



2019
World ATM Congress



SESAR
walking
tours



#PoweredBySESAR

Stand 931

GRADE: demonstrating the ability of GA and rotorcraft to benefit from SESAR concepts

- **Scope:** Smooth integration of General Aviation and Rotorcraft into commercial air traffic
- **Objective:** demonstration of GNSS based technology and low level operations



- Real-Time Simulations with hardware and humans in the loop (2018)
- In-flight live trials (2019)
 - GA flights in Italy
 - R/C tests in Germany

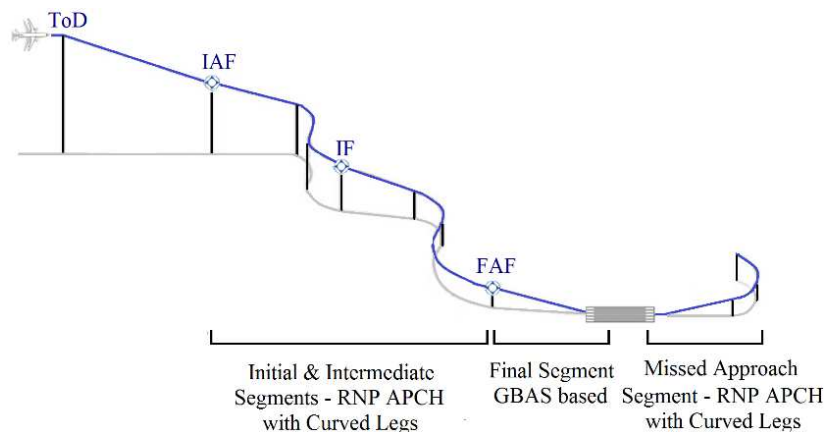


2019 World ATM Congress



GA Real Time Simulation

- Precision approach
 - vertical guidance
 - curved legs and
 - continuous descent
- Two real time simulation campaigns
 - 2 experimental pilots
 - 4 Air Traffic Controllers and
 - 1 ATC Supervisor



The demo was carried out on the LIAU airport (Capua, Italy)

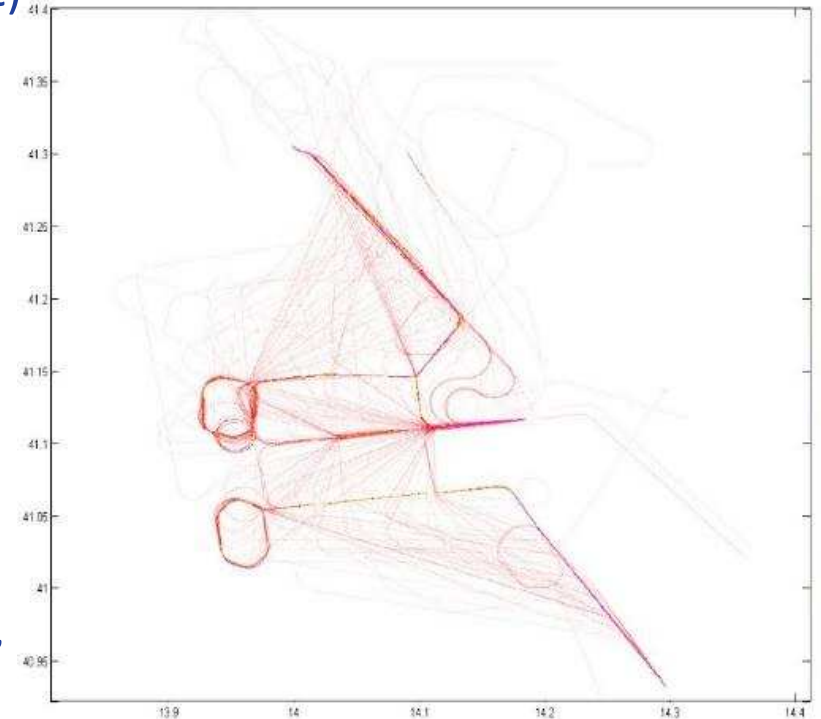


2019 World ATM Congress



GA Real Time Simulation Results

- 75 approaches (~17 hours of simulated flight)
- nominal and off-nominal conditions
- Different air traffic densities and meteorological conditions (wind & visibility)
- SESAR Solutions show high feasibility and acceptance from pilots and controllers
- Positive affect on workload and situational awareness
- GNSS based trajectories provided benefits in navigation performance, airport throughput, and environmental impact



