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SESAR INTEROPERABILTY DEMONSTRATIONS

(Presented by Lithuania on behalf of European Union and its Member States[1]; by the other Members States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper presents information on Single European Sky ATM Research's (SESAR) current and planned activities to run interoperability validations and demonstrations to support development and deployment of the technologies as described in the European ATM Master Plan which is aligned to the *Global Air Navigation* Plan (Doc 9750) and its Aviation System Block Upgrades (ASBUs). The SESAR Programme has since its outset organized interoperability demonstration activities, which enable the active participation in the change process of operational actors. So far, more than sixty five partners, including twenty airlines and general aviation partners covering more than five thousand commercial flights, eighteen air navigation service providers (ANSPs), six airports and over twenty manufacturing industry partners and the militaries, have successfully participated in these activities. The SESAR interoperability demonstrations are covered under the SESAR Programme and further demonstrations are planned for 2014/2015. The main goal of the SESAR interoperability demonstrations is to assess in real operational environments the gains that would be enabled by improved procedures and systems as well as seamless transfer of information between service providers (e.g. ANSPs and airports) and airspace users in the ATM network to promote more efficient ATM operations across Flight Information Regions.

Strategic Objectives:	This working paper relates to all Strategic Objectives.
Financial implications:	Not applicable.

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 Europe believes that the ICAO-proposed ASBUs proposed in the edition of the ICAO *Global Air Navigation* Plan (Doc 9750) submitted to this session of the Assembly is the best possible approach to reaching the international aviation community's modernization goals. The ASBUs enable global interoperability and allow for flexibility and scalable building blocks. Although every item within the ASBU system is not applicable to every State, each State will need to accept (in accordance and compliance with the particular national legal framework, i.e. SES regulations,…) the new Standards and Recommended Practices (SARPs) that will be required to support the ASBUs.

1.2 Europe's programme for modernization is called the Single European Sky ATM Research (SESAR), which constitutes the technological pillar of the Single European Sky (SES) initiative. SESAR is embodied in the European ATM Master Plan. The SESAR Joint Undertaking (SESAR JU) is the organisation developing, executing and maintaining the European ATM Master Plan. SESAR represents a paradigm shift in ATM, as a more air-ground integrated ATM system which will lead to a fundamental change in the management and operation of flights. It includes advancements in operational procedures and technologies as well in the domains of communication, navigation and surveillance (CNS), safety, energy, and the environment.

1.3 In an effort to increase the compatibility of air navigation systems regionally and across the globe, the SESAR Programme is running interoperability validation activities and demonstrations across most domains of ATM, following the direction set in the European ATM Master Plan which directly relates to GANP and the ASBU modules. The purpose of these validation activities and demonstrations is to bring together stakeholders from all fields of ATM in real life operational environments to illustrate the beneficial impact of interoperable ATM network operations. The demonstrations during recent years (refer to the Appendix to this WP) have involved many ATM partners inside and beyond Europe and in several cases (as in the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) initiative) they have already resulted in the changing of operational procedures and investment plans in the direction set in the GANP. It is now time to expand these demonstrations one step further in the global context by inviting other regional modernization programmes to join in.

1.4 Complementary to its main development and interoperability activities, the SESAR Programme has also launched a number of demonstration projects to help bridge the transition from development to operational deployment. One of these projects, the Interoperability Cross-Atlantic TrialS (ICATS), is interconnecting European and US flight data processing systems in shadow mode, using SWIM developments from both sides, to demonstrate in a real environment the possible operational benefits of having available timely and accurate flight information. A specific call for Remotely Piloted Aircraft Systems (RPAS) demonstrations have been offered in 2013 and nine projects have been selected involving thirty eight companies in eight States starting before the end of 2013.

1.5 For 2014, the SESAR Programme intends to further extend its demonstrations of interoperability at the global level through global demonstration of SWIM services, with the seamless transfer of data between service providers (e.g. ANSP´s and airports) and airspace users in the ATM Network, to ultimately promote more efficient operations across Flight Information Regions (FIRs). These SESAR interoperability demonstrations will help participants observe the benefits of using up-to-date and more efficient modes of communication to transmit data (including flight plans) and thereby creating greater service efficiencies in the ATM system. Results will be disseminated to further visualize the interoperability performance impact.

1.6 The SESAR JU is building on the very successful approach already taken with the SWIM Master Class, and combining it with a call for further demonstration activities. SESAR will encourage its members and other organisations around the globe to put in place interconnected SWIM compliant technical infrastructure on which interoperability demonstrations will be organised with specific scenarios using various SWIM services covering different information domains that fit with the foreseen first SESAR deployments. SESAR JU will actively seek participation from all actors around the globe with which memoranda of understanding and or collaboration will or have been established. Within the SESAR framework further demonstrations focussed on global interoperability of SWIM services can hence be expected for the end of 2014, while it can be foreseen that these demonstration activities will continue into 2015.

2. DISCUSSION

2.1 The success of global modernization efforts depends in part on effective service collaboration with national and international civil and military airspace users, airport operators and service providers. To operate across borders regionally or globally, operators must be able to easily traverse multiple FIRs. To facilitate this, the SESAR demonstrations seek to advance collaborative pre-flight and in-flight information services exchanges amongst ATM partners. They directly support the concepts included in the GANP, and are cognizant of the SARPs, and guidelines that need to be developed for modernization, as articulated in the ASBU concept.

2.2 To participate in the SESAR interoperability demonstrations, operators or service providers need to be able to link, through their own SWIM infrastructure. Participants will be asked to provide and consume live or simulated data, while observers will be able to monitor and better understand how the data is used and shared.

2.3 The goal is to demonstrate how service providers and airspace users can be more interoperable and how the sharing of common flight information will boost their capabilities in order to:

a) Improve collaborative decision-making (CDM);

b) Improve safety, efficiency, capacity and cost-efficiency of air traffic management (ATM);

c) Promote an international service registry and global standardization of flight information;

d) Reduce the reliance on antiquated flight plan formats.

2.4 The SESAR Programme demonstrates the interoperability and applicability of different ATM stakeholders' infrastructures through a SWIM registry using ISRM (Information Service Reference Model), defined services and global data exchange models derived from AIRM (ATM Information Reference Model) for flight, aeronautical and weather information using the FIXM (Flight Information Exchange Model), AIXM (Aeronautical Information Exchange Model), WXXM (Weather Information Exchange Model) standards as well as EUROCAE/RTCA/ARINC globally used formats.

2.5 The SESAR interoperability demonstrations provide a scenario using simulated or live ATM data in support of the concept of a seamless global sky. They enable service providers and airspace

users to determine their current capabilities and level of compatibility with other ATM systems, and will also help States determine what changes, if any, are needed to further harmonize on the international level. The demonstrations help to identify and convey the benefits that can be achieved through greater global harmonization of data exchange.

2.6 Assessing the compatibility of information models and of services designed to share flight information will also work to improve the fidelity of predicted flight behaviour and enable the optimization of planning for all phases of the flight. We believe this will ultimately reduce the dependence on antiquated flight plans formats and support the global concept of seamless flight operations and interoperability.

2.7 The SESAR interoperability demonstrations are ongoing and under development and to be held with a wider range of regional and global ATM partners in the 2014/2015 timeframe. If ICAO is planning a 2014 Block Upgrade Demonstration Showcase and Symposium (BUDSS), which may be planned to be held by ICAO in Montreal, The SESAR work will also be presented and demonstrated as required. In addition, it is intended to provide the international community, including ICAO's relevant panels, with feedback on the main results of SESAR demonstrations.

3. CONCLUSION

3.1 This paper has presented information on SESAR's current and planned activities to run interoperability validations and demonstrations to support development and deployment of the technologies described in the European ATM Master Plan and also the Global Air Navigation Plan. The SESAR Programme has since its outset organized interoperability validation and demonstration activities, which enable the active participation of operational actors to the change process.

3.2 So far, more than sixty five partners, including twenty airlines and general aviation partners covering more than five thousand commercial flights, eighteen ANSPs, six airports and over twenty manufacturing industry partners and militaries, have participated successfully in these activities and further demonstrations are planned for 2014/2015, enabling the assessment in real operational environments of the operational gains that would be enabled by improved procedures and systems as well seamless transfer of information between service providers and airspace users in the ATM Network to promote more efficient ATM operations across FIRs.

3.3 The Assembly is invited to note the information provided in this paper, and States/observers are invited to consider participating in, contributing to, or observing, the SESAR interoperability demonstrations.

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APPENDIX

SESAR DEMONSTRATION PROJECTS

This appendix provides a summary of performed, on-going and planned SESAR demonstration projects. Further details can be found on the SESAR Joint Undertaking website, www.sesarju.eu.

AIRE I – 2009 - 2010

Domain	*Location*	*Number of trials*	*CO2 benefits per flight (kg)*
Surface	Paris, France	353	190-1200
Terminal	Paris, France	82	100-1250
	Stockholm, Sweden	11	450-950
	Madrid, Spain	620	250-800
Oceanic	Santa Maria, Portugal	48	90-650
	Reykjavik, Iceland	38	250-1050

AIRE II – 2010 - 2012

Domain	*Project*	*Location*	*Number of trials performed*	*CO2 benefits per flight (kg)*
Surface	Greener airports under adverse conditions	Paris, France	1800	79
	Airport CDM	Vienna, Austria	208	54
Terminal	B3 – applying partial CDOs to the maximum extent	Brussels, Belgium	2094	160-315
	DoWo – Down wind Optimization	Paris, France	219	158-315
	REACT-CR – CDAs in TMA	Prague, Czech Republic	204	205-302
	Less CO2 emissions during transition from en-route to final approach	Cologne, Düsseldorf, Germany	362	110-650
	RETACDA2 – CDAs from TOD comparing time deviations planned/real	Madrid, Spain	210	250-800
Oceanic	DORIS – more efficient transoceanic routes	Santa Maria FIR, NY FIR	110	3134
	ONATP - Free Route Airspace	Lisbon, Portugal Casablanca, Morocco	999	526
	ENGAGE – transatlantic efficient flight by varying aircraft altitude and/or Mach	Shanwick FIR, Gander FIR	23	1310
	RlongSM – reduced longitudinal separation minimum on efficiency of a flight	Shanwick FIR, Gander FIR	53	441
Gate-to-Gate	Green Shuttle – city pair flight optimisation through improved ATM procedures, CDAs	Paris, France Toulouse, France	60	221/788
	Transatlantic A380 Green Flights – optimised ground and cruise	New York JFK, Gander OCA, Shanwick OCA	15+4	1200-1900

Domain	*Project*	*Location*	*Number of trials performed*	*CO2 benefits per flight (kg)*
	operations			
	Transatlantic green flight PPTP – optimised FMS calculation, improved operational and weather data	Paris, France, Pointe-à-Pitre, Shanwick FIR, Santa Maria FIR, New York FIR	1+8+8	2090+1050
	Greener Wave – optimising sequencing of long-haul arrivals to save fuel	Zurich, Switzerland	1700	504
	VINGA – exploiting state-of-the-art aircraft capabilities, RNP and best practice Gate-to-Gate	Gothenburg, Sweden	189	70-285
	AIRE Green Connection – city pair trials using RNP-AR	Gothenburg and Stockholm, Sweden	25	220
	Trajectory based night time CDAs at Schiphol airport	Amsterdam, The Netherlands	124	tbc

AIRE III – 2012 - 2014

Domain	*Project*	*Location*	*Number of trials planned*	*(Expected) CO2 benefits per flight (kg)*
Terminal	CANARIAS – reduction of track miles through optimized vertical and horizontal paths	La Palma, Lanzarote, Spain	50 + 50	50-100 40-80
	AMBER RNAV STARS and RNP-Arrivals	Riga, Latvia	100	50-100
	REACT-PLUS – CDAs and CCDs	Budapest, Hungary	CDA:200 CCD:100	50-70 20-50
	OPTA-IN – speed control concept and ATC tools	Palma de Mallorca, Spain	50	120-230
Oceanic, En-route	SMART – most economical route under actual met conditions	Lisbon FIR, Santa Maria FIR, New York OCA	250	1% fuel save
	SATISFIED – flexible optimized oceanic routes	EUR-SAM Corridor	50	3000
	ENGAGE Phase II – progressive step climb and continuous altitude change	North Atlantic	75-100	1300
	WE FREE – free routes during weekends	France, Italy, Switzerland	50+	
Gate-to-Gate	MAGGO – quick enhancements in ACC and TWR communications and Surveillance	Santa Maria FIR and TMA and the Azores, Portugal	250 550 500	0.5% fuel save

SESAR solutions demonstrations – 2012 – 2014

Domain	*Project*	*Location*	*Participation*	*Number of trials planned*
Terminal	FAIRSTREAM – use of Target time of Arrival (TTA) instead of Calculated Take Off Time(CTOT) when	Zurich, CDG, Munich	DSNA, DFS, Skyguide, Air France, Lufthansa, Airbus ProSky	60

Domain	*Project*	*Location*	*Participation*	*Number of trials planned*
	sequencing traffic to airports			
Surface	DFLEX – departure flexibility at Paris CDG- new collaborative Pre-departure sequence management system	Paris, France	Air France, Aéroport de Paris, Airbus Prosky/Metron, DSNA, EUROCONTROL, FedEx	60
Network, Terminal	NEWBRIDGE – time based coordination of air traffic movements	Network	LFV, Airbus Prosky, Boeing Research & technology Europe, EANS, EGIS AVIA, Estonian Air, EUROCONTROL, GosNIAS, TF, NLR, Novair, RCF, SAS, Swedavia	3000-4000
En-Route	FRAMAK – Free Route Airspace	Maastricht, The Netherlands, Karlsruhe, Germany	DFS, DLH, EUROCONTROL	
Terminal	NASCIO– demonstrating the NAV specs in the new PBN Manual	Barcelona, Spain	Pildo Labs, Aeroports de Catalunya, LPR, CAT Helicopters, CAA SK, ONDA, DHMI, BULATSA	56
Network	TOPMET – Met service provision to airlines and ANSPs	Brussels Airlines, Belgium DSNA, France	Thales Air Systems, Thales Avionics, EUMETNET EIG, DSNA, Brussels Airlines	20
Oceanic, Terminal	TOPFLIGHT – Optimized Gate-to-Gate trajectories including AMAN	UK, North-Atlantic	NATS, British Airways, NAVCANADA	Around 400
En-Route, Terminal	AFD – ATC Full Data link	London Rome city pair flight	ENAV, SELEX, SITA, NATS, Airbus ProSky, Air France, Boeing, EasyJet Airline	36
Oceanic	ICATS – Interoperability Cross Atlantic showing regional ground systems interoperability	Spain, Portugal to US transatlantic flights	INDRA, AENA, NAV Portugal, Lockheed Martin UK, Air Europa, CRIDA	40

RPAS ATM integration – call on-going 2013 – 2015

Nine Projects awarded involving thirty seven companies in eight States (UK, The Netherlands, France, Spain, Italy, Czech Republic, Malta and Germany

SESAR Solutions Demonstrations - phase II – under planning for 2014- 2016

Demonstrations aimed at bridging and supporting the process of moving from development and deployment as well as focussing on global interoperability as per the WP.

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