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Stand 849

Runway Condition Code Prediction

- SESAR 2020 context:
 - part of PJ.03b-06 Solution;
 - improve safety and predictability;
 - feasibility validations (E-OCVM V2).



- SESAR 2020 Objectives:
 - improvement of airport operations;
 - improved prediction of runway state;
 - reduce risk of runway excursion & overrun;
 - meet ICAO Annex 15 recommendations.



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Runway Condition Code Prediction

- PANSA / Warsaw University RCAMS:
 - validation goal: show increase of situational awareness and safety in changing weather;
 - use advanced mathematics to support prediction of RWYCC;
 - support Airport Duty Officers, ATCOs & CREWs.



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RCAMS validation

- RCAMS use case:
 - validated in different environments
(primary and secondary airport);
 - validated with variable inputs and different data;
 - both ATC and Airport Officers were targeted.



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What RCAMS does?

- Asses and display current & predicted RWYCC for each 3rd of runway.
- Allows for both automatic and manual dissemination.
- Provides RWYCC with probability levels (graceful degradation).
- Integrates with SNOWTAM message.



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RCAMS brings benefit!

- Support with automation daily routines of:
 - TWR ATS,
 - Airport Operator,
 - Flight Crews.
- Forecasts change in RWYCC (1h).
- Allows manual correction of erroneous output.
- Meets ICAO Global Reporting Format requirements.



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Honeywell



THALES



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 734139



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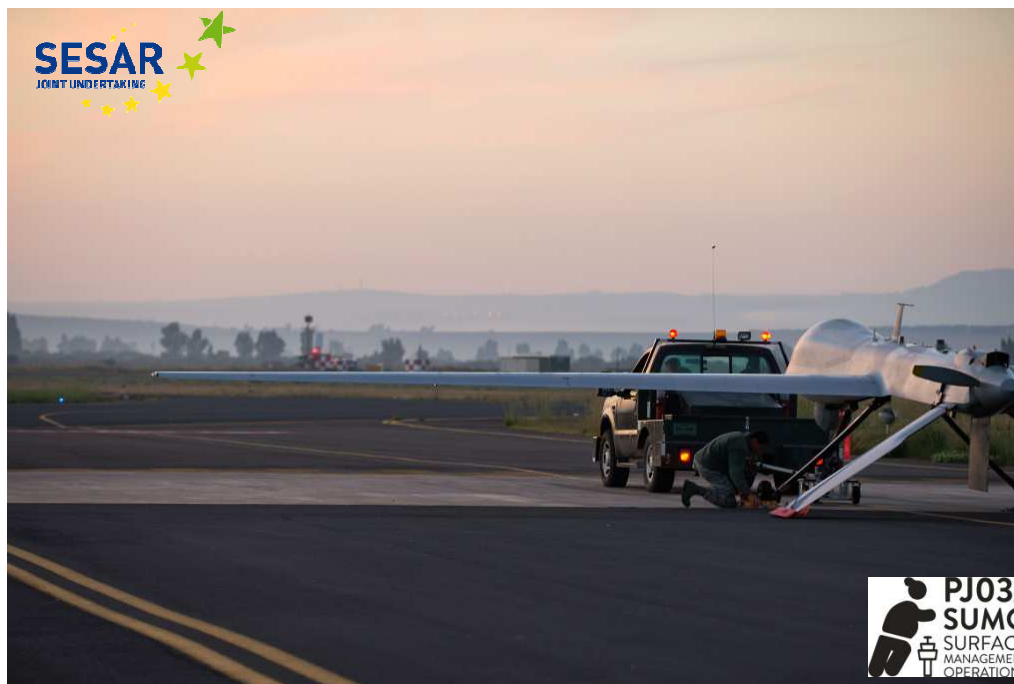
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Solution 03a-09: Surface Operations by RPAS

Giovanni Riccardi



Members



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Surface operations by Remotely Piloted Aircraft Systems (RPAS) facilitate the operation of RPAS at airports and their integration into an environment which is dominated by manned aviation. To the maximum extent possible, RPAS will have to comply with the existing rules and regulations. The solution includes the particular requirements of remotely piloted operations, and will describe their specificities with respect to the manned operations, providing operational requirements for technological developments that could mitigate them.

ATM Procedures, for
Airport

Development of
operational and
performance
requirements

Adaptation/definition of
roles & responsibilities
and working methods

Human Performance,
Safety, Cyber Security,
Capacity, Access and
equity

Contingency situations
during airport
operations

Development of specific
use cases for airport
operations

Stakeholder	Expected Benefits
ANSP	- The possible increase of economic entrance (fees) linked to the provision of aerodrome control service for new Airspace Users (RPAS). - Appropriate integration solutions will support and ease ANSP's task to guarantee a high level of safety and efficiency also in mixed manned and unmanned traffic
RPAS Industry	Selling vehicle, hardware/software, systems, technological solutions, trainings related to RPAS.
Regulatory Authorities	Revenues related to certifications process
RPAS Operator	- New business opportunity related the possibility of RPAS to operate on airports - Free and equal access to airport/aerodrome infrastructure
Airport Operator	- The increase of economic entrance (fees) linked to the provision of Aerodrome services for new AUs (RPAS). - Regional and remote airports with low traffic could benefit from an increase of operations related to this new RPAS AU



Operational Environment



Environment: Airport in mixed mode (*RPAS/Other manned Traffic*)

Operations: Taxi-in, Taxi-out, Arrival, Departure (*non segregated operations*)

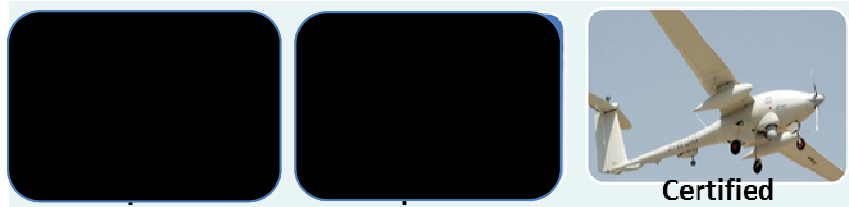


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RPAS Target Categories

EASA
'Certified' category
Requirements are
comparable to those
for manned aviation.



IFR Operations

Use of taxiways,
apron, runway

Flight plan (included
contingencies,
backup comm.link)

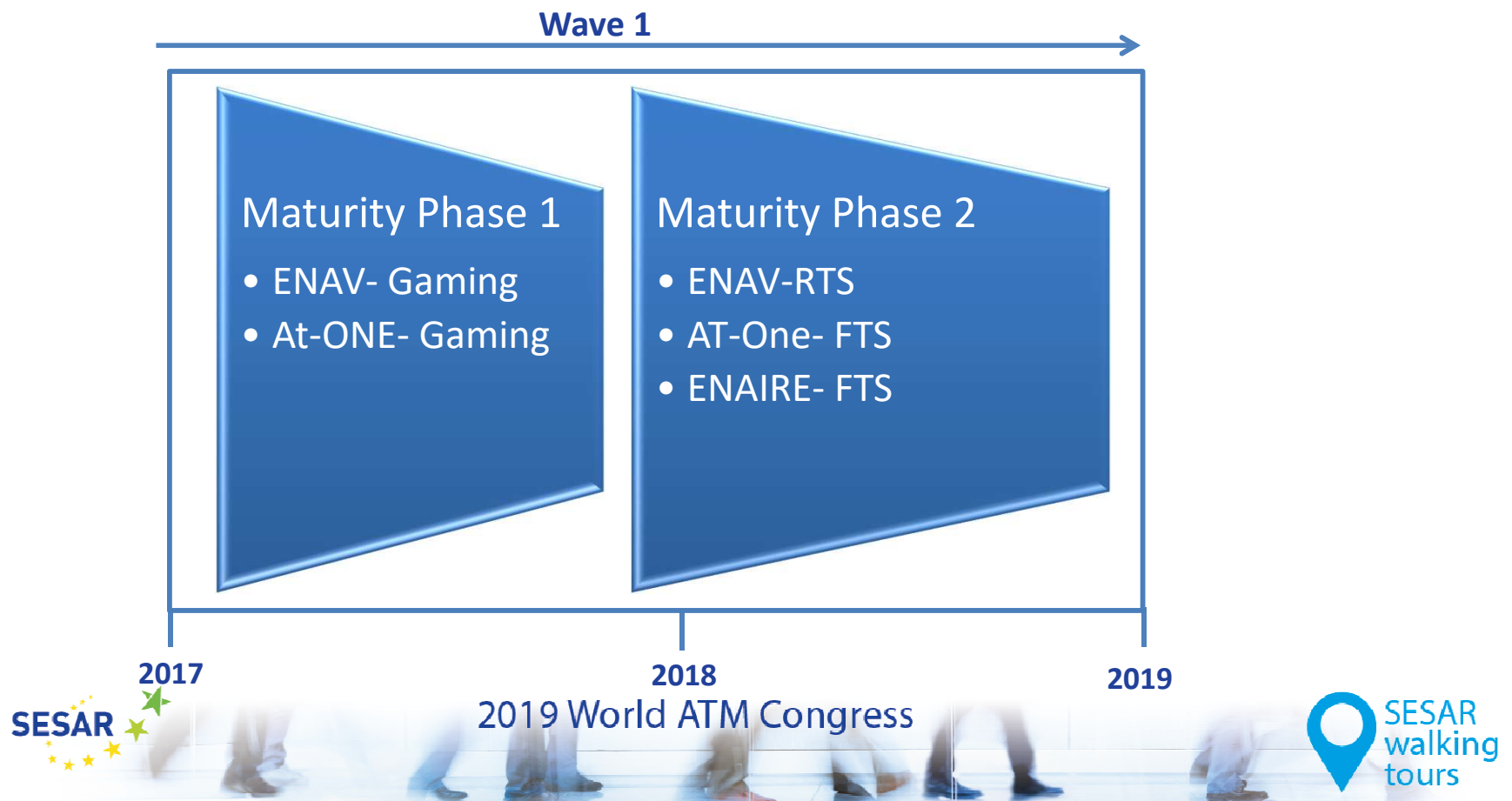
Two way
communication link
with ATC

Meet CNS Airport
Requirements

Interoperability with
airport safety nets

EUROCONTROL
RPAS CONOPS
'Class VI'

Simulations and Validations





Simulations and Validations: Maturity Phase 1



Gaming

- Integration of RPAS on airport for surface operations
- Italian regional/third node airport with simple layout
- Analysis of: Working Practices and operational procedures in nominal and contingency situations
- Assessment of Airport Moving Map for Remote pilot to enhance situational awareness



Gaming

- Use of segmented taxi routes for RPAS
- Difference between segmented taxi routes for RPAS and use of external towing vehicle
- 2 Airports (Stuttgart and Köln/Bonn) were assessed during workshops
- Analysis of Nominal and Contingency situations



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Results of Maturity Phase 1



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Simulations and Validations: Maturity Phase 2



RTS

- Integration of RPAS on airport for surface mixed operations
- Italian regional/third node airport (Grottaglie) with simple layout
- Analysis of: Working Practices and operational procedures in nominal and contingency situations
- Real Time Simulation environment with Ground/ATC platform and RPS simulator. ATCO + Remote Pilot involved



FTS

- Difference between segmented taxi routes for RPAS and use of external towing vehicle
- Stuttgart Airport with realistic manned traffic +RPAS
- Analysis of Nominal and Contingency situations
- Impact on safety, resilience



FTS

- Spanish third level node airport (MATA CAN)
- Fast- Time simulation in a mixed environment with civil/military manned commercial, general aviation traffic and RPAS
- Specific focus on loss of C2 link and loss of communication procedures
- Assessment of Capacity, predictability and environmental sustainability

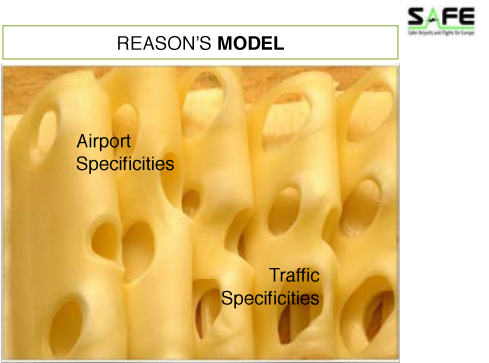


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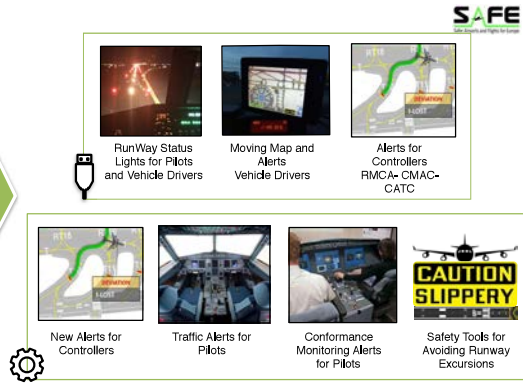
Thank you for your attention





COMPLEMENTARY AIRPORT SAFETY SUPPORT TOOLS

SESAR 1 - SESAR 2020



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MOVING MAP AND TRAFFIC ALERTS

VEHICLE DRIVERS

Candidate for Common Project 2 (CP2)



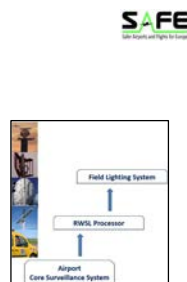
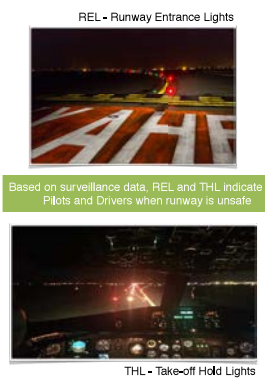
- Moving map view of the traffic
- Area infringement Alerts
- Traffic conflict Alerts

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RUNWAY STATUS LIGHTS (RWSL)

PILOTS AND VEHICLE DRIVERS

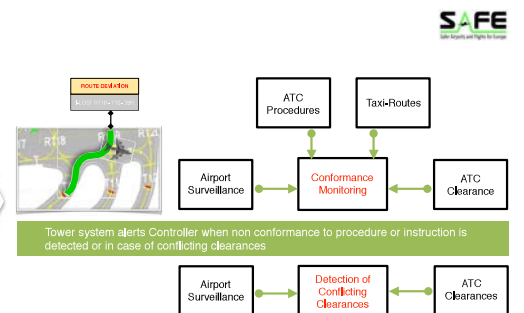
Implemented at Paris-CDG
In 2016-2017
Candidate for Common Project 2 (CP2)



CONFORMANCE MONITORING ALERT AND DETECTION OF CONFLICTING CLEARANCES

TOWER CONTROLLERS

PCP



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NEW AIRPORT SAFETY SUPPORT TOOLS

TOWER CONTROLLERS

In the pipeline

- New Conflicting ATC Clearances (CATC)
- New Conformance Monitoring Alerts for Controllers (CMAC)
- Targeted Airport Environment: with A-SMGCS or with Alternative Ground Surveillance



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TRAFFIC ALERTS ON RUNWAY AND TAXIWAY

PILOTS

In the pipeline

Based on ADS-B receptions, the on-board system detects conflicting aircraft to alert the Flight Crew during take-off, landing and surface operations



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CONFORMANCE MONITORING ALERTS

PILOTS

In the pipeline

- Detection of Non Conformance to ATC instructions or procedures
- Detection of Non Compliance to airport specificities
- Provision of visual and audio alerts to the flight crew



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SAFETY SUPPORT TOOLS FOR AVOIDING RUNWAY EXCURSIONS

PILOTS, AIRPORT OPERATORS
AND TOWER CONTROLLERS

In the pipeline

Provision of indications and alerts about runway condition and risk of runway excursions to:

- Flight crew
- Airport Operator
- Tower Controller



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NEXT STEPS



17
Validation
Exercices
will be
completed

Delivery in 2019 of:

- Validation Results
- Solutions Specification
- Recommendations

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Project Manager



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4
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PROJECT MEMBERS



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 734139



AIRBUS



Honeywell

SAFE
Safer Airports and Flights for Europe



indra



LEONARDO

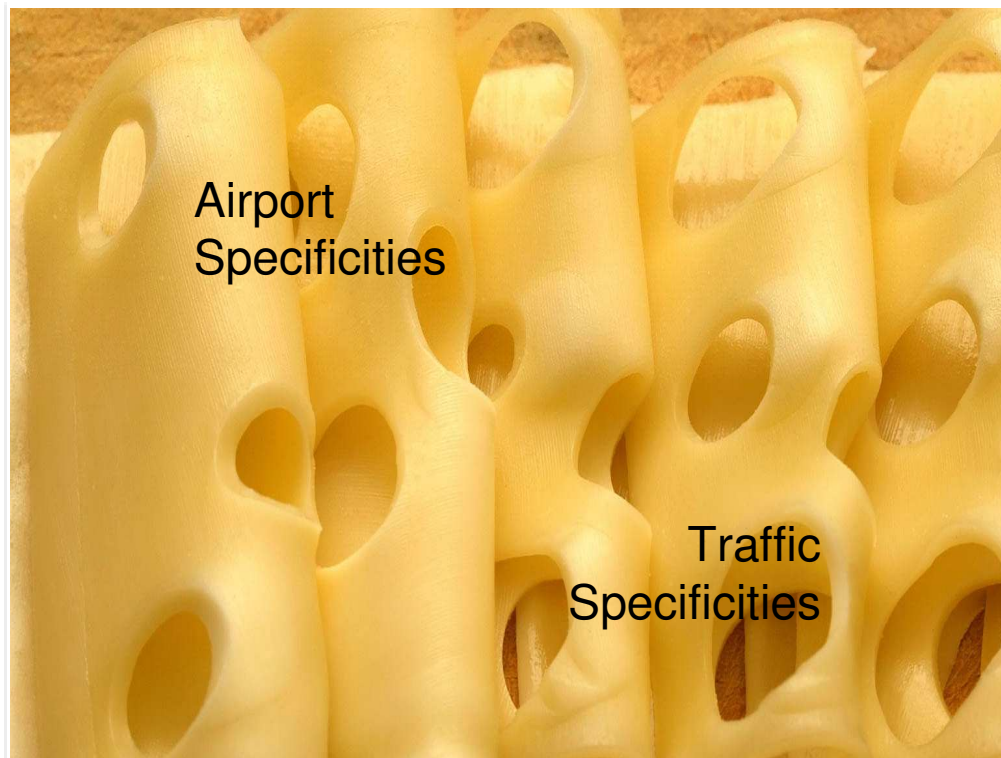


THALES

**COMPLEMENTARY
AIRPORT
SAFETY SUPPORT
TOOLS**

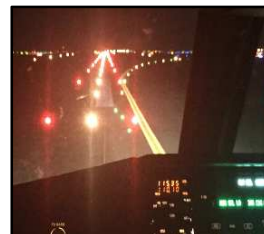
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REASON'S MODEL



COMPLEMENTARY AIRPORT SAFETY SUPPORT TOOLS

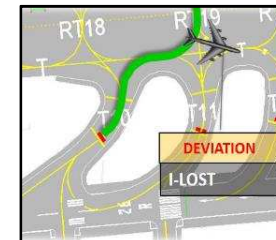
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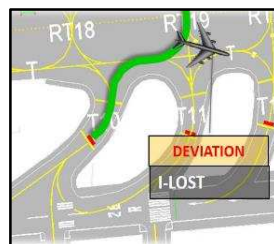
RunWay Status
Lights for Pilots
and Vehicle Drivers



Moving Map and
Alerts
Vehicle Drivers



Alerts for
Controllers
RMCA- CMAC-
CATC



New Alerts for
Controllers



Traffic Alerts for
Pilots



Conformance
Monitoring Alerts
for Pilots



Safety Tools for
Avoiding Runway
Excursions



RUNWAY STATUS LIGHTS (RWSL)

PILOTS AND VEHICLE DRIVERS

Implemented at Paris-CDG
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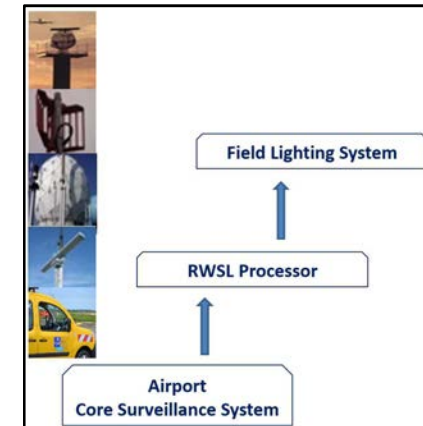
REL - Runway Entrance Lights



Based on surveillance data, REL and THL indicate
Pilots and Drivers when runway is unsafe



THL - Take-off Hold Lights



MOVING MAP AND TRAFFIC ALERTS

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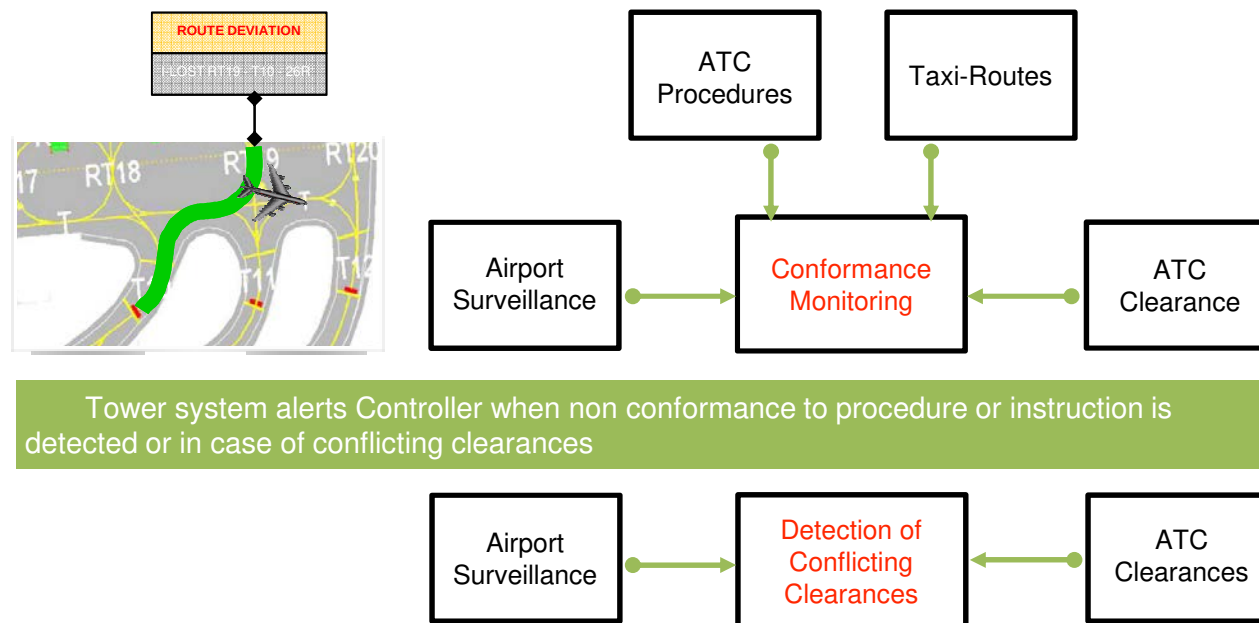


On-board system displays traffic and raises traffic alerts and area infringement alerts

- ⦿ Moving map view of the traffic
- ⦿ Area infringement Alerts
- ⦿ Traffic conflict Alerts

CONFORMANCE MONITORING ALERT AND DETECTION OF CONFLICTING CLEARANCES

TOWER CONTROLLERS



NEW AIRPORT SAFETY SUPPORT TOOLS

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NEXT STEPS

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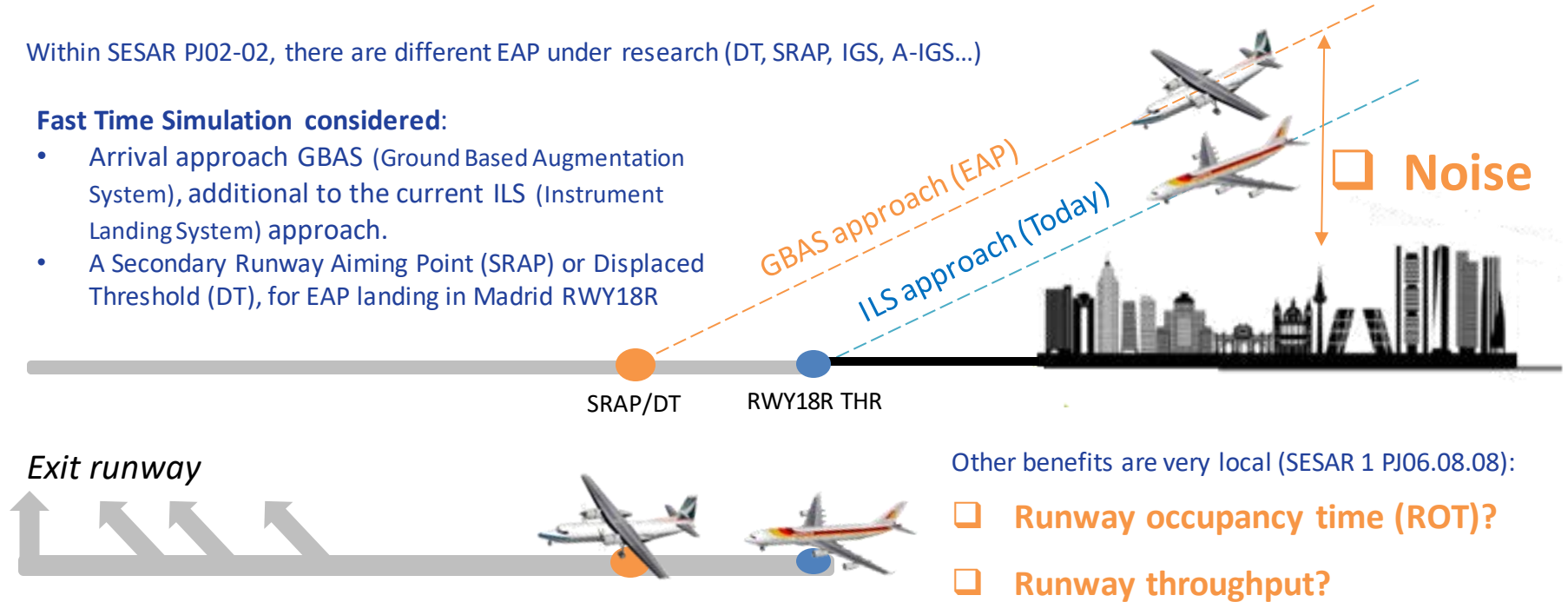


Enhanced Arrival Procedures (EAP)

Within SESAR PJ02-02, there are different EAP under research (DT, SRAP, IGS, A-IGS...)

Fast Time Simulation considered:

- Arrival approach GBAS (Ground Based Augmentation System), additional to the current ILS (Instrument Landing System) approach.
- A Secondary Runway Aiming Point (SRAP) or Displaced Threshold (DT), for EAP landing in Madrid RWY18R



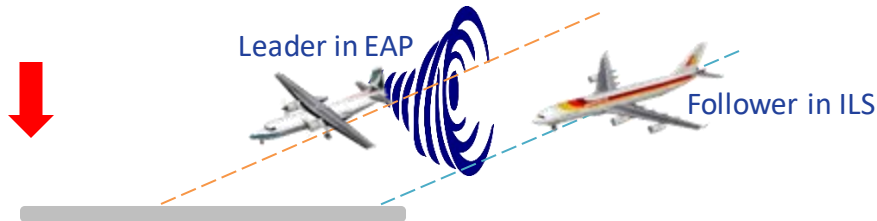
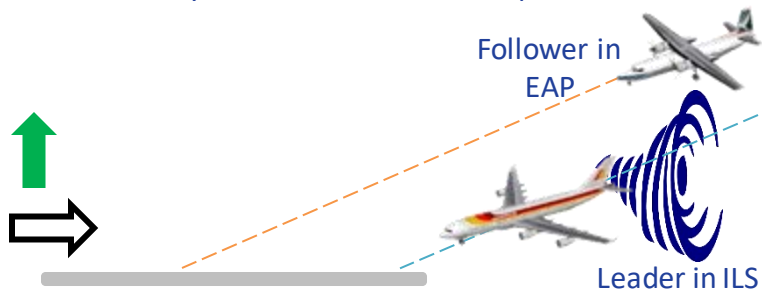
Other benefits are very local (SESAR 1 PJ06.08.08):

- Runway occupancy time (ROT)?
- Runway throughput?

Enhanced Arrival Procedures (EAP)

❑ Separations (wake turbulence)

- Can any distance be used for displacement?



❑ CBA aspects

- Is it possible to enlarge the runway?
- Is it needed to modify runway exits?

❑ Aircraft capabilities

- % of aircraft able to use EAP (GBAS equipped)?

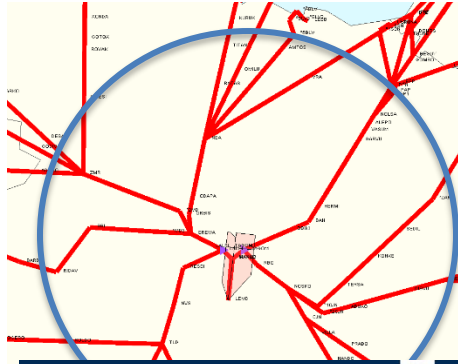
❑ Standards & Regulations

- Lightings and markings on the runway?

Enhanced Arrival Procedures (EAP)

FAST TIME SIMULATION IN MADRID ADOLFO SUÁREZ BARAJAS AIRPORT (DT/SRAP)

ECTRL NEST



SRAP 300m Approach Separation Minima (in NM) with ICAO WT categories - with 4 NM minimum separation as in LEMD

Baseline DBS (ICAO)

Note: "LST" -> lower glide, "SRAP" -> upper glide

Lead S/S	S	H	M	L
S	4	5	7	8
H	4	4	5	6
M	4	4	4	5
L	4	4	4	4

Lead S/S	S	H	M	L
S	4	5	7	8
H	4	4	5	6
M	4	4	4	5
L	4	4	4	4

Lead S/S	S	H	M	L
S	4	5	7	8
H	4	4	5	6
M	4	4	4	5
L	4	4	4	4

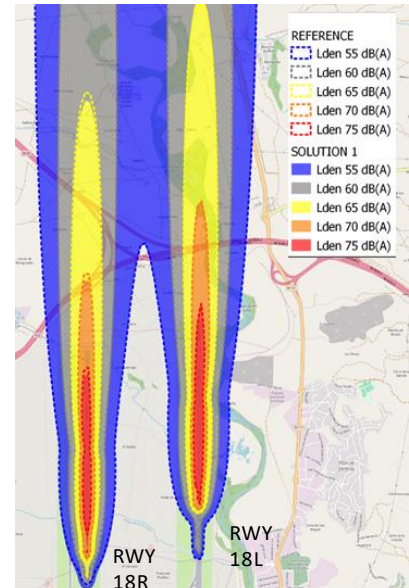
CARTA PARA SIMULACIÓN



RAMSPlus



ECTRL IMPACT



- Dependent (DT) and Independent (SRAP) use for arrivals
- 300 m displacement in RWY18R
- Heavy (19%), Medium (79%), Light (2%)



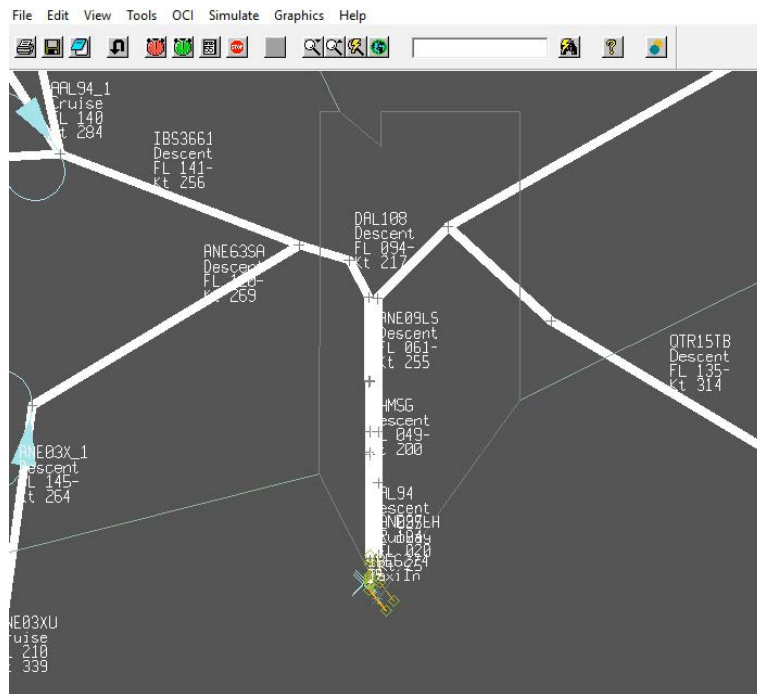
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Enhanced Arrival Procedures (EAP)

- **EAP Local assessment** identifies:
 - Opportunities in the daily hours for having benefits in runway throughput (e.g. 4-6% depending on runway use)
 - 2% benefit in total day CO2 emissions
 - 4% benefit in number of people exposed to noise levels during daytime
 - **These benefits need of:**
 - Tool to support APP/TMA ATC for identifying opportunities in daytime, while maintaining safety in separation provision (e.g. LORD & AMAN integration)
 - Research on runway markings and lightings below 1000m displacement
- Assessed benefits could be increased if runway could be enlarged (i.e. bigger displacement) and/or runway exits modified (i.e. costs incremented)





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THANK YOU!

