SESAR Showcase

A Conference & Exhibition of SESAR 1 Results

Amsterdam, 14-16 June 2016

SESAR JOINT UNDERTAKING

2016

Welcome

Florian Guillermet,

Executive Director, SESAR JU

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Amsterdam, 14-16 June 2016

Keynote speeches

Marian-Jean Marinescu,

Member of the European Parliament

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Amsterdam, 14-16 June 2016

Opening remarks

Maurizio Castelletti,

Head of Unit Single European Sky,

DG MOVE, European Commission

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Amsterdam, 14-16 June 2016

Opening remarks

Frank Brenner,

Director General, Eurocontrol

Vice-Chair of the SESAR JU Administrative Board

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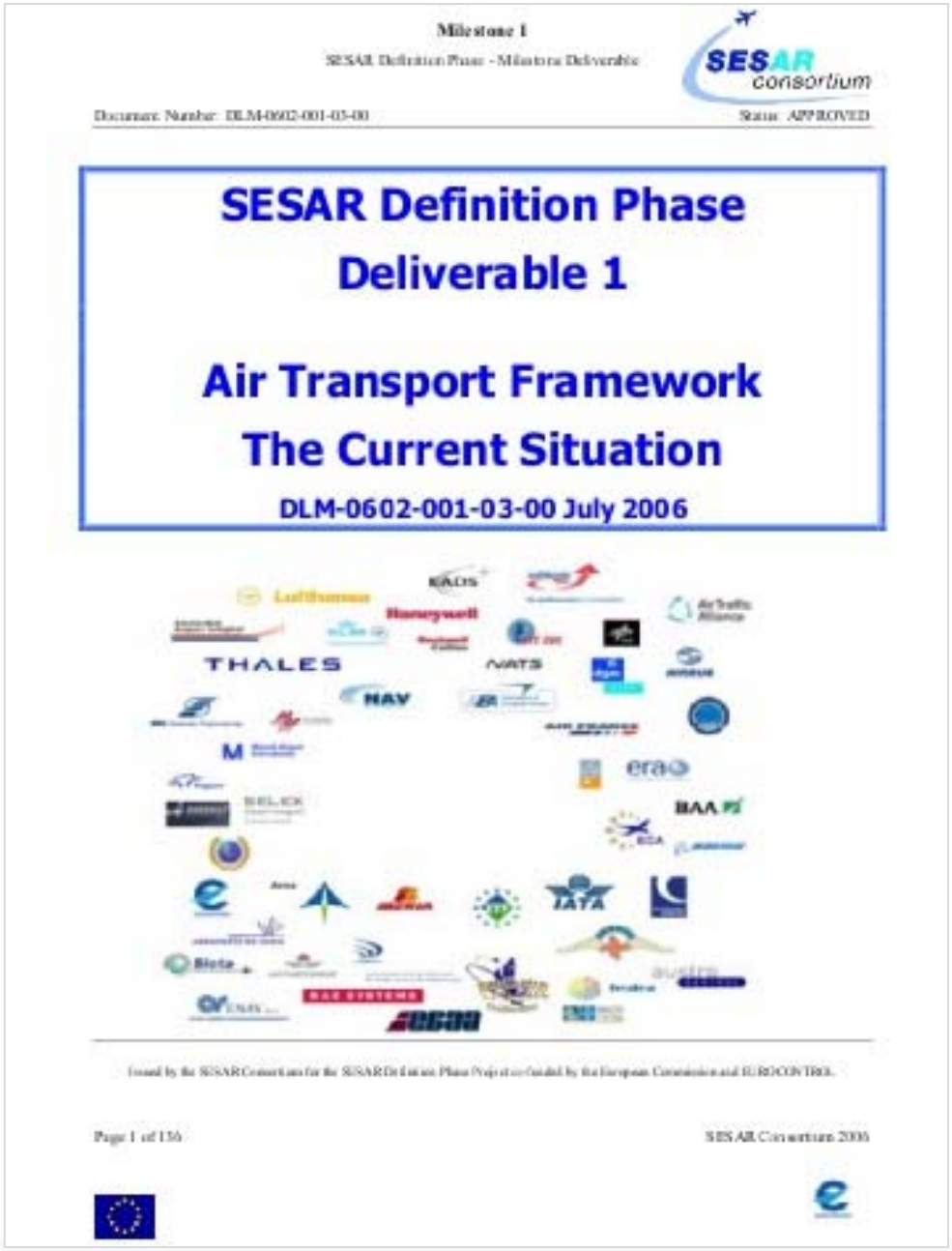
Amsterdam, 14-16 June 2016

