DEMONSTRATING SESAR

11 March 2015
World ATM Congress

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AN INTRODUCTION TO SESAR DEMO ACTIVITIES

Alain Siebert,
SESAR JU

11 March 2015
World ATM Congress

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The starting point

to see is to believe

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We’ve come a long way in 5 years

>30,000 flight trials performed
We’ve come a long way in 5 years

90% of SESAR Members active

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We’ve come a long way in 5 years

85% of the procedures demonstrated are in operations today
We’ve come a long way in 5 years
We’ve come a long way in 5 years
We’ve come a long way in 5 years

Requirements ready
Real Time Simulation
focusing at MUAC primarily

Establish a Free Route Airspace
for Maastricht and Karlsruhe
through live flight trials
Looking ahead

Need for larger scale demonstration activities confirmed to effectively bridge R&D with deployment
Looking ahead up to 2016
Looking ahead

SESAR 2020

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Thanks for your attention
GLOBAL INTEROPERABILITY - Exchanging Flight Object Information Across ICAO Regions

Jose Manuel Asensio
INDRA
11 March 2015
World ATM Congress
Is it possible to optimize the airlines operations according to their preferences, improve the capacity management of air navigation service providers and reduce the impact in the environment by sharing advanced information among ICAO regions?
The Interoperability Cross Atlantic Trials (ICATS) - SESAR Demonstration project probed that the exchange of advanced flight information in the form of flight object among ICAO regions during the execution of the flights produces benefits for airspace users, service providers and environment.
Demonstration SOLUTION

• The solution consists in the deployment of an interoperable ATM infrastructure at Air Navigation Service Providers and Airline, fed with live data, enabling the exchange of advanced flight information in real time, permitting airline route optimizations and ANSPs capacity evaluation

• The solution is based in SESAR already existing enablers (Flight Object Interoperability and SWIM)
Consortium Information

Consortium composed by Indra (leader), Lockheed Martin (industries providing ATM infrastructure additional to the available at ANSPs), Enaire (formerly Aena), NAV Portugal, (the ANSPs involved), CRIDA (R&D Enaire support) and AirEuropa (airline involved).
• The operational context included Oceanic air traffic management operations (New York and Santa Maria Oceanic), and the En-Route continental part of the oceanic flights from/to Madrid in both, the US and European regions, supported by the Airline Operations Center of Air Europa
Trials operation

Trials using the real Oceanic West and East bound traffic basically from/to Madrid, crossing the Santa Maria and New New York Oceanic Airspace (and Lisbon Airspace in most of the cases)

Trials working in infrastructure parallel to the real ATM systems, fed with live ATM data for synchronisation

Airline Operations Center participates as a key actor in the parallel infrastructure to propose route changes in the real airline flights concurrently to the ATC operation
Actors involved in the Demonstration

Operational Chain

Inter-SWIM (I-SWIM)

Shadow Mode Chain

Data Feeds

ACARS

Voice

Indra

FROM INNOVATION TO SOLUTION
Global Flight Object

US RFO-GFO Mapping

NextGen RFO (FIXM)

US Region Interactions

INTEGEGEN REGION
ADAPTER
Inter-SWIM NODE
Inter-SWIM NODE
Inter-SWIM NODE
Airline Operations Center

EU RFO-GFO Mapping

SESAR RFO (ED-133)

EU Region Interactions

RFO Regional Flight Object

GFO Global Flight Object

ICATS GFO Domain

AOC Interactions
Global Flight Object composition

- Built using FIXM data structures and EUROCAE ED-133 principles:
  - FIXM
    - Data Structures and Data Types
    - GUFI
  - ED-133
    - Clustering principle
    - Services
    - Role Model (GFO Manager and GFO Contributor)

An ad-hoc solution was used to fit ICATS needs where necessary
- Trajectory Structure (inspired by ED-133)
- Flight Route divided into Regions
- Airline Operations Center Route Optimization Proposal
- GFO Distribution List
- GFO Ownership Handover
Demonstrations
Demonstration Exercises

- **Exercise 1.** Eastbound and Westbound Air Europa flights from/to Madrid to/from US and Caribbean airports. Route optimization requests submitted by the airline, Air Europa, evaluated by ATCs.