2019 World ATM Congress



R/C Real Time Simulation

- Test of optimised Low Level IFR routes including Point-In-Space (PinS) procedures as enabler for Simultaneous Non-Interfering (SNI) operations.
- real time simulation campaign involving
 - 3 DLR test pilots
 - 4 Technical experts, and
 - 1 human factors expert
- Total of 12 patterns flown
- Very hard to fly environmental condition (CAVOK, Night, Wind, Low Clouds)



DLR's HubSim simulator at DLR in Braunschweig, Germany

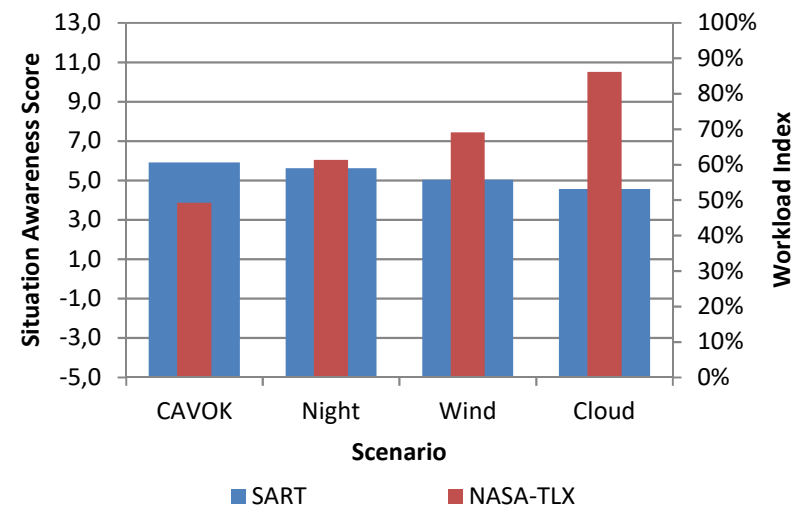


2019 World ATM Congress



R/C Real Time Simulation Results

- Large variation of subjective workload
- Precision remained always within RNP 0.3
- Pilots were skeptical about safe separation in turn phase during approach and missed approach procedure
- Mitigation by using advanced PinS (radius to fix) instead of standard PinS (fly by) for manual flight





This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 783170



2019 World ATM Congress





2019
World ATM Congress

SESAR walking tours



#PoweredBySESAR

Stand 849

FLIGHT OBJECT INTEROPERABILITY

- Air Traffic Control planned trajectory performance improvement

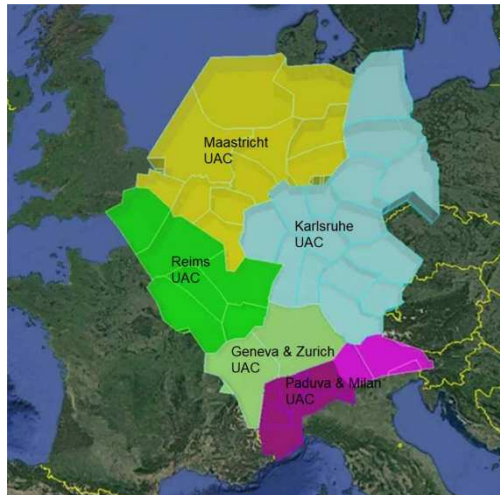


2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- **IOP Area** **Union of the Areas of Responsibility (AoRs) and Areas of Interest (Aols) for several ATSUs.**



IOP Area for SESAR EXERCISE IOP-EXE01

- ✓ Maastricht UAC
- ✓ REIMS UAC
- ✓ Karlsruhe UAC
- ✓ Padua and Milano UAC



2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- Flight Object

Flight Key
Flight Plan Data
Flight Identification
ATSU Distribution List
Coordination
SSR
Aircraft
Trajectory
IOP information
Departure
Script
Arrival
Departure Clearance

➤ provide **consistent view** of the flight.

➤ support **sharing of consistent flight data** between all stakeholders.



2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- IOP Roles

1. Flight Data Manager Publisher (FDMP)
2. Flight Data Contributor (FDC)
3. Flight Data User (FDU)

- IOP Distribution

When a new release of the flight-object is created, the FDMP shall distribute it according to the filtering rules which have been defined (static and dynamic).