Memories…



Milestone 1

SESAR Definition Phase - Milestone Deliverable

SESAR consortium

Document Number: DLM-0602-001-03-00 Status: APPROVED

SESAR Definition Phase

Deliverable 1

Air Transport Framework

The Current Situation

DLM-0602-001-03-00 July 2006

Page 1 of 136

SESAR Consortium 2006

EUROCONTROL

The Plan


SESAR
THE ROADMAP FOR DELIVERING HIGH PERFORMING AVIATION FOR EUROPE
European ATM Master Plan
Executive View
Edition 2015
EUROPEAN UNION
EUROCONTROL

Deliverables

Airport:	PBN, Extended AMAN, RECAT EU, TBS, A-CDM, TAM
En-route:	Free Routes Airspace, AFUAS, Medium-term conflict detection
Network:	Short-term airspace measures, Rolling Operations Management, i4D
Infrastructure:	SWIM

Disruptive Innovation

« An innovation that created a new market and eventually disrupts an existing market and value network displacing established market leaders and alliances ».

Wikipedia

Virtualisation - Remote TwR

Virtualisation - Centre

Centre 1
Maastricht

Centre 2
Ljubljana

Centre 3
Belgocontrol

Data
Centre

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Frank Brenner
Director General EUROCONTROL

Opening remarks

Martin Rolfe,

CEO NATS

Vice-Chairman of CANSO Europe

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Amsterdam, 14-16 June 2016

Opening remarks

Simon McNamara,

Director General, ERA

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A bit of history….

