Procedures
- ATC Controller Tasks

The ATC Operational Staff role is to verify all the required data and define procedures and tasks and for the methodology in a series of meetings with the CAPAN Team Experts. A full CAPAN study takes 4 to 6 months.

Results Available from a CAPAN Methodology Simulation
- Detailed Traffic Analysis.
- Controller workload and working times.
- Working time distribution by different categories of activities.
- Analysis of controller workload and traffic patterns
- Sector capacities
- Recommendations for improved working procedures

When to use the CAPAN Methodology?
CAPAN can be used for different types of studies for both ACC and TMA:
- Estimation of Sector Capacity
- Airspace re-design
- ATC procedures development / improvement

Where has the CAPAN Methodology been used