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Stand 849

Classification: Public

Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)

- The Arrive on Time Programme was set up in 2017 to embed TTAs into Heathrow's operation
- Benefits of TTAs include:
 - A reduction in airborne holding delay
 - A reduction in fuel burn for our airlines
 - A reduction in noise and emissions for our local community
 - A better experience for our passengers
- Supports Heathrow aim to move from 'first come, first served' to a '*best planned, best served*' model



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Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)

- Embedding TTAs for flights originating within the European Civil Aviation Conference (ECAC) area falls under Exercise 3B of Work Package 6 in SESAR Project 24
- We will be participating in a VLD later this month to demonstrate the use of TTAs within the ECAC area
- We will start trialling TTAs for long haul flights later this year



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Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)

- Use cases for the Very Large Demonstration (VLD) later this month include:
 - The ability of our Demand Capacity Balancing (DCB) Tool to identify a hotspot in airborne delay at the planning stage (D-1)
 - Analysis to show that the proposed solution devised by DCB at the planning stage is sound
 - Evidence to show that the plan that DCB develops at the planning stage delivers the predicted outcomes on the day
 - Dynamic exchange of arrival and departure information from airport to network before and after flight plans have been filed



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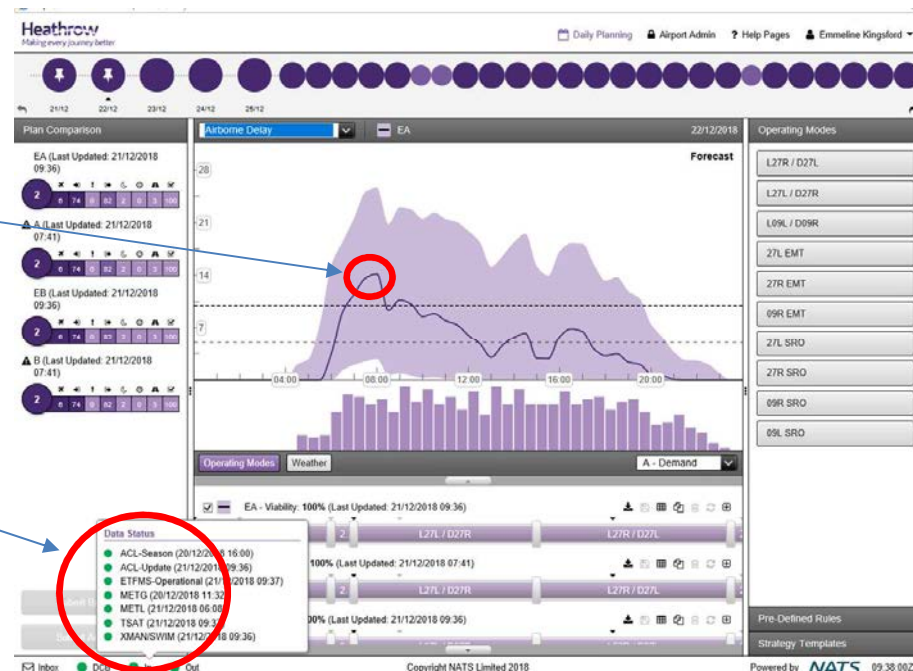


Classification: Public

Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)

Hotspot in
airborne delay

Data feeds into DCB



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Classification: Public

Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)



TTAs are assigned to candidate flights, such as those that are forecast to arrive early. This moves them out of the hotspot and smooths demand.



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Classification: Public

Arrive on Time Programme – Embedding Target Times of Arrival (TTAs)

Process flow from DCB, through our Airport Operating Plan (AOP) into the Enhanced Tactical Flow Management System (ETFMS), where flights assigned TTAs are given a Calculated Take-Off Time (CTOT):



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TOUR 7: On-time arrivals and departures

Focus achievements in SESAR Pj01-01 and PJ01-02



Pj.01-01: Tools for En Route controllers contributing to the arrival sequencing towards multiple TMA with overlapping AMAN operations

Pj.01-02: Supporting tool for identification and resolution of over-demand periods over given timeframes in the

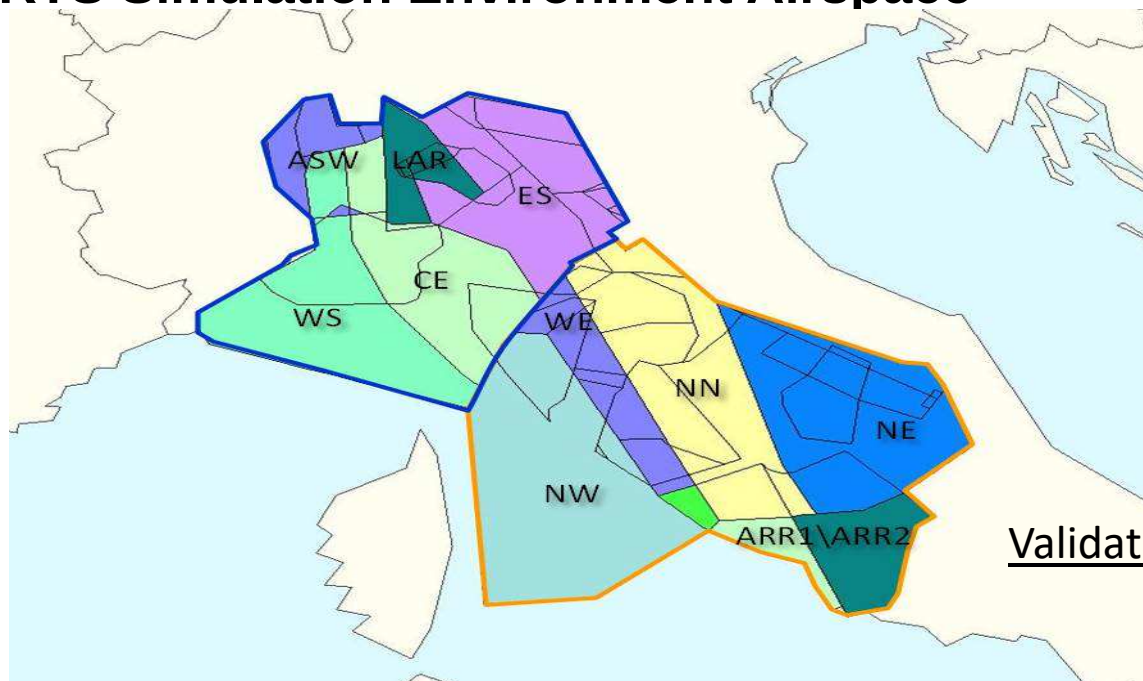


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Pj.01-01 Validation Exercise #EXE-01.01-V2-VALP-006

RTS Simulation Environment Airspace



Rome airspace (LIRR)
Milan airspace (LIMM)

En-route phase:

Rome ENR1: NW, WE, NN and NE;
Milan ENR2 : WS, CE, ES.

TMA area (ARR/DEP phases):

Rome TMA1: ARR1, ARR2;
Milan TMA2: ASW, LAR.

Validation Exercise



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Pj.01-01

Validation Objectives:

- Assess feasibility of supporting tool for En-route sectors affected by concurrent arrival management advisories due to a Multiple AMAN environments.
- To demonstrate that Controlled Time of Arrival (CTA) in high density/complexity En-route environment is interoperable with other services and that the appropriate exchanges of information (A-G) are technically feasible.
- Demonstration of latest version of ATN B2 D/L standard

Sequencing techniques:

- CTA for i4D equipped aircrafts
- TTL/TTG with a delay sharing strategy for non i4D equipped aircrafts

En-route tools:

- What-if function to aid Controller assessment of sequence advisory impacts on trajectory/traffic
- On the basis of the sector overload, the Controller can notify to AMAN(s) a period in which advisories will not be managed (per single flight or per sector)



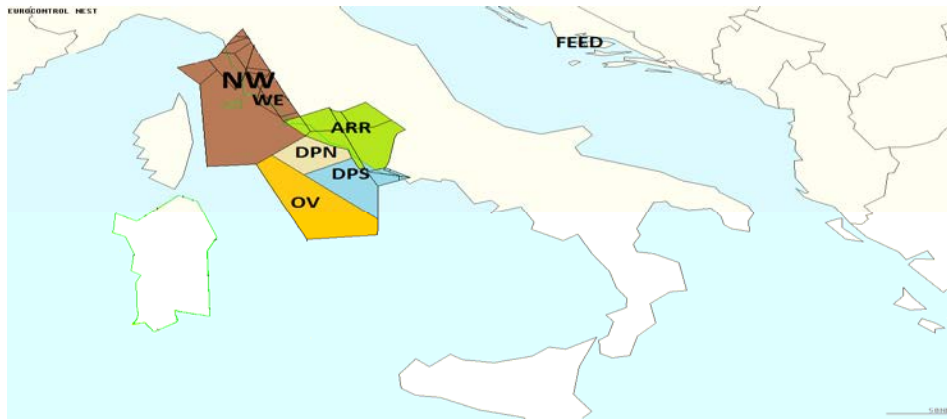
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Pj.01-02 Validation Exercise #EXE-01.02-V2-VALP-004

RTS Validation Environment

- Validation exercise will simulate the LIRR ACC including both Pre-sequencing sectors and LIRR TMA



The following sectors will be considered in the validation scenario:

- 2 Departure sectors: PS1 and PN1
- 1 Arrival sector
- OV and NW+EW
- 1 Feeder for the rest of the World

Mixed traffic will be considered into Departure sectors (departures + arrivals + overflying flights)

	LIRF – Fiumicino Airport					LIRA – Ciampino Airport	
SCENARIO	RWY25	RWY16L	RWY16R	RWY34R	RWY34L	RWY15	RWY33
1	DEP	ARR	CLOSED	CLOSED	CLOSED	DEP+ARR	CLOSED
2	DEP	CLOSED	CLOSED	ARR	CLOSED	CLOSED	DEP+ARR



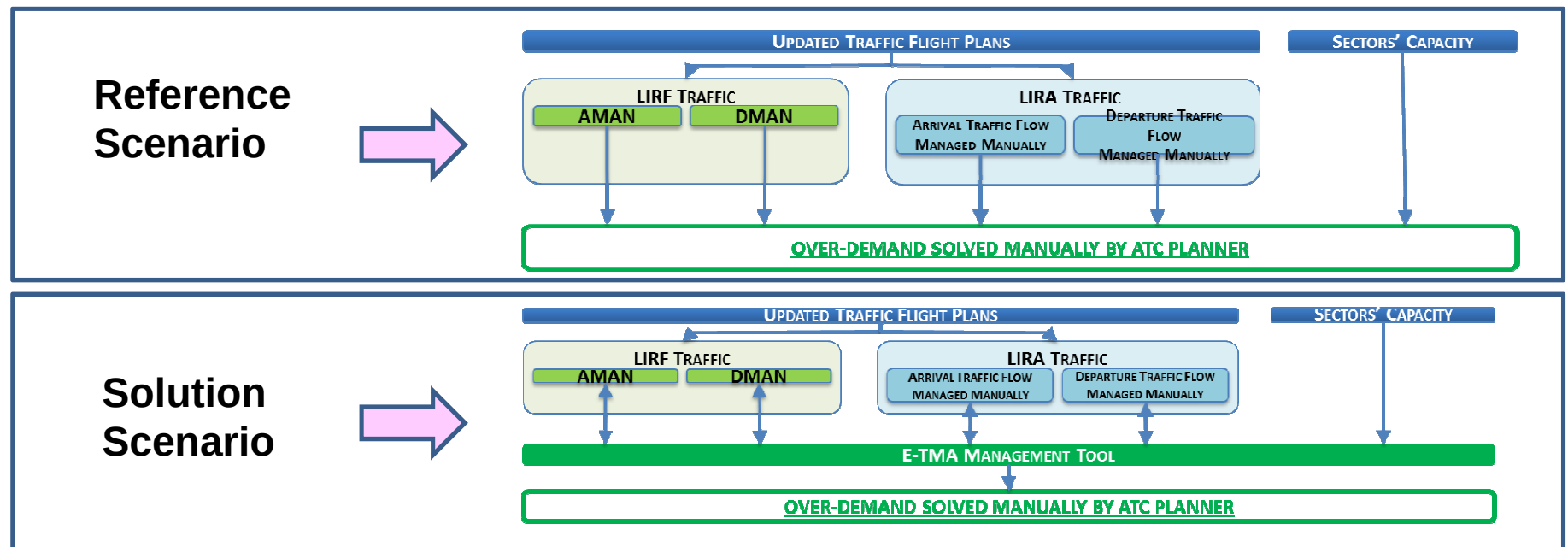
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Pj.01-02

Validation Objectives:

- Management of arrival and departure flow to identify and resolve sector over-demand and to balance the sector/flow load in the E-TMA through use of alternative SID
- More consistent and manageable delivery of traffic through the TMA into En-Route phase of flight



Thank you and.....



.... have a nice walking!



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Stand 931

SESAR PJ.01 EAD Enhanced arrival and departure for enhanced rotorcraft operations in the TMA



Solution Scope:

The Solution validates Rotorcraft Advanced Point-In-Space procedures as an operational enabler for simultaneous non-interfering (SNI) concept of operations to allow RC and GA to operate to and from airports without conflicting with fixed-wing traffic or requiring runway slots.

Intended Benefits:

- Increase of runway and airspace capacity executing dedicated rotorcraft procedures and allowing aircraft and rotorcraft simultaneous non-interfering operations
- pilot situation awareness improvement
- increase of landing rate deriving by the use of procedures dedicated to the rotorcraft
- safety enhancement with improved avionics accuracy, reduction of fuel burn.



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Simulation Facility for RTS

- DLR's Generic Cockpit simulator in helicopter configuration with collimated vision system has been used for THALES system integration
- Integration of a THALES helmet-mounted display system (HMD), synthetic vision head-down display (HDD), and Flight Management System (FMS) into simulator
- X-Plane with EC135 aerodynamic flight model provided flight status data
- Design of an Advanced Point-In-Space R/C flight procedure and encoding in ARINC 424 format



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Braunschweig/Donauwoerth Flight Trial Configurations

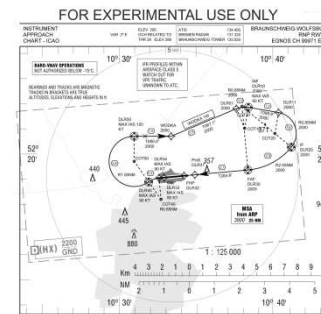
Braunschweig Flight Trials:

- DLR's research helicopter EC135
- same hardware configuration compared to RTS (HMD, FMS, HDD)

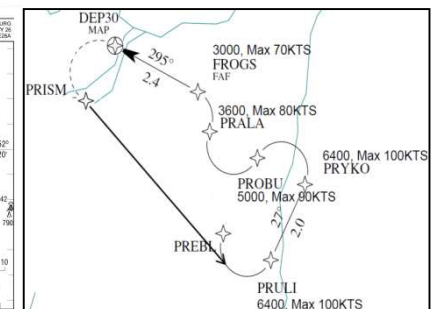
Donauwörth flight Trials:

- IFR-certified avionics suite (Helionix®) has been used, including a flight management system (FMS) and a 4 axis autopilot to automatically fly an advanced PinS procedure.

The pilots evaluated the benefit of having SBAS navigation for advanced PinS RNP 0.3/LPV approaches and departures to and from the FATO area



Braunschweig (EDVE)



Donauwörth (EDPR)



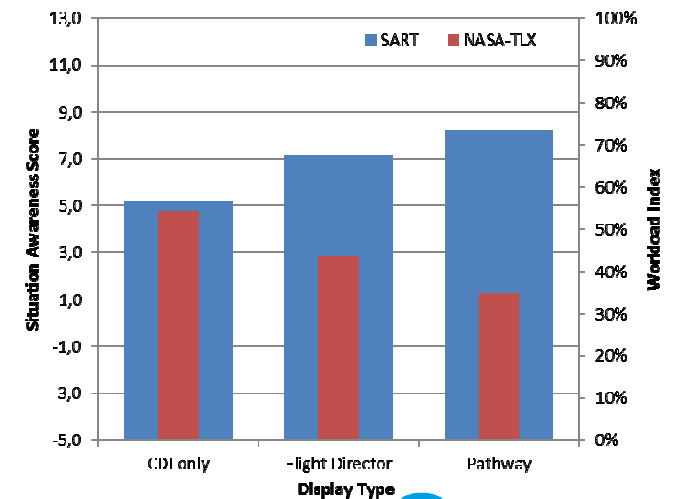
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PJ.01-06 RTS Results

- 4 test pilots participated in the RTS
- 12 continuous departures and approaches
- Minimum sized footprint enabled by RF legs
- Varying wind, ceiling and daytime
- Using a CDI only doesn't allow to fly the pattern
- Both HMD variation – flight director and 3D pathway – allowed to fly the pattern
- The flight director type is juggled by trend slightly better than the pathway display

Display Type	Failed RNP 03	Failed RNP 01
CDI only	5/12	9/12
Flight Director	0/12	0/12
3D Pathway	0/12	0/12



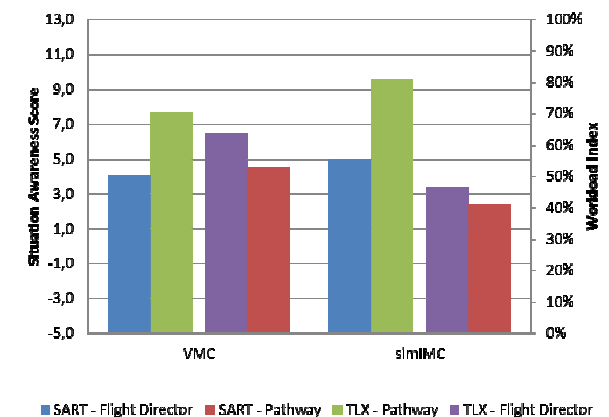
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PJ.01-06 Braunschweig Flight Trial Results

- 5 test pilots participated in the flight trials
- In total 15 continuous departures and approaches
 - Roughly even mix of runs under VMC and simulated IMC
 - Some flights with strong wind and less than needed ceiling
- Minimum sized footprint enabled by RF legs
- Both HMD variation – flight director and 3D pathway – allowed to fly the pattern
- RNP03 fail is except for one run due to the strong wind and the limited head tracker leading to a misinterpretation
- AHD (Donauwoerth) results are expected in Feb/March 2019

Display Type	Failed RNP 03	Failed RNP 01
Flight Director	0/6	2/6
3D Pathway	3/6	6/6



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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 731864



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Jürgen Rataj
DLR (AT-One)

Booth 931



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Tour 7



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SESAR2020 PJ.16-04 CWP HMI

Controller Working Position Human Machine Interface

- Innovative Interaction Technologies for Air Traffic Controllers
- Improvement of Controller Productivity
- Solution Lead: DLR
- Automatic Speech Recognition (ASR)
- Attention Guidance (AG)
- 13 Validation Exercises

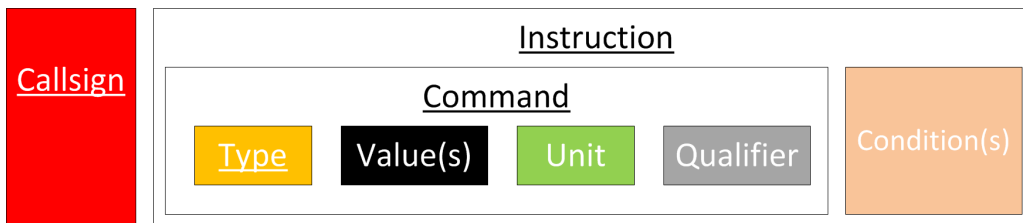


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Automatic Speech Recognition (ASR)

- *Transcription of Controller Command:*
 “Good morning lufthansa one two three descend flight level eight zero
 reduce your speed two hundred knots or less until four miles final bye”
- *Annotation of Controller Command (following an Ontology):*
 DLH123 DESCEND 80 FL, DLH123 REDUCE 200 kt OR_LESS UNTIL 4 NM



Additional words (not relevant for ontology)

- Applications: Electronic Labels, Workload, etc.

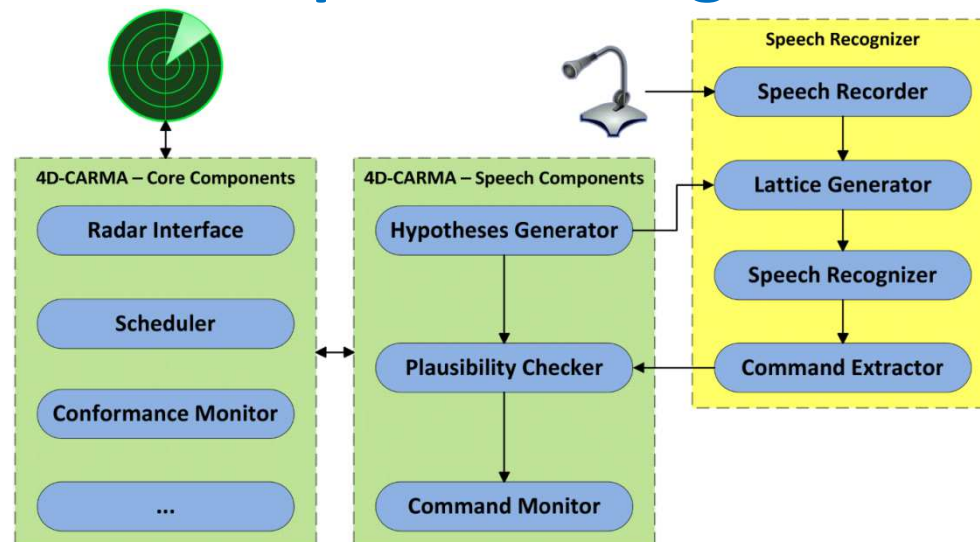
Altitude Commands			
Type	Value(s)	Unit	Qualifier
DESCEND CLIMB ALTITUDE STOP_DESCEND STOP_CLIMB STOP_ALTITUDE MAINTAIN_ALTITUDE	Altitude Value FL Value	FL ft none	BELOW ABOVE OR_BELOW OR_ABOVE
CONTINUE_PRESENT_ALTITUDE			



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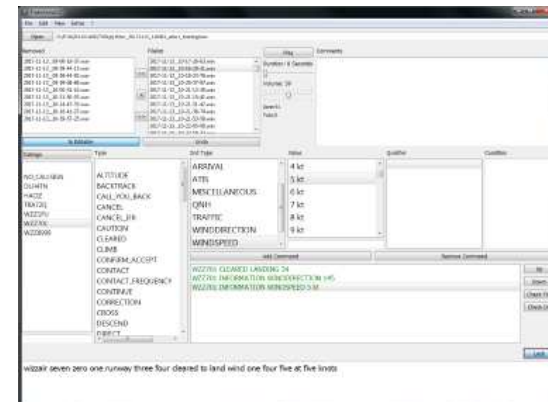
Assistant Based Speech Recognition for Approach



- Prague/Vienna Approach Trials in Q1/Q2 2019
- THALES (Rungis SkyCentre), ANS-CR+INTEGRA, COOPANS and DLR

Assistant Based Speech Recognition for Tower

- Multiple Remote Tower Trials with Hungarian and Lithuanian Controllers at DLR Braunschweig



- Command Hypotheses had Accuracy >>90% (Trials in Q4/2018)

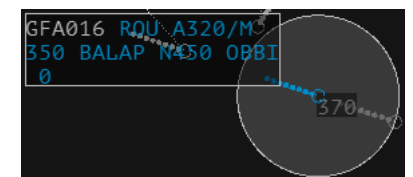


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Attention Guidance

- A) Where should the Controller look at?
- B) Where is the Controller actually looking at?
- If $A \neq B$, Visual Cues to guide attention
- Triggers (prioritized ATC events)
- Escalation Levels (0/1/2/3)
- Validation Trials (Q1/2019) at HungaroControl in connection with Flight-Centric ATC

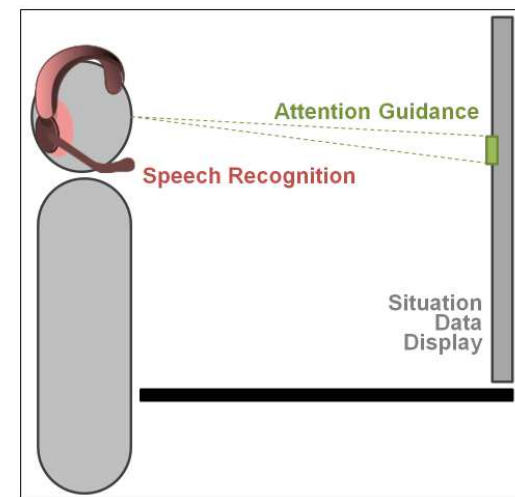


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Summary and Outlook

- Address all senses of controllers: **Speech Recognition** and **Attention Guidance** really support controllers and increase their performance
- Continuation in SESAR2020 Wave-2
- Next Air Traffic Control CWP's **must have ASR and AG**



CWP HMI



This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No734141



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Stand 931

SESAR PJ.01 EAD Enhanced arrival and departure for enhanced rotorcraft operations in the TMA



Solution Scope:

- Smooth integration of Rotorcraft and commercial air traffic by using Advanced Point-In-Space procedures for simultaneous non-interfering (SNI) approaches and departures

Intended Benefits:

- Increase of runway and airspace capacity
- Pilot situation awareness improvement
- Increase of landing rate deriving by the use of procedures dedicated to the rotorcraft
- Safety enhancement with improved avionics accuracy, reduction of fuel burn.



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Simulation Facility for Real Time Simulation

- Integration of a THALES helmet-mounted display system (HMD), synthetic vision head-down display (HDD), and Flight Management System (FMS) into simulator
- X-Plane with EC135 aerodynamic flight model
- Design of an Advanced Point-In-Space R/C flight procedure at airport Braunschweig
- Participation of 4 test pilots
- Simulation of 36 continuous departures and approaches with varying wind, ceiling and daytime



THALES HMD system in Generic Cockpit simulator at DLR in Braunschweig

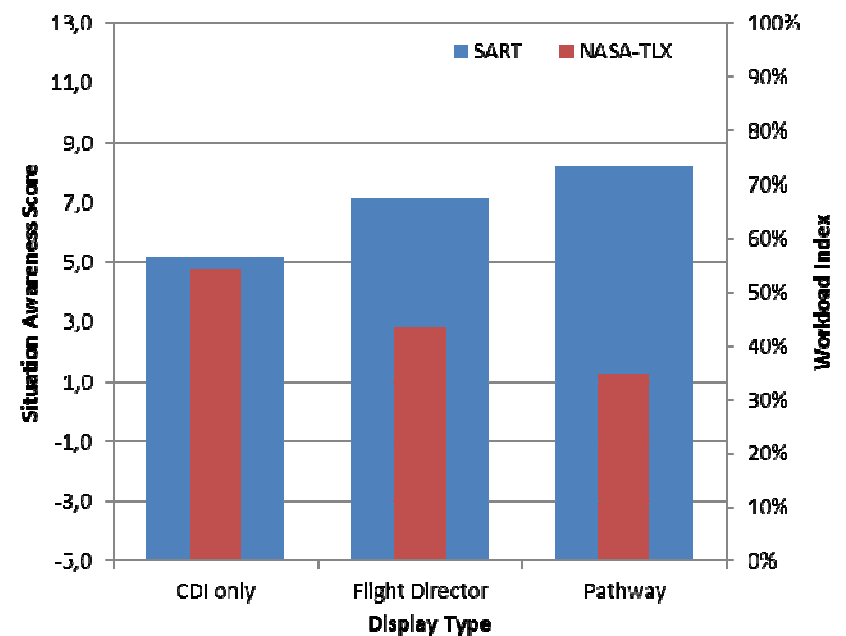


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PJ.01-06 Real Time Simulation Results

- Reduced footprint size of R/C procedures enabled by RF legs
- Using a Course Deviation Indicator (CDI) only does not allow to fly the pattern
- Both HMD variations – flight director and 3D pathway – allowed to fly the pattern
- No significant differences between flight director and pathway symbology



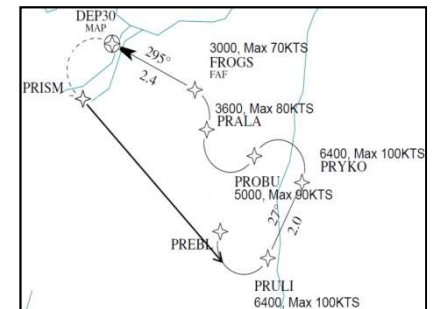
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Braunschweig/Donauwoerth Flight Trial Configurations

- **Braunschweig**

- DLR's research helicopter EC135
- Same hardware configuration (HMD, FMS, HDD)
- 5 test pilots, 15 continuous departures and approaches, VMC, simulated IMC, strong wind and low ceiling



Donauwoerth (EDPR)

- **Donauwoerth**

- Airbus Helicopter's EC135 with IFR-certified avionics suite
- Flight management system (FMS) and 4 axis autopilot to automatically fly advanced PinS procedure
- Results expected in March 2019



Braunschweig (EDVE)

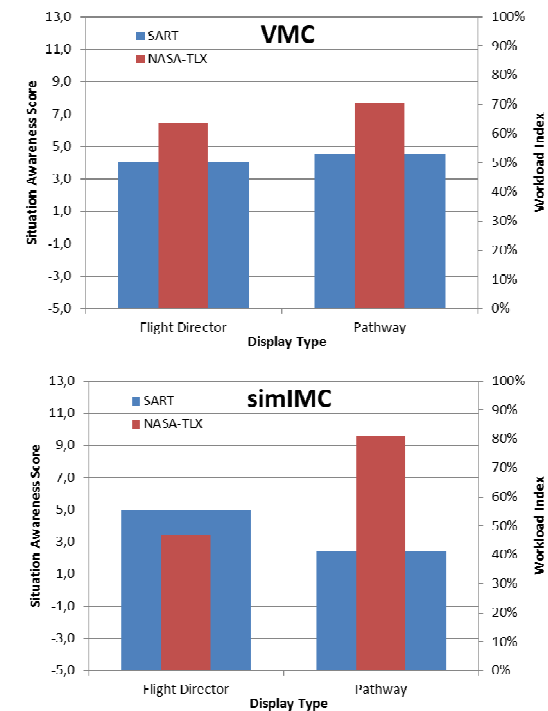


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PJ.01-06 Braunschweig Flight Trial Results

- Minimum sized footprint enabled by RF legs
- Both display variations – flight director and 3D pathway – allowed to fly the pattern
- One flight outside RNP 0.3 limits due to strong wind conditions, incidental head tracker dropouts, and misinterpretation
- The pilots rated SBAS navigation for advanced PinS RNP 0.3/LPV approaches and departures positive



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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 731864



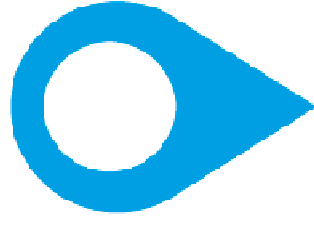
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PJ01: Enhanced Arrivals and Departures



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PJ01: Enhanced Arrivals and Departures

- To address forecast traffic growth, PJ01 EAD is developing concepts, tools and procedures to increase the capacity of TMAs in a safe, cost-effective and sustainable manner
- This will be achieved by taking advantage of the latest technological developments from both airborne and ground systems, and through the secure sharing of data
- The needs of all Airspace Users will be addressed including General Aviation and Rotorcraft



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PJ01: Enhanced Arrivals and Departures

- The driver is to exploit the environmental benefits of Continuous Climb and Descent Operations, and improved arrival sequencing for capacity-constrained high-density/complexity TMAs
- The focus is to
 - minimise delays, improve resilience and providing environmental benefits by enhancing arrival and departure management through the dynamic use of Precision Based Navigation
 - optimise traffic flows by improving the integration arrivals with departures, and improving the capability to balance traffic demand and available capacity

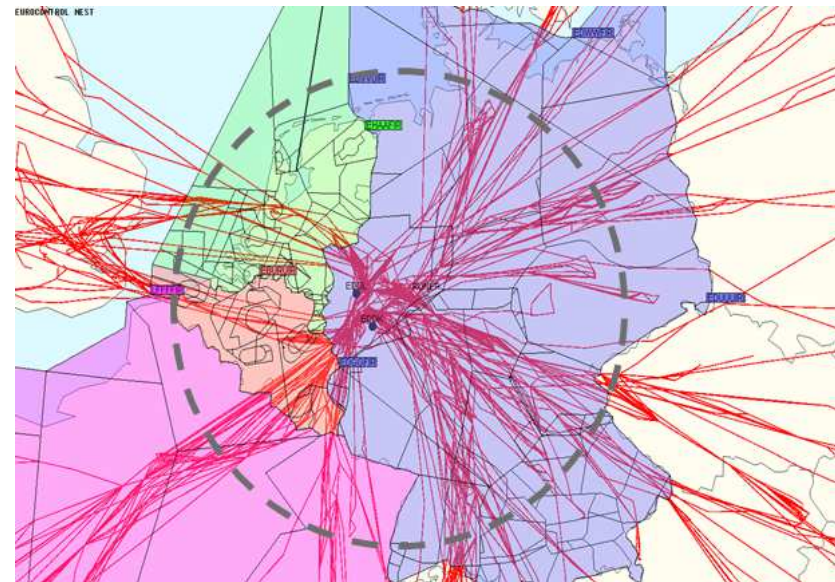
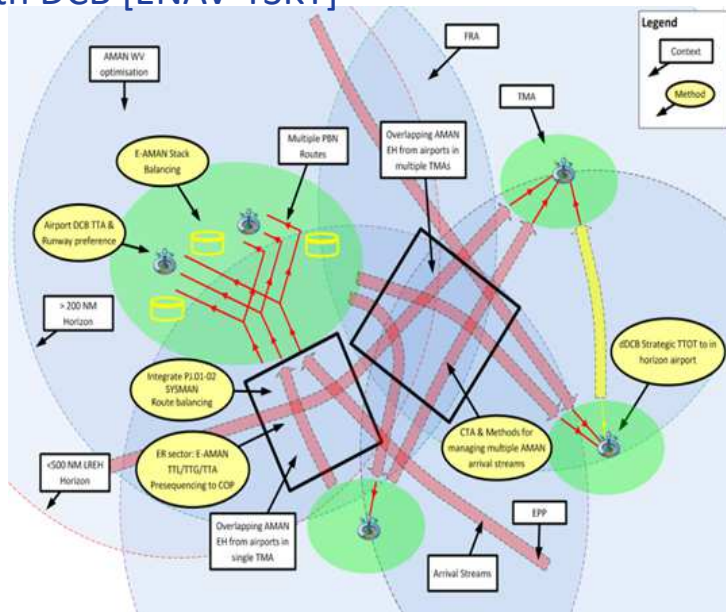


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PJ01: Enhanced Arrivals and Departures

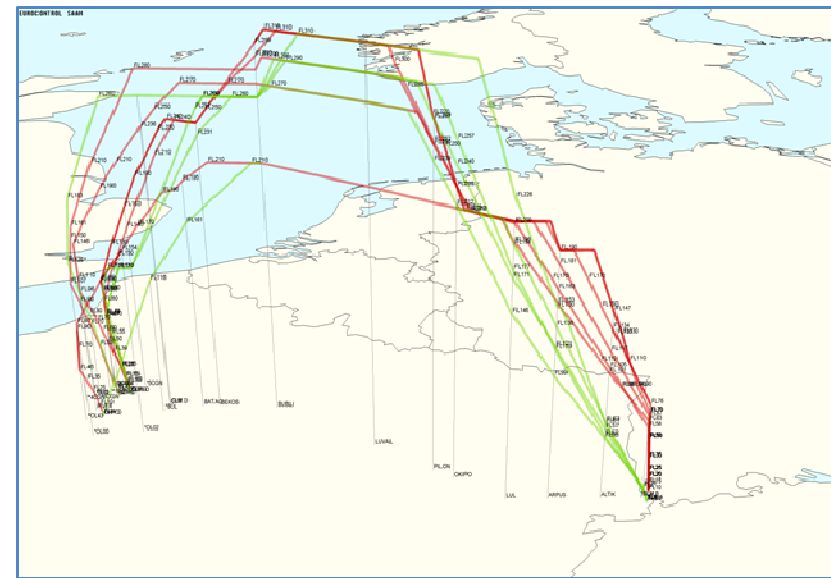
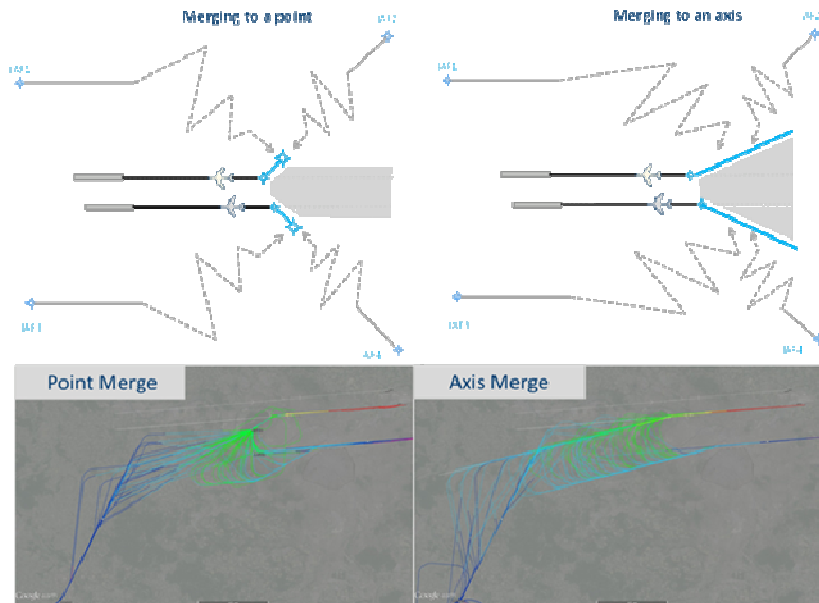
PJ.01-01 - Extended Arrival Management with overlapping AMAN operations and interaction with DCB [ENAV-TSKY]



PJ.01-02 – Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA [NATS]

PJ01: Enhanced Arrivals and Departures

PJ.01-03A - Improved Parallel Operations [Eurocontrol]



PJ.01-03B - Dynamic E-TMA for Advanced Continuous Climb and Descent Operations [Airbus]

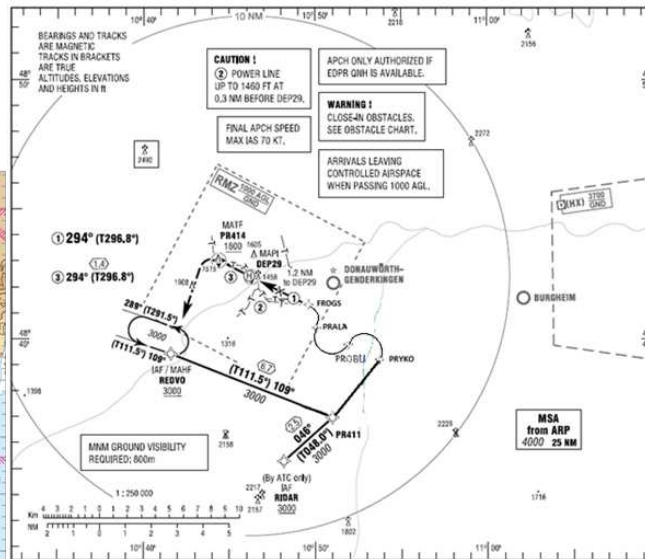


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PJ01: Enhanced Arrivals and Departures

PJ.01-05 - Airborne Spacing Flight Deck Interval Management [NLR]



PJ.01-06 - Enhanced Rotorcraft and GA operations in the TMA [DLR]

PJ.01-07 - Approach Improvement through Assisted Visual Separation [Airbus]



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PJ01: Enhanced Arrivals and Departures

The concepts are investigated through the solutions using:

- Computer based Fast Time Simulations (FTS)
- Real Time Simulations using prototypes, platforms and procedures using “realistic simulated” environment with human expertise interaction
- Flight Trials using real aircraft with installed prototypes and developed procedures
- Project has worked in this phase to target each solution to either V2 or V3 maturity



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PJ01: Enhanced Arrivals and Departures

During this SESAR Walking Tour we will be presenting the work within PJ01 EAD:

- NATS work on PJ.01-01 & PJ.01-02: Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA [NATS]
- PJ.01-05: Airborne Spacing Flight Deck Interval Management [NLR]
- PJ.01-06: Enhanced Rotorcraft and GA operations in the TMA [DLR]

Some partners have presented on other tours – PJ.01-03A in Tour 5



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 699238



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PJ01: Systemised Airspace Manager (SYSMAN) & AMAN

NATS R&D activity has included:

- New functionality (SYSMAN and AMAN)
- Support to Systemised Airspace
- Support to Collaborative Decision making



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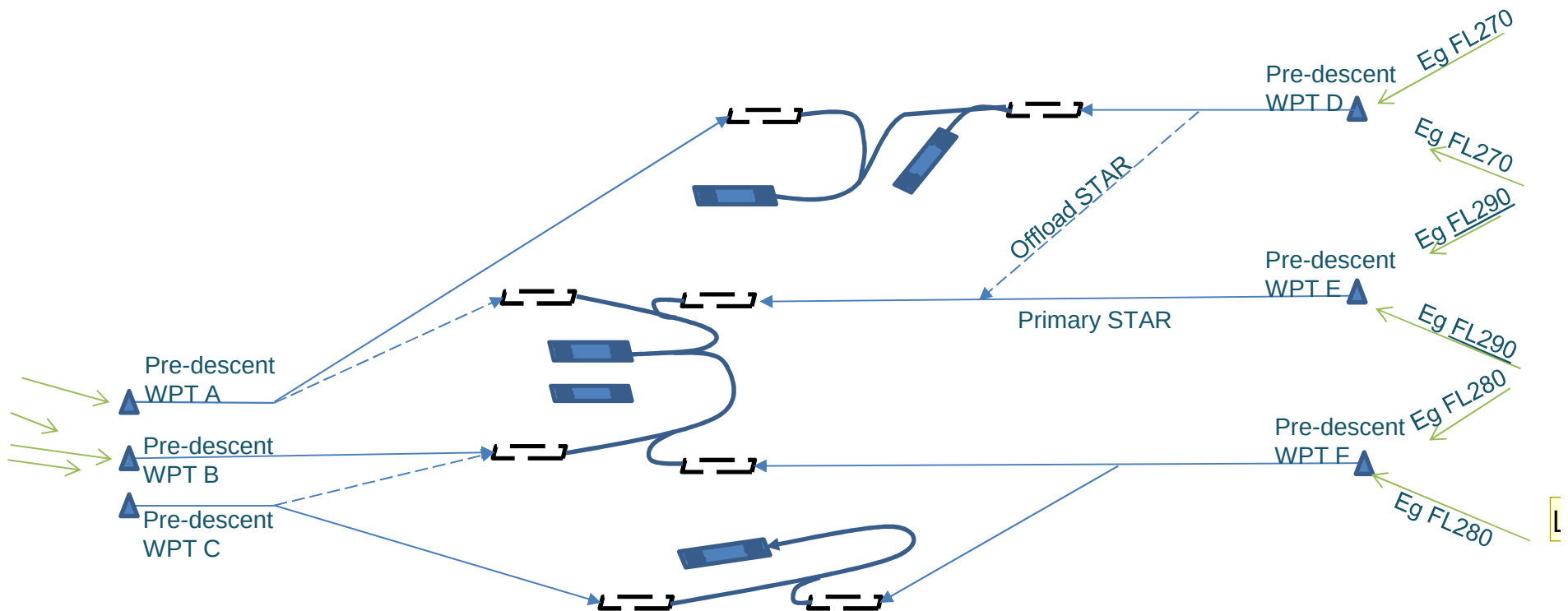
- NATS vision for future airspace animation



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Systemised Arrivals Airspace



Slide 12

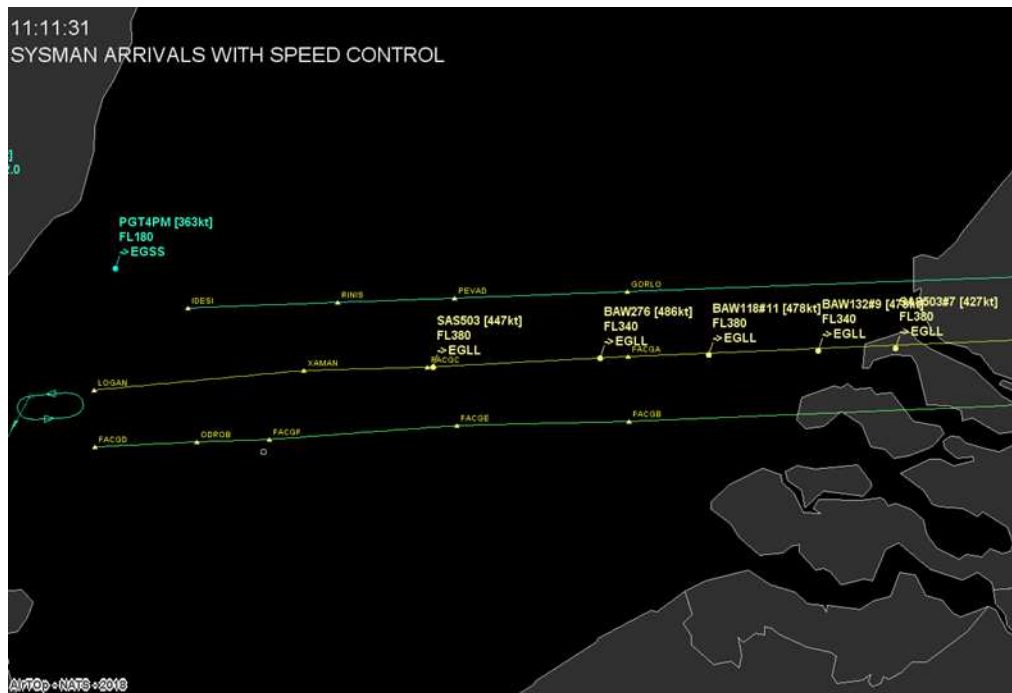
LL1

I'd suggest getting rid of the text on these slides - there is already quite a lot going on and I think it will be better to cover in the voice over

LAW, Luke; 27-02-2019

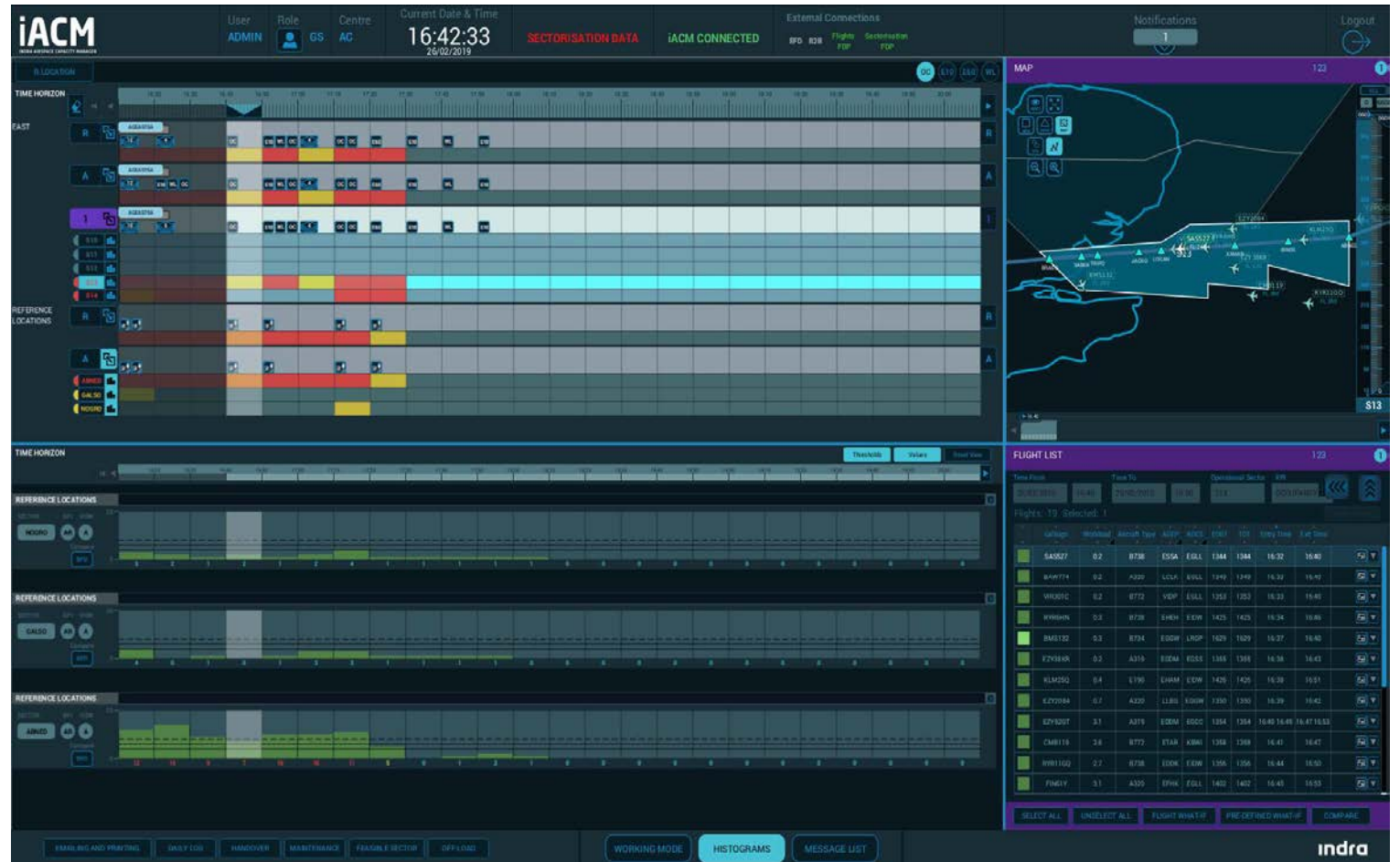
Fast-Time Simulation

Use of Systemized Airspace Manager decision support tool to improve traffic presentation across systemized [inbound] route structure



- 3x parallel routes, each nominally assigned to specific airports.
- Frequent imbalances of demand and available capacity; high numbers of Heathrow inbound.
- *Note: 2025 traffic reflects Heathrow third runway*

Real-Time Simulation



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Questions?



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