Paris/Brussels, 14 June 2005

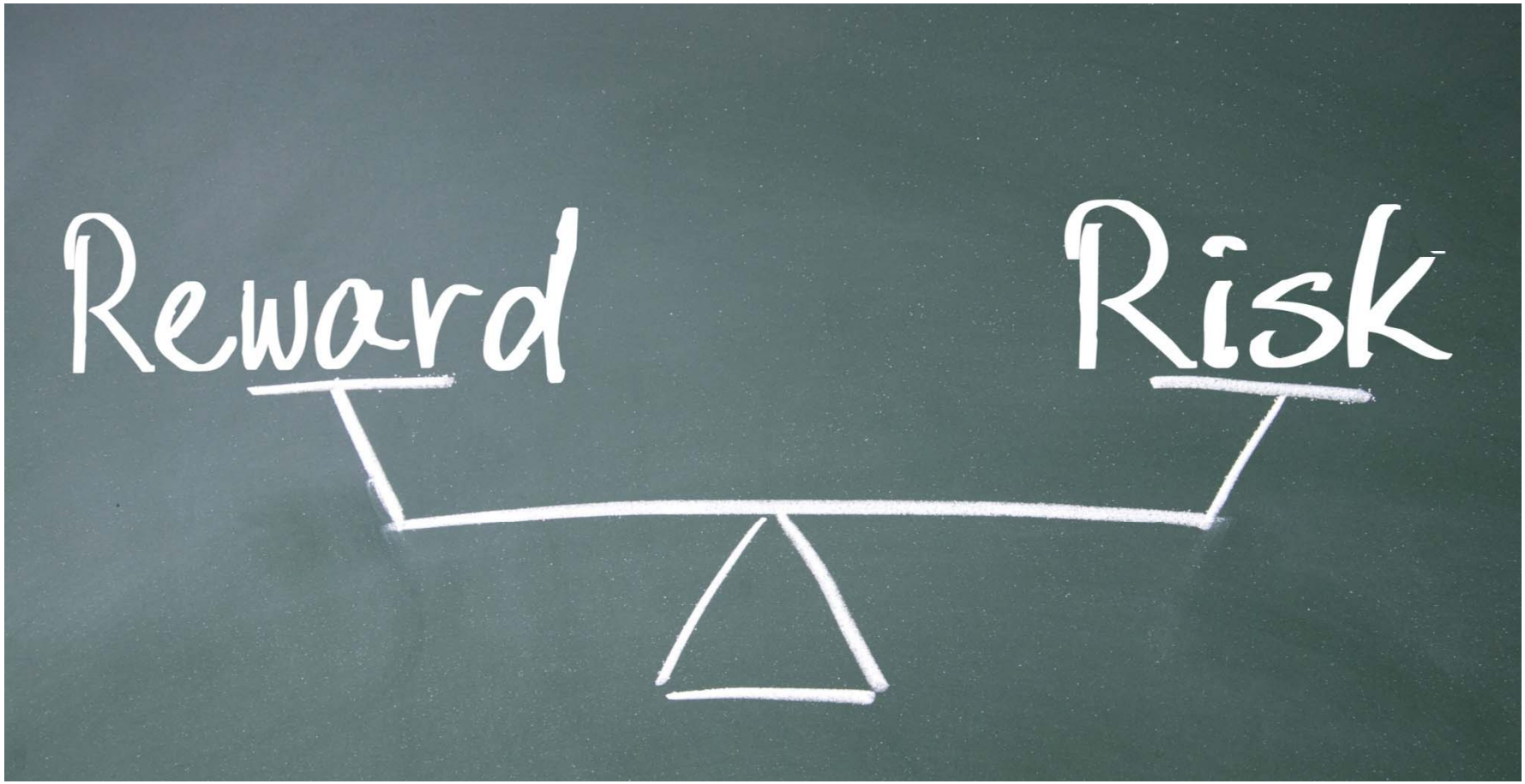
SESAME: European Commission and Eurocontrol announce imminent launch of Definition Phase

In a press conference held during the Paris Airshow, Jacques Barrot, Vice-President of the European Commission and Víctor M. Aguado, Director General of Eurocontrol, announced the imminent launch of the Definition Phase for SESAME, the modernisation programme for European air traffic control infrastructure, which is one of the key elements in the development of the Single European Sky.

"SESAME is a programme of strategic importance for Europe and its Single European Sky. We need new technologies and procedures to accommodate air traffic growth and to increase safety. It is also a major industrial initiative which will boost growth and create new high added-value jobs in Europe. The Commission appreciates the fruitful partnership which has been built with Eurocontrol, and looks forward to an imminent launch of the work" said Jacques Barrot. "There is a lot of work still to be done, but the impressive level of commitment and expectations of the industry in this project is a guarantee for success" concluded the Vice-President.

The importance of promoting SESAR

Weighing up the risks and rewards



Meeting different user needs

Conclusion

Keep delivering the benefits

PLENARY 1

Improving network management and flight planning

Moderated by Michael Standar, Chief Strategy & External Relations

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Amsterdam, 14-16 June 2016

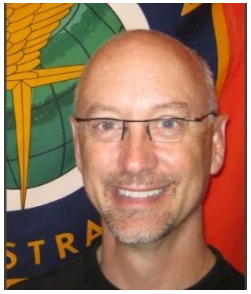
Plenary 1: Improving network management & flight planning

Frank Goldnadel,
Chief Airport Operations Officer & Paris CDG Manager Director (Group ADP)