- **Exercise 2.** All Eastbound flights for the different companies to Madrid, Enaire measuring the improvement in predictability and load calculation of the entry traffic to Madrid ACC.

- A baseline scenario was created, from already existing information, for objective evaluation of the results.
Exercise 1: Expectations and results

- M03-Reduction of at least 5% the number of Coordination Revision/Rejection. 4,78%
- M04-Fuel saving >= 1% 1,4%
- M05-Reduction of CO2 Emission >= 1% 1,4 %
- M06-Reduction of at least 10 % of the Tactical Conflicts.

No means to measure this in a quantitative way.
Exercise 1: Conclusions

I. Airline able to fly trajectories closer to their optimum profile: reduction in 1.4% of fuel consumption and CO2 emissions per flight.

II. The number of trajectory change requests demanded by the Flight Crew and rejected have been decreased by a 5% comparing with today's operations.
EXERCISE 1: Proven benefits for users
Exercise 2: Expectations and results

- **M01- Hourly Sector Entry Rate.** Improve the accuracy of sector entry rate calculations by 15% of oceanic traffic. >15%

- **M02- Load-Sector Occupancy.** Improve in 10% of the calculation of sector load due to Oceanic traffic. 10% on 45% of the time

- **M07- Improvement in data predictability** 18 minutes

- **M08- Improvement in data accuracy** 8 minutes
I. The calculation of the sector entry rate (15%) and the sector load (45%) has been improved.

II. Regarding the predictability and the accuracy of the data, it has been proved that for the data analyzed, the demonstration system is slightly more predictable and accurate than the current systems. An average improvement of 18 minutes in predictability and 8 minutes in accuracy is obtained from the analysis.
Exercise 2 confirms the value of sharing in advance accurate information.
In the line of the Oceanic Interoperability:
1. Demonstrate more operational benefits that can be supported by Ground-Ground Interoperability (Extended AMAN for oceanic traffic, Traffic Load, Improved oceanic coordination...)

In the line of the involvement of the airline in the ATM process, for oceanic and continental traffic:
1. Study the feasibility of making aware to the AOC the traffic situation and constraints, to facilitate the fly and fleet optimization.
2. Study if the involvement of the airline in the execution phase of the flight may provide benefits for ATC.
3. Study the benefits of using the airline operational flight data in the ATC...

This is in the path of the incoming SESAR2020 Very Large Demonstrations (VLDs)
Global Interoperability Trials SESAR

Airline FO Demo Atlantic

Efficiency SWIM Predictability Teaming

ANSPs Capacity

FROM INNOVATION TO SOLUTION
Thank you for your attention

Jose Manuel Asensio
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SESAR and Automation Technology
SECURING QUICK WINS AT AIR FRANCE

LAURENT RENOU
AIR FRANCE

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What « Quick-wins » mean?

2 years ago

Now

Considered as a Quick – win In ATM

March 2015
Air France fuel savings program

Typical Long-haul flight (IAD-CDG)

PRE-FLT
-15 min carrying fuel 300 kg

TAXI OUT
-30 min APU use 120 kg

TAXI IN
10 min Taxilng N-1 150 kg

TAXI OUT
NADP 2 50 kg

TAKE OFF / CLMB

CRUISE
Direct Route Negotiation 300 kg
Block Alt. 150 kg

LANDING
Flaps 25 Rev Idle 130 kg

TOTAL = 1200 kg = 900 €

100 m€ saved in 2 years

March 2015
Air France involvement in AIRE initiatives

3 projects in AIRE 1 (2009)
6 projects in AIRE 2 (2010-2011)

Demonstrating fuel savings:
At Airports, in Approach, En-Route & Oceanic
In Europe, Canada and USA

More than 500 commercial flights involved
More than 1000 m.d. (Pilots, Flight ops, OCC, HubCC)

AIRE demonstrations that lead to « quick-wins »