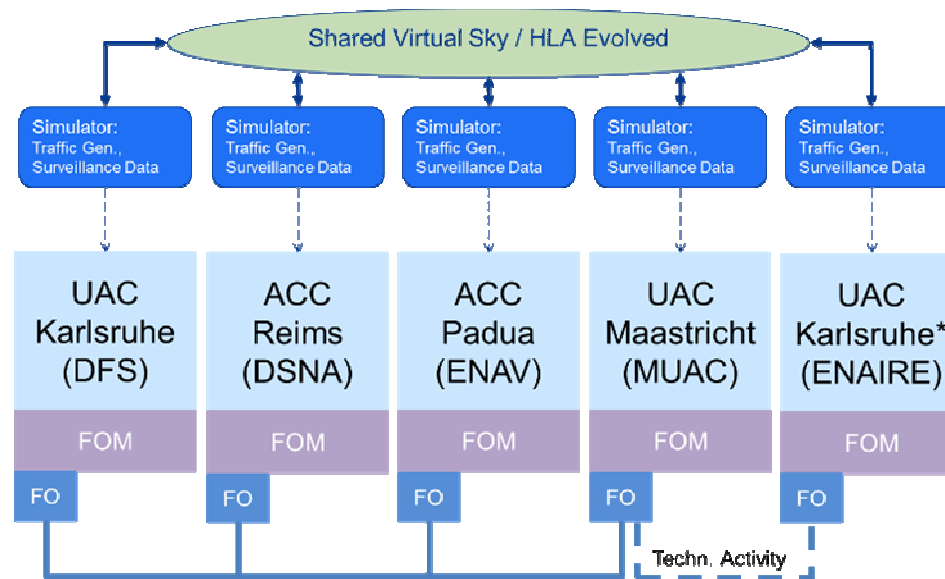


2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- SESAR EXERCISE (IOP-EXE01 Q2/2019)



* ENAIRES IBP will be adapted with German airspace



2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- IOP benefits
 - ✓ Upstream/downstream bi-directional exchanges, with distant sectors as well as neighbours.
 - ✓ Real-time sharing between all interested partners.
 - ✓ Same level of information for all within the IOP area concerned actors



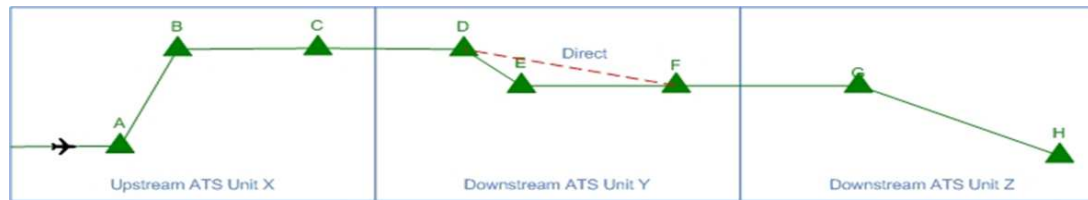
2019 World ATM Congress



FLIGHT OBJECT INTEROPERABILITY

- IOP benefits

Direct route modification



No need for tedious phone calls, any upstream or downstream sector can retrieve the new route information immediately:

- ✓ Coordination is immediate, easy and unambiguous
- ✓ Common situation awareness between multiple partners is ensured in real time



2019 World ATM Congress





2019
World ATM Congress



SESAR
walking
tours





**World ATM
Congress 2019**
A CANSO partnership with ATCA

EXPECTED BENEFITS OF INTEROPERABILITY (IOP) BY AN AIR NAVIGATION SERVICE PROVIDER

GUÉRARD Paul



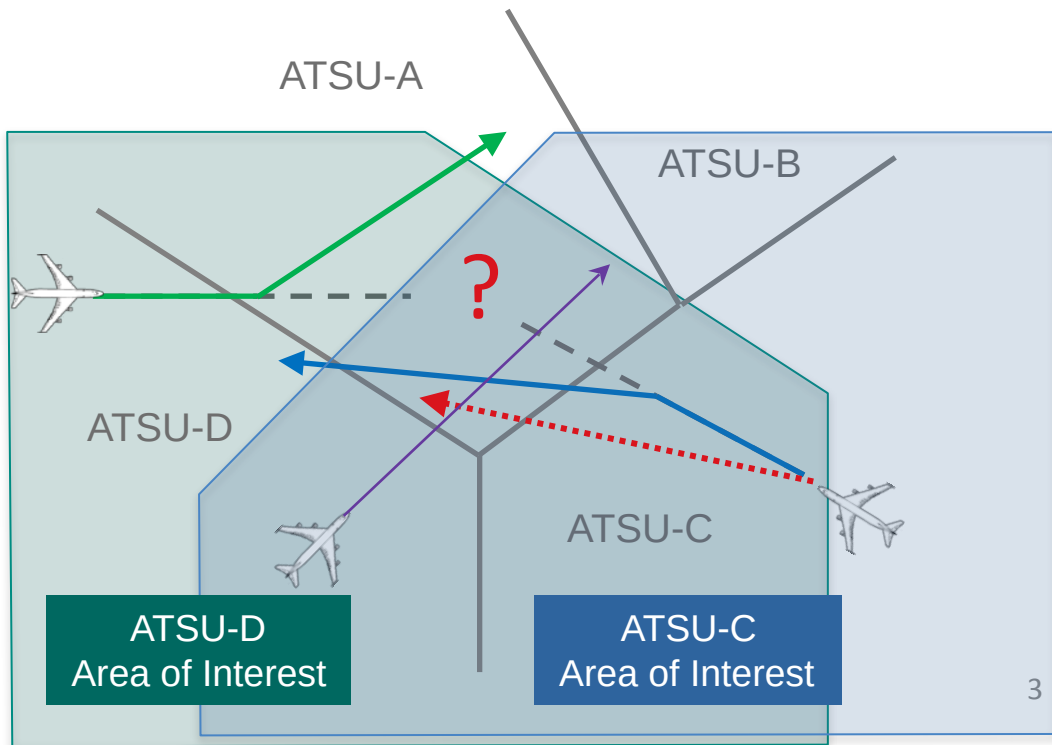
CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves safety and capacity

Conflict detection and resolution

What do we need ?

- Up-to-date trajectories (lateral & vertical)
- Clearances sharing
- Awareness beyond the boundaries



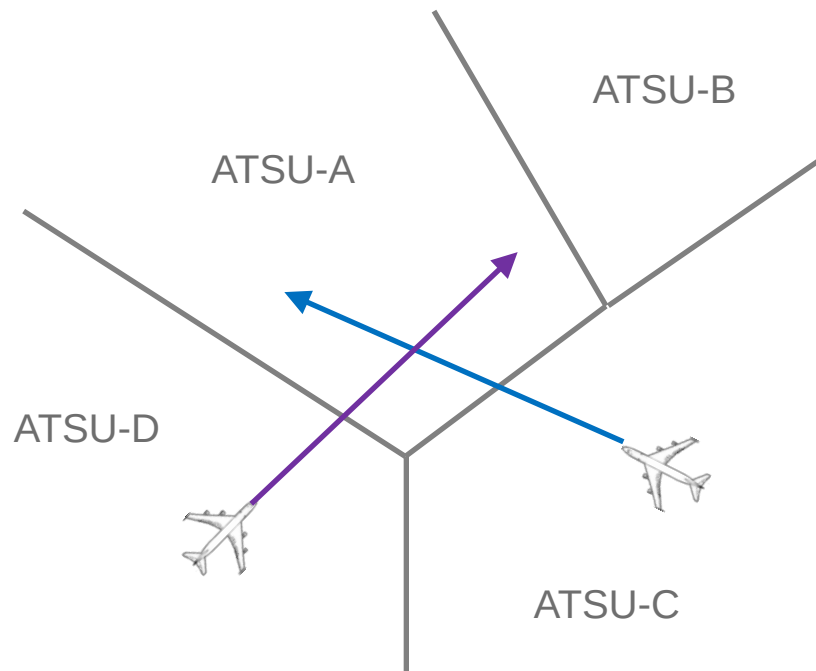
CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves safety and capacity

ATCO workload

What do we need ?

- Optimized coordinations & negotiation tools
- Skip & Delegation functionalities

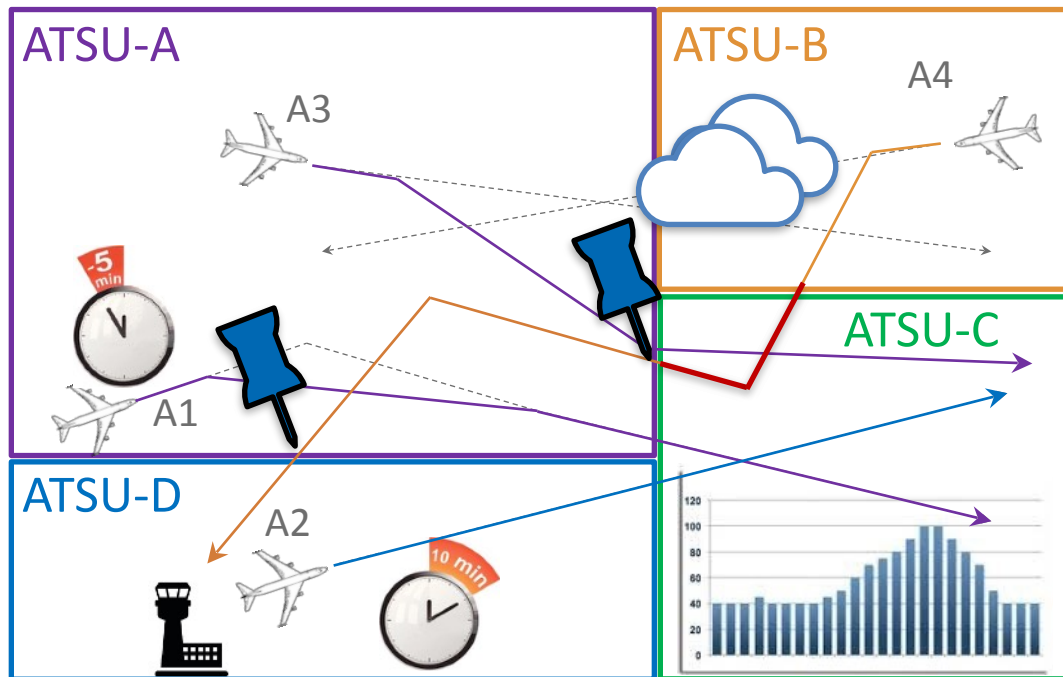


CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves planned trajectory and Demand & Capacity Balancing (DCB)

Network traffic prediction What do we need ?

- Estimates continuously updated:
 - Accurate departure time
 - Time consequence of a route change
 - Reassessment of the list of crossed ATSUs
- Anticipation :
 - Constraints sharing between ANSPs and NM
 - Advanced DCB solutions anticipations at ATCO level (STAM)
 - AMAN & delay sharing





CURRENT OPERATIONS AND EXPECTATIONS ON IOP



At the pre-tactical level

IOP

- Significant improvement on trajectory consistency/accuracy reducing uncertainty buffer
- Enhanced planning information for the benefit of Airspace Users



At the tactical level

IOP

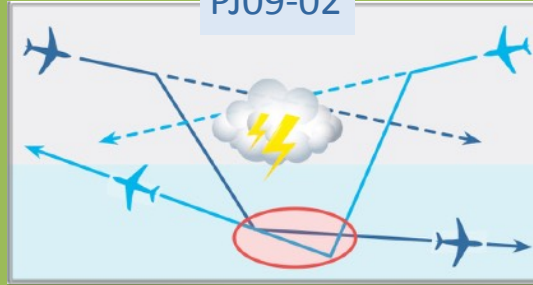
- An up-to-date and consistent view of all traffic flows
- Reducing ATCO workload
- Enhanced and more efficient coordination
- Reducing voice negotiations with adjacent units

FUTURE OPERATIONS

SESAR SOLUTIONS: IOP & NETWORK OPERATIONS

ATFCM tools

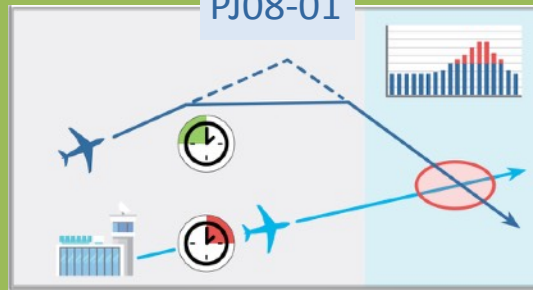
PJ09-02



A hotspot generated by a rerouting to avoid adverse weather conditions

Dynamic Airspace Configuration

PJ08-01

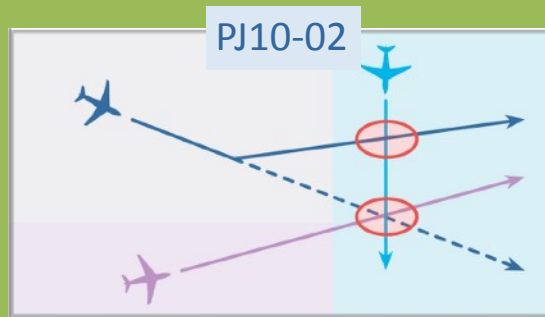


A hotspot generated by a direct route and a late take-off

FUTURE OPERATIONS

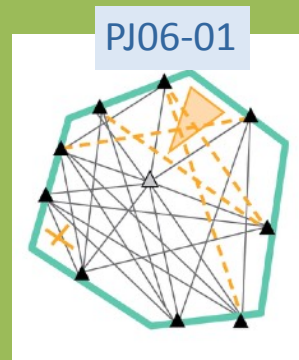
SESAR SOLUTIONS: IOP & CONFLICT MANAGEMENT, FREE ROUTING

MTCD and CORA tools



Conflicts to be detected sufficiently in advance

Direct routing or
Free Routing



Automatic coordination
between ATSU for cross
border Free routing

FUTURE OPERATIONS

IOP enabling future
concepts integration

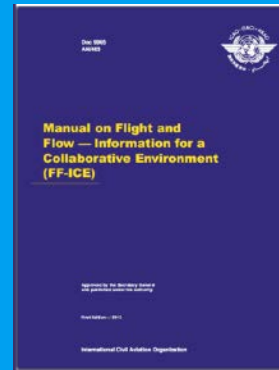
SESAR Solutions

- IOP : a natural enabler of several SESAR solutions
- IOP : better data sharing, essential for advanced tools



SESAR Solutions

- IOP : a natural enabler of several SESAR solutions
- IOP : better data sharing, essential for advanced tools



IOP, A SOLUTION TO EUROPEAN AIRSPACE FRAGMENTATION

Operational and Technical engineers are working together to make IOP

- A powerful and robust enabler for ATC, Planning, Network future operations
- An essential tool that will provide efficiency in every days coordination operations

IOP concept is designed to address Operational needs

- Closing the gap between the local ATC Unit view and all distributed ATC units
- Closing the gap between what is flown, what are the ATCO clearances and Network predictions

IOP concept is designed to solve technical limitations due to today's architecture

- MTCD today not efficient in high density airspaces
- Point to point communications are limited between transferring and receiving units thus limiting automations
- Optimised technical level: Robust against Flight data system discrepancies



paul.guerard@aviation-civile.gouv.fr





2019
World ATM Congress

SESAR walking tours



#PoweredBySESAR

Stand 849

EXPECTED BENEFITS OF FLIGHT OBJECT INTEROPERABILITY BY AN AIR NAVIGATION SERVICE PROVIDER

GUÉRARD Paul



SESAR 2020 Project



This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement 734145.



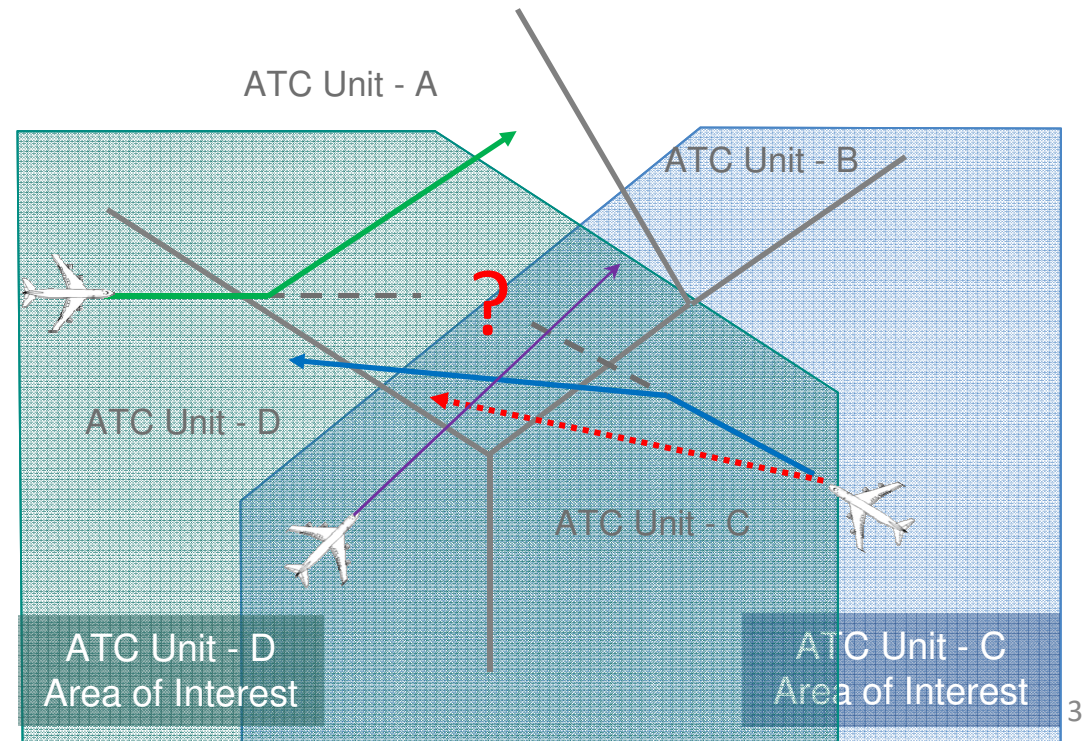
CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves safety and capacity

Conflict detection and resolution

What do we need ?

- ◉ Up-to-date trajectories (lateral & vertical)
- ◉ Clearances sharing
- ◉ Awareness beyond the boundaries



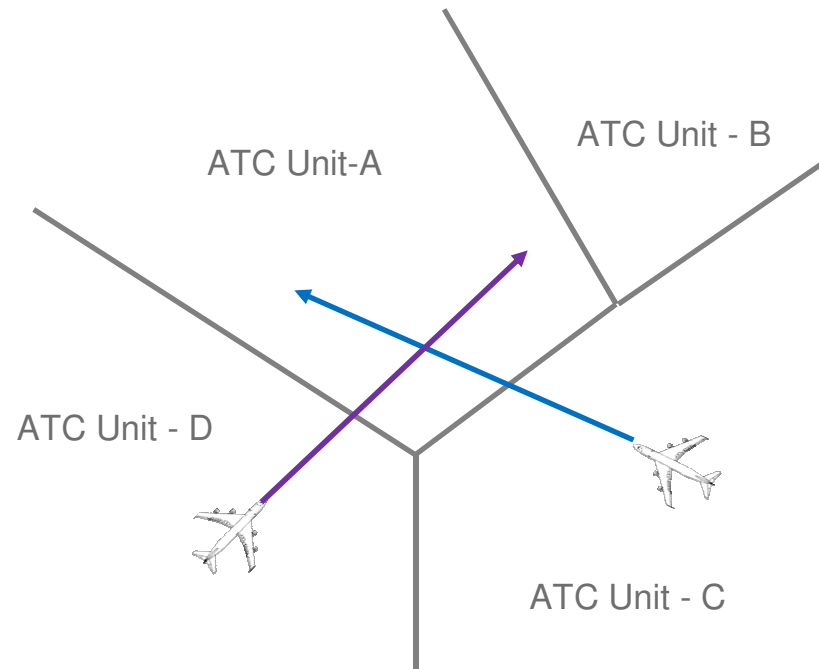


CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves safety and capacity

ATCO workload What do we need ?

- ⦿ Optimized coordinations & negotiation tools
- ⦿ Skip & Delegation functionalities



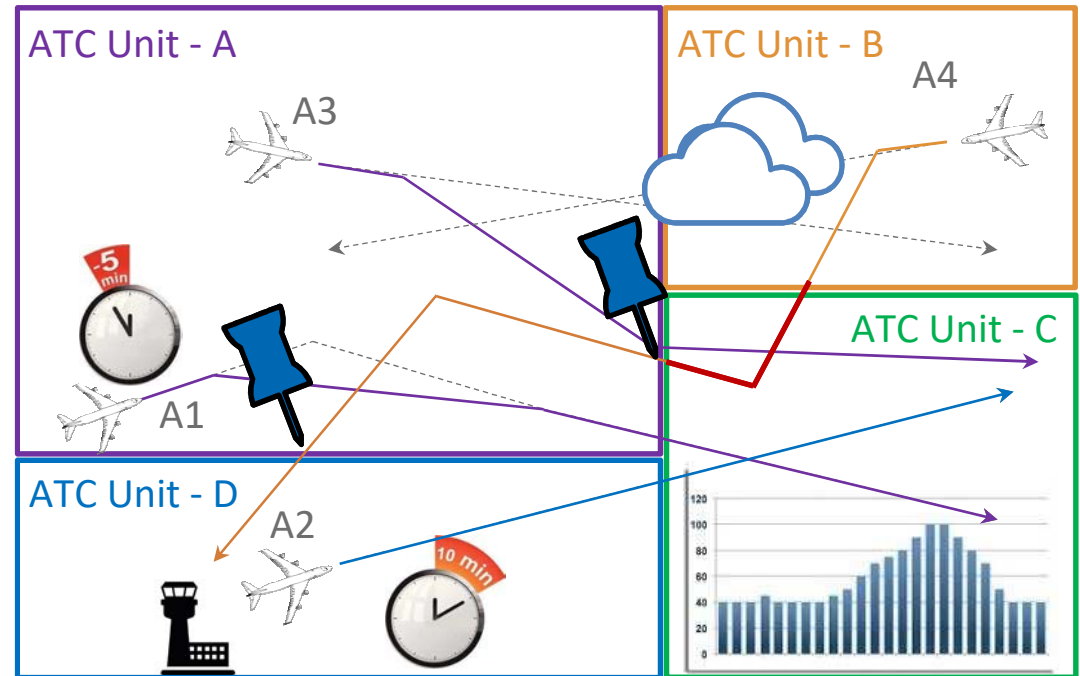


CURRENT OPERATIONS AND EXPECTATIONS ON IOP

IOP improves planned trajectory and Demand & Capacity Balancing (DCB)

Network traffic prediction What do we need ?

- Estimates continuously updated:
 - Accurate departure time
 - Time consequence of a route change
 - Reassessment of the list of crossed ATSUs
- Anticipation:
 - Constraints sharing between ANSPs and NM
 - Anticipating advanced DCB measures at ATCO level
 - AMAN & delay sharing





CURRENT OPERATIONS AND EXPECTATIONS ON IOP

At the pre-tactical level

IOP

- ⊙ Significant improvement on trajectory consistency/accuracy reducing uncertainty buffer
- ⊙ Enhanced planning information for the benefit of Airspace Users

At the tactical level

IOP

- ⊙ An up-to-date and consistent view of all traffic flows
- ⊙ Reducing ATCO workload
- ⊙ Enhanced and more efficient coordination
- ⊙ Reducing voice negotiations with adjacent units



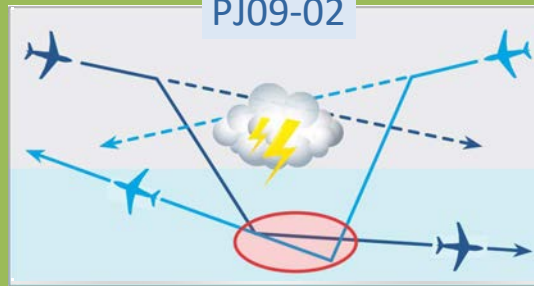
FUTURE OPERATIONS

IOP & NETWORK OPERATIONS



ATFCM tools

PJ09-02

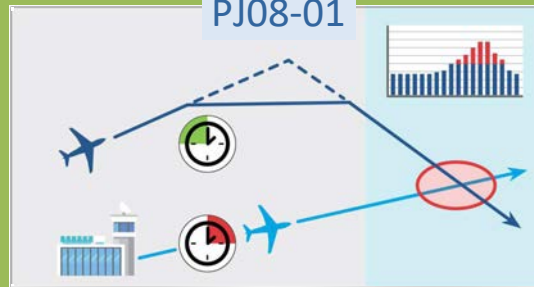


SESAR SOLUTION

A hotspot generated by a rerouting to avoid adverse weather conditions

Dynamic Airspace Configuration

PJ08-01



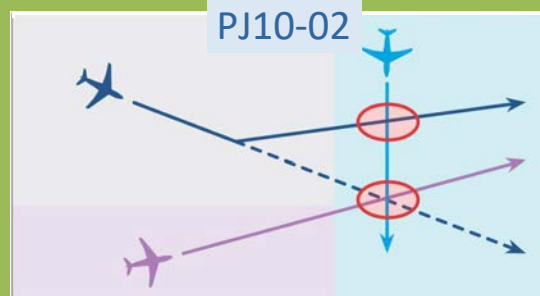
SESAR SOLUTION

A hotspot generated by a direct route and a late take-off

FUTURE OPERATIONS IOP & CONFLICT MANAGEMENT, FREE ROUTING



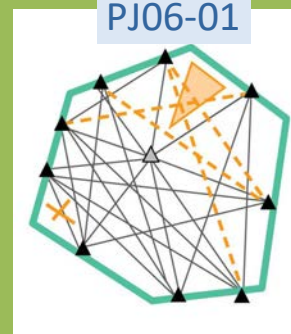
MTCD and CORA tools



SESAR SOLUTION

Conflicts to be detected sufficiently in advance

Direct routing or
Free Routing



SESAR SOLUTION

Automatic coordination
between ATSUs for cross
border Free routing

FUTURE OPERATIONS

IOP enabling future concepts integration

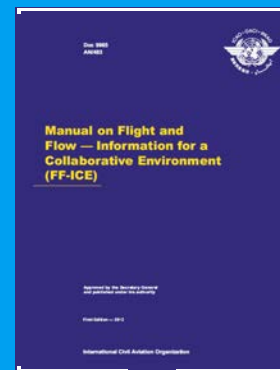
SESAR Solutions

- ⊙ IOP : a natural enabler of several SESAR solutions
- ⊙ IOP : better data sharing, essential for advanced tools



ICAO Trajectory Based Operation (TBO) standards

- ⊙ Promote our IOP standard within ICAO studies to exchange trajectories
- ⊙ IOP integration with eFPL data for the benefit to Airspace Users



IOP, A SOLUTION TO EUROPEAN AIRSPACE FRAGMENTATION

Designed to solve technical limitations due to today's architecture

- ⦿ MTCD today not efficient in high density airspaces
- ⦿ Point to point communications are limited between transferring and receiving units thus limiting automations
- ⦿ Optimised technical level: Robust against Flight data system discrepancies

Designed to address operational needs

Closing the gap between:

- ⦿ the local ATC Unit view and all distributed ATC units
- ⦿ what is flown, what are the ATCO clearances and Network Manager predictions

Operational and technical engineers are working together to make IOP

- ⦿ A powerful and robust enabler for ATC, Planning, Network future operations
- ⦿ An essential tool that will provide efficiency in every day coordination operations



paul.guerard@aviation-civile.gouv.fr