Joe Sultana
Director Network Manager, Eurocontrol

Rafael Schvartzman,
Regional Senior Vice President for Europe, IATA

Todd Donavon,
Vice President, Strategy & Marketing - Air Traffic Management, Thales



Donald Ward, Head of NextGen International Office, FAA

15:15 – 15:45	**COFFEE BREAK**		
15:45 – 16:45	**Improving network management and flight planning** *Moderated by Peter Alty, SESAR JU*	**More efficient airport operations** *Moderated by Robin Garrity, SESAR JU*	**Efficient flight operations and air navigation service provision** *Moderated by Olivia Nunez, SESAR JU*
	Auditorium, floor 2	***Theatre, floor 2***	***Panorama hall, floor 5***
	A1 A1.1. Airspace users reducing delay costs with the user driven prioritisation process (UDPP), *Nadine Pilon, Eurocontrol & Olaf Belzer, SABRE* A1.2. Departure flexibility (Dflex) at Paris Charles de Gaulle (SESAR Demonstration Project), *Melanie Grandmaire, Air France & Kamal Amri, Aéroports de Paris*	**C1** C.1.1 Precision approaches using GBAS Cat II/III, *José Manuel Rísquez Fernández, ENAIRE & George Papageorgiou, Honeywell* C.1.2 Time-based separation , *Robert Graham, Eurocontrol & Mark Watson, NATS*	**B1** B1.1 Conflict detection and resolution aid to controllers, *Jean-Louis Garcia, DSNA* B1.2 Advanced separation management tools and new controller organisation schemas, *Leticia González Mota, Indra* B1.3 Conflict detection and resolution aid to planner controllers, *Roberta Pigliacampo, Leonardo-Finmeccanica*

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2016

Long-term and innovative research (WPE): Lessons learned

Keir Fitch,

Head of Unit
Research and Innovative Transport Systems (DG MOVE)