<table>
<thead>
<tr>
<th>Flight trials in</th>
<th>Operational since</th>
<th>Yearly fuel savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2010</td>
<td>2.500 tons</td>
</tr>
<tr>
<td>2009-2011</td>
<td>2012</td>
<td>200 tons</td>
</tr>
</tbody>
</table>
Latest AIRE initiatives – WE-FREE

Average savings per Day: 20 tons of CO₂
DFlex – Departure Flexibility

Quick-wins with RoI ~1 year

<table>
<thead>
<tr>
<th>Developed</th>
<th>Flight trials</th>
<th>Operational since</th>
<th>Yearly savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2012</td>
<td>in 2013 *</td>
<td>2014</td>
<td>300 k€ in 2014</td>
</tr>
</tbody>
</table>

* > 1500 flights involved

100k€ in 12 Feb 2015 (ADP strike)
Securing « Quick-wins » - a Cultural Change

Other areas to explore

“quick-wins” in Safety, Capacity & Efficiency

Disrupted situations

Snow  Fog  Thunderstorm

2010  2015  2020

Difficult to predict > 3 years

Must stay agile

To operate safer, better, cheaper

March 2015
PAVING THE WAY FOR THE IMPLEMENTATION OF THE SESAR FREE ROUTE SOLUTION

GIANCARLO FERRARA
ENAV

#SESAR
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FREE Solutions – Problem Statement

Today’s ATM operations are constrained to the existing ATS route network. Despite the amount of benefits introduced by the current airspace organization, there is room for improvement by trying to going ahead and gradually **rethink the way airspace is organized and consequently managed**.

Providing the airspace user with the highest possible degree of freedom in flight planning in order to **allow for highly efficient flight routings** is one of the main objective of the entire SESAR Program.

This is captured in the PCP as AF#3, Flexible Airspace Management and Free Route, which may include elements of airspace configuration, airspace allocation and flexible sectorisation. This functionality is expected to **enable a more efficient use of airspace**, thus providing significant benefits linked to fuel consumption and delay reduction.

FREE Solutions demonstration activities will bring effective benefits in terms of fuel savings, reduction of CO2 emissions, improved real-time flight planning capabilities as well as **higher ATM performances, flexibility and efficiency**.
The consortium - led by ENAV S.p.A. - consists of 5 AUs, 5 ANSPs and the NM: ENAV S.p.A., Air France Group, Alitalia, DFS, DSNA, EUROCONTROL/Network Manager, Lufthansa, MATS, Ryanair, Skyguide and Swiss Airlines.
FREE Solutions – Project Overview

FREE Solutions aims to:

• bridge the gap between R&D and deployment

• prove the benefits of identified operational solutions in real-life environment

• address Free Routing operations over a wide multi-FAB continental area as a first step towards the implementation of Airspace Users’ preferred business trajectories

• exploit current ATM system capabilities and ensure more effective FUA operations
The scope of the project is the definition and demonstration of those operational solutions gradually leading to the implementation of FREE Route operations over a multi-FAB continental area in order to improve ATM performances, flexibility and efficiency.

**City-pairs and Direct Routings:** providing performance enhancements in terms of mileage savings, fuel consumption and environmental impacts, combining horizontal and/or vertical efficiency improvements.

**Free Routing:** designing and testing an ad hoc cross-border/multi-FAB Free Route Airspace (FRA) across 4 countries where AUs will be free to fly from a fixed entry point to a fixed exit point on the basis of their business/operational needs.

**Flexible Use of Airspace (FUA):** further exploiting the effective and flexible use of airspace through a more efficient and dynamic civil-military coordination and an enhanced AUs flight planning process.
FREE Solutions - KPAs addressed

• The FREE Solutions project will assess the identified operational solutions performance benefits mainly in the following KPAs:

  – Safety
  – Environment - Fuel Efficiency
  – Predictability and ATC planning
  – Capacity

• ... and Human Performance as Transversal area

• Demonstrating that all identified scenarios are acceptably safe and are not negatively affected by the proposed operational solutions.
FREE Solutions – Stepwise Approach (1)

**STEP 1:** Winter-Spring 2015 (City Pairs live trials)

**STEP 2:** Autumn 2015 (Direct Routing live trials)

**STEP 3:** Winter-Spring 2016 (Free Routing live trials)
# FREE Solutions - Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
<th>Weekend/Weekday</th>
<th>KPAs</th>
<th>Planning (M8)</th>
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<tbody>
<tr>
<td>SCN-LSD0105-001</td>
<td>City-pairs</td>
<td>Weekends</td>
<td>Safety, Environment, Capacity, Predictability, Efficiency</td>
<td>12/04/2015</td>
</tr>
<tr>
<td>SCN-LSD0105-002</td>
<td>City-pairs</td>
<td>Weekdays</td>
<td>Safety, Environment, Capacity, Predictability, Efficiency</td>
<td>12/04/2015</td>
</tr>
<tr>
<td>SCN-LSD0105-003</td>
<td>Direct Routing</td>
<td>Weekends</td>
<td>Safety, Environment, Capacity, Predictability, Efficiency</td>
<td>29/11/2015</td>
</tr>
<tr>
<td>SCN-LSD0105-004</td>
<td>Direct Routing</td>
<td>Weekdays</td>
<td>Safety, Environment, Capacity, Predictability, Efficiency</td>
<td>29/11/2015</td>
</tr>
<tr>
<td>SCN-LSD0105-005</td>
<td>Free Routing</td>
<td>Weekends</td>
<td>Safety, Environment, Capacity, Predictability, Efficiency</td>
<td>31/03/2016</td>
</tr>
</tbody>
</table>
...looking forward taking off FREE Solutions flight trials in March 2015 for optimized City Pairs!
FREE Solutions – towards Deployment

- **ENAV S.p.A** recently performed airspace re-organization
  - The same **Division Levels** were adopted for all Italian ACCs

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### Division Levels Table

<table>
<thead>
<tr>
<th>Level</th>
<th>Sectors</th>
<th>FL</th>
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<tbody>
<tr>
<td>6</td>
<td>Upper Sectors</td>
<td>460</td>
</tr>
<tr>
<td>5</td>
<td>Upper Sectors</td>
<td>365</td>
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<tr>
<td>4</td>
<td>Upper Sectors</td>
<td>335</td>
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<tr>
<td>3</td>
<td>AWY Sectors</td>
<td>305</td>
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<tr>
<td>2</td>
<td>AWY Sectors</td>
<td>285</td>
</tr>
<tr>
<td>1</td>
<td>Terminal &amp; Arrivals Sectors</td>
<td>195</td>
</tr>
</tbody>
</table>

**Upper sectors will become Free Route Airspace from 2017!**
SESAR2020 - PJ23 Multi-FAB FREE Routing is in its preparatory activity to plan further VLDs from 2017 onward
FREE Solutions - Conclusions

FREE to deploy benefits...

implementing our SOLUTIONS
Thank you for your attention
SESAR’S RPAS INTEGRATION DEMO PROJECTS

Célia Alves Rodrigues,
SESAR JU

11 March 2015
World ATM Congress

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Common objectives (1/2)

• Demonstrate how to integrate RPAS into non-segregated airspace;

• Focus on concrete results filling the operational and technical gaps;

• Be relevant at European scale;
• Cover various types and sizes of RPAS;

• Capitalise on the SESAR delivery approach;

• Support paving the way and establishing current state of the art for future SESAR 2020 work on RPAS.
1. **DEMORPAS – Demonstration Activities for Integration of rPAS in SESAR**

   **ISDEF; ENAIRE, INTA, CREDA, FADA-CATEC**
   
   Three types of exercises (live trials) with 2 types of short range fully remotely piloted small aircrafts (SIVA, ALO) and 1 motor glide: STEMME S15) will be performed in April, May and July 2015 in a civil / military airfield.

2. **INSuRE - Integration into non-segregated ATM**

   **IDS; Sistemi Dinamici, Air Navigation Services of the Czech Republic**
   
   Simulations and flight trials on SD-150 Hero piloted from a fixed station on the ground using CPDLC , ADS-B, and TCAS technology to assess technological and operational procedures, as well as safety aspects required to allow safe integration of RPAS into a non-segregated airspace.

3. **RAID – RPAS ATM Integration Demonstration**

   **Cira, Deep Blue, Nextant, Nimbus, University of Malta, MATS**
   
   Demonstrates and evaluates the short-term ATM impact of RPAS integration into unrestricted airspace. Real-time simulations (CIRA facility and simulators in Malta) and flight trials.

4. **MedALE - Mediterranean ATM Live Exercise**

   **Alenia Aermacchi; Selex, ENAV, Nimbus, Thales Alenia**
   
   Gap analysis between existing RPAS capabilities and the procedures/rules required for insertion into non-segregated airspace. Real-time simulations and flight demonstrations with a fully remotely piloted RPAS (Alenia Aermacchi Sky-Y).

5. **TEMPAERIS - Testing Emergency Procedures in Approach and En Route Integration Simulation**

   **DSNA; Airbus Prosky, Cassidian, STERIA, ENAC**
   
   Investigated RPAS performance in low-medium TMA airspace through live flight trials and simulations providing conclusions on low-performance RPAS, including communications and operational latency (compliance with ATC instructions) and handling of non-nominal situations. Demonstrations carried out with MALE OPV.
## ODREA – Operational Demonstration of RPAS in European Airspace

**Rockwell Collins France; DSNA, ENAC, SAGEM**

Real-time simulations and live trials to measure the impact of handling several RPAS arrival, approach and departure procedures in a terminal area alongside piloted aircraft. Sagem’s Patroller OPV used.

## CLAIRE - CiviL Airspace Integration of RPAS in Europe

**THALES UK, NATS, NLR**

Live trials and simulated demonstration exercises using Thales Watchkeeper to investigate different classes of airspace and flight modes. ATC simulation exercises carried out by NATS (en route aspects) and NLR (ground sector and CTA operations). Trials also enable the RPAS to interact with the safety nets incorporated into current ATM processes and systems.

## AIRICA - ATM Innovative RPAS Integration for Coastguard Applications

**NLR, Ntl Coastguard, Schiebel, Royal Netherlands Air Force**

Project will demonstrate a realistic coastguard mission, involving beyond visual line-of-sight flights. Appropriate sensors and onboard detect-and-avoid capabilities are implemented and tested. After take-off from Den Helder Airport, the RPAS flies towards the targeted area, performs its mission in non-segregated airspace, and returns.

## ARIADNA - Activities on RPAS Integration Assistance and Demonstration for operations in Non-segregated Airspace

**Indra Sistems, ENAIRE, CRIDA, Fada-Catec**

Satellite-Based Augmentation System (SBAS) approach and landing at an aerodrome; plus concepts for RPAS Ground-Based Situational Awareness System (GBSAS). Condor platform will be used.
Initial high-level recommendations

Regulatory issues

• The status of testing RPAs for these type of activities (aimed to collect data and investigate safety measures) should be recognised and the obtaining of permits simplified;

• The definition and standardization of Permit to Fly acquisition procedures is desirable - the definition of specific test areas for such purposes would be welcome;

• Simplified procedures / standard phraseology / better military/civil coordination are desirable.
Initial high-level recommendations
Integration

• RPAS integration should not hamper aviation network capacity and should not result in any (major) change of existing SES rules;

• Recommended to keep the RPAS mission very regular and predictable so that the light aircraft can perform the necessary adjustments to establish the under-separation condition;
Further R&D on ADS-B, especially for Light RPAS (and in particular for “small” RPAS) is recommended: miniaturization will make possible to equip even the smallest RPA and make them “visible” to any other airspace user;

Larger, cross-borders demos needed;

Need to promote aviation education especially to the low end RPAS manufacturers (SMEs).
Thank you for your attention
RPAS CLAIRE DEMO PROJECT
CIVIL AIRSPACE INTEGRATION OF RPAS IN EUROPE

EMMA BELL & NEIL WATSON
THALES UK

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Agenda

• Introduction

• Exercises & Scenarios

• Regulatory & Approvals

• Initial Findings
Introduction

**Key Objectives**
- To operate an RPAS within a non-segregated mixed traffic environment & demonstrate ATM procedures that need to be applied within different classes of airspace
- To undertake a series of live flights using a certified RPAS enabling the completion of an extended Safety Case using Hazard Analysis for flights in non-segregated airspace
- Key activities will also include logistical planning; agreed Contingency Management procedures; ATC sector hand-over

**Validation Approach**
- Simulation exercises will identify technical and operational gaps and inform flight trials using a true RPAS with regulatory approval from both civilian and military authorities
- A Safety Case will be completed and approved for both RPAS platform and airspace utilisation

**Consortium Partners**
- Thales UK (consortium coordinator)
- NATS (ANSP)
- NLR
EXERCISES & SCENARIOS
Exercise 1

- Hosted by NLR (May & Oct 2014)
- Scenarios
  - Approach and landing of RPAS in mixed traffic environment (IFR/VFR)
  - Descent into TMA and guidance towards final approach for landing
  - Take-off and departure
  - Go-Around / Missed approach
  - Failure of communication
  - Adverse weather conditions during approach into destination airfield. Interaction RPAS - ATC for alternative routing

Scenarios (Exercise 2 & 3)
Scenarios (Exercise 2 & 3)

Route Key:
- Route X (Yellow): WWA – D291 – L9 – D211 – West Wales Airport
- Route Y (Green): WWA – D291 – L9 – TDA – Return via Sammybridge Corridor (D332)
Exercise 2

- NATS SPACE Simulation – June 2014
- Verification of the ATM procedures associated with the operation of RPAS in controlled, multi-agency, mixed traffic non-segregated airspace using the agreed scenarios
- Multiple separate sectors with dedicated ATCOs
  - Handover procedures (Approach and Area)
- Operational Concept demonstrated in UK airways structure
- Additionally, emergency and contingency procedures were demonstrated including:
  - Loss of link
  - RPAS communication failure
  - SSR transponder failure
  - Engine and / or control problems
  - Weather / traffic related issues
REGULATORY & APPROVALS
Watchkeeper & Approvals for Trials

- First UK RPAS Certified for Release To Service (RTS) in Feb 2014
- Current operations limited to segregated airspace and military theatre
- CLAIRE flights will be performed under a Military Flight Test Permit (MFTP)
- MFTP is the equivalent of the RTS for a trial
  - Defines the conditions for operations during the trial
  - Identifies trial specific limitations or exemptions (waivers)
  - Supported by a Trials Risk Assessment (TRA)
- Watchkeeper does not currently have a DAA System fitted
  - Waiver required as this precludes flight in unsegregated airspace
  - PROHIBITS flight in unsegregated Class G airspace

- Due to lack of DAA, CAA requires Temporary Danger Areas (TDAs) to be developed to provide a safeguarded Glide Route to Emergency Recovery Positions (ERPs)
  - Cover for engine failure contingency
CLLAIRE TDAs
Exercise 3 Status

- **UK MoD**
  - Authorisation to perform Yellow and Green routes

- **NATS**
  - Draft Airspace Temporary Operating Instructions available
  - Airspace Safety Case to be submitted to CAA for information 30 days before flights

- **AIS (NATS)**
  - AIC to be published on next AIRAC cycle – 19 March
  - TDAs activated by NOTAM

- **CAA**
  - TDA Application currently in review

- **Flight Approval / Authorisation**
  - Hazard Analysis complete – no new hazards, some new mitigations
  - Trials risk assessment complete and submitted to MAA (and CAA)
  - Flights scheduled for second half of April
  - Communications license obtained
  - Insurance arrangements on-going

- **Cardiff Airport**
  - Cardiff Airport engaged and supportive
  - Deployment plan agreed
INITIAL FINDINGS
Initial Findings

Exercises 1 & 2 complete – Results consistent

- **Normal RPAS Operation:**
  - Unmanned aircraft made little or no difference to ATM operations
  - ATCOs developed techniques for RPAS operations
  - Operational transponder considered essential
  - Control Station handovers seamless

- **Abnormal Events and Situations:**
  - Increase in ATCO workload
  - Slow speed of RPAS considered positive and negative
  - RPAS considered significantly more predictable than manned aviation
  - Specific procedures required for backup comms between ATSU and RPAS Pilot
  - Sector Handovers gave no problems

- **Contingency Planning and Management:**
  - Key area, unique to RPAS
  - Need to agree how much information is shared with ATC
  - Need to agree phraseology
Thank you for your attention
ODREA
OPERATIONAL DEMONSTRATION OF RPAS IN EUROPEAN AIRSPACE

Eric THOMAS (RCF) & Catherine RONFLE-NADAUD (ENAC)
On behalf of the ODREA Consortium

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Agenda

• Project Overview

• Tailored Trajectory into LFBO

• Initial Findings &

• Lessons Learned

• Recommendations
Project Overview: Consortium

Aeronautics Industry Coordinator

RPAS Manufacturer and Operator Resp. Demonstrations

ANSP Resp. Simulations

Civil Aviation Univ. Resp. Dissemination & Procedures Definition

FROM INNOVATION TO SOLUTION
Project Overview: Objectives

1. Define and Validate Procedures for RPAS (SID, STAR...)

2. Investigate and Demonstrate (Simu + Flight):
   - Capability to integrate an RPA into the managed traffic of a mid-size commercial airport
   - Capability to conduct missions in lower airspace, incl. abnormal situations (C2 link loss, D&A)
Project Overview: Achievements

Fast Time Simulations (EXE-RPAS.06-01)

Summer 2014 + Winter 2014
Actual D&A s/w in EASY™ Simulator
800,000+ Fast Time Runs

Procedures Definition

Real Time Simulations (EXE-RPAS.06-02)

Feb-2014 / Apr-2014
Tailored Trajectories
“RPA Perf. in ATM”

Oct-2014
Blagnac – Eragny
2x7 ATCo; 2x45’ exe

Demonstration Flights (EXE-RPAS.06-03)

Nov-2014
Toulouse Area
10+ Integrations; 5 D&A
Project Overview: RPAS and Test Sites

Sagem’s Patroller:
- 1 Ton Class RPA
- Long Endurance Operations
- Based on EASA Certified S6
- Authorizations & Permit to Fly
- RPA and OPV Modes

Sagem’s D&A Demonstrator:
- Coop / Non-Coop Sensors
- Collision Avoidance Algorithm

Muret-Lherm GenAv aerodrome (88,000 mvt/y)

Toulouse-Blagnac Int’l Airport (95,000 mvt/y)
Tailored Trajectory into LFBO

Tailored Trajectory Allowing RPA Between 2 Commercial Flights
Initial Findings & Lessons Learned

• Integrating an RPA into the Managed Traffic of a Mid-Size Commercial Airport is Feasible:
  – RPA Similar to Any Other Light Aircraft
  – Tailored Trajectories and Pre-Defined Procedures are Efficient (Predictability)
  – No Impact on Safety; Concerns from ATCo on Capacity

• Industry-ANSP-CAA Collaboration Was Key to Success
  – Efficient Trajectories & Procedures Definition
  – Relevant and Realistic [FT & RT] Simulations
  – [Long but] Smooth Approval Process
  – Successful and Numerous Live Flights Validating RPA Specific Procedures

• 1st Step in Demystifying RPAS towards ANSP and CAA
Recommendations

• New R&D Projects on:
  – **Detect & Avoid**: Simulation / ACAS X / WXR / Eu Airspace
  – **RPS HSI**: RT Simulation / Advanced Concepts
  – **C2 DL**: C-Band RLOS-BRLOS / Network / Cyber-Security

• New Demo Projects on:
  – **Flight Planning**: Degraded Modes / Mission / 4DT / SWIM
  – **ATM / RPAS Communication**: Network / VoIP / CPDLC / SWIM
  – **Iterative Integration**: Mission / Airspace / Equipage / ATC-RP
  – **“Large Scale” Insertion**: Multiple RPA(S) / X-Border / FAB / SWIM
Thanks for your attention
CONCLUSIONS

Alain Siebert,
SESAR JU

11 March 2015
World ATM Congress