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Amsterdam, 14-16 June 2016

Introducing SESAR WPE

Colin Meckiff,

Head of Long Term and Innovative Research, Eurocontrol

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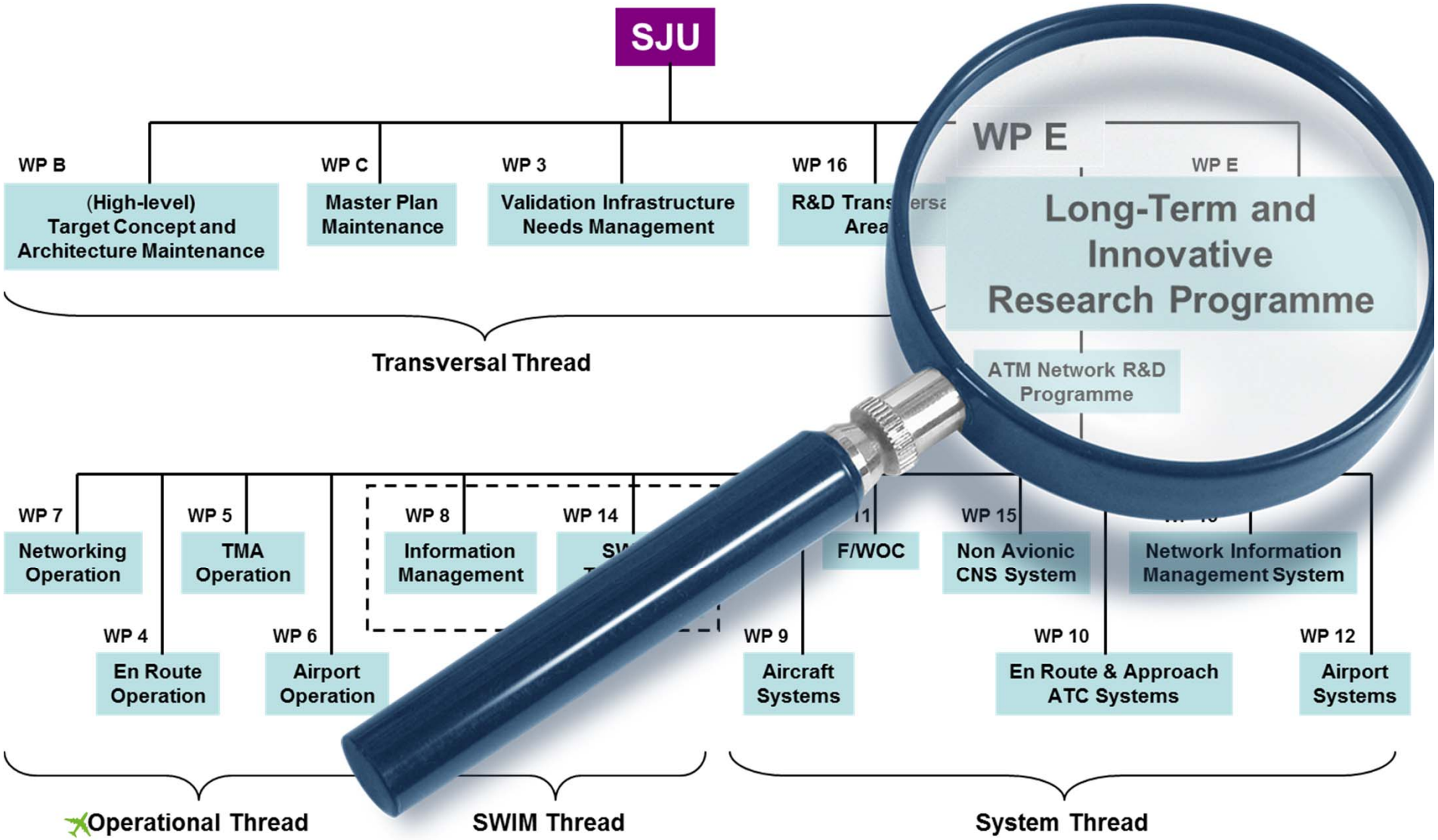
Amsterdam, 14-16 June 2016

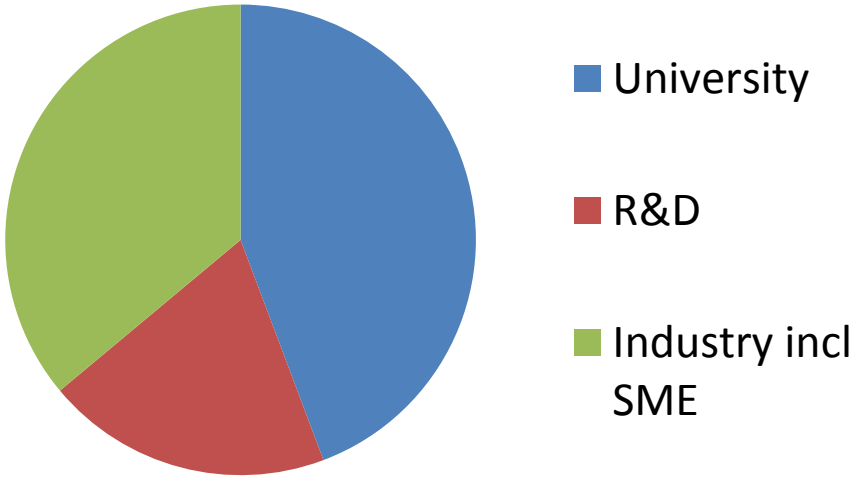

SJU
WP B
(High-level) Target Concept and Architecture Maintenance
WP C
Master Plan Maintenance
WP 3
Validation Infrastructure Needs Management
WP 16
R&D Trans ersa Area
WP E
WP E
Long-Term and Innovative Research Programme
ATM Network R&D Programme
Transversal Thread
WP 7
Networking Operation
WP 5
TMA Operation
WP 8
Information Management
WP 14
SW
11
F/WOC
WP 15
Non Avionic CNS System
Network Information Management System
WP 4
En Route Operation
WP 6
Airport Operation
WP 9
Aircraft Systems
WP 10
En Route & Approach ATC Systems
WP 12
Airport Systems
Operational Thread
SWIM Thread
System Thread

Much was done with limited budget

Overall WPE budget was €23m

More than 70 organisations were funded following open calls

Average project co-funding (usually 2-4 partners): €525k



WPE networks

We had two (thematic) research networks

They did:

Studies, books, articles, workshops, summer schools … and also managed 20 PhDs

ComplexWorld - complex systems research in ATM

www.complexworld.eu

HALA! - higher automation levels in ATM

www.hala-sesar.net

WPE projects

We ran 40 research projects in a number of themes applied to ATM:

- Mastering complex systems safely
- Higher levels of automation
- System architecture and design
- Information management, uncertainty, optimisation
- Enabling change (economics, legal, performance)

http://www.sesarju.eu/innovation-solution/exploratory-research

A few project teasers…

POEM: Passenger-oriented enhanced metrics

ZeFMaP: Zero failure at maximum productivity in safety critical control rooms

NINA: Neurometrics indicators for ATM

ALIAS: Addressing liability impact on automated systems

CASSIOPEIA: Complex adaptive systems for optimisation of performance in ATM

RobustATM: Robust optimisation of ATM planning by modelling of uncertainty impact

SCLOUD: Secure data cloud

MOTA: Exploring gradual transition towards modern taxiing

ACCESS: Application of agent-based computational economics to strategic slot allocation

ASHiCS: Automating the search for hazards in complex systems

The SESAR Innovation Days (SIDs)

- A key forum for sharing research results and for networking
- Showcase for WPE projects, also open to non-SESAR papers
- Quality ensured by triple review, now SCOPUS listed

Hosted by WPE partners:

- 2011: ENAC Toulouse
- 2012: TU Braunschweig and DLR
- 2013: KTH Stockholm
- 2014: UP Madrid
- 2015: University of Bologna

Many consortia in WPE and S2020 ER were born at the SIDs


6th SESAR Innovation Days
8-10 November 2016
hosted by Technical University of Delft
Delft, The Netherlands
http://www.sesarinnovationdays.eu/

Thank you
for your attention

More information:

Colin.meckiff@eurocontrol.int

Strategic Allocation of Traffic Using Redistribution in the Network - SATURN

Lorenzo Castelli,

University of Trieste

k]kYj&k¢'† {y›}
Amsterdam, 14-16 June 2016

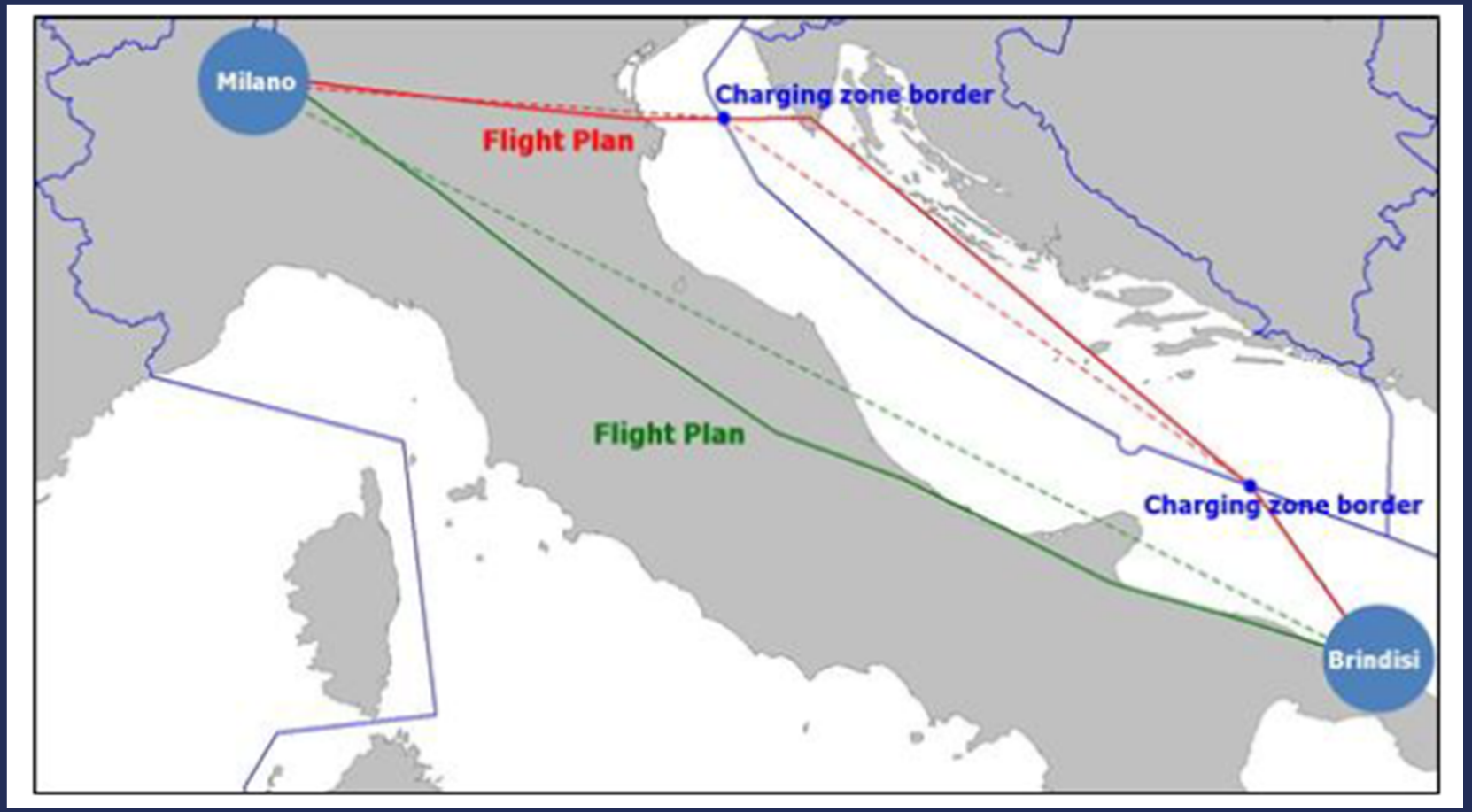
SATURN's research question

- Design market-based demand management mechanisms to redistribute air traffic in the European airspace, at the **strategic** level

SES Charging Regulation 391/2013 – Article 16
Member States […] may […] reduce the overall costs of air navigation services and increase their efficiency, in particular by modulating charges **according to the level of congestion of the network in a specific area or on a specific route at specific times**. […]
The modulation of air navigation charges means a variation of the en route charge and/or the terminal charge calculated on the basis of the provisions of Articles 11 and 12.

Pricing is already an option

Longer route (through Croatia) but cheaper in terms of en route charges



From *PRB Annual monitoring Report 2012, Volume 1, European overview and PRB recommendations, Section 3.2*, 13/09/2013

Consortium

UNIVERSITÀ
DEGLI STUDI DI TRIESTE

ULB UNIVERSITÉ LIBRE DE BRUXELLES

University of Belgrade
FACULTY OF TRANSPORT AND TRAFFIC ENGINEERING

UNIVERSITY OF WESTMINSTER

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Amsterdam, 14-16 June 2016

Pricing policies

Peak-load pricing
Assign a higher rate where and when a peak in demand is expected, and a lower rate for off-peak areas and times
Rewarding predictability
Give incentives to Airspace Users to reduce uncertainties by filing their flight intentions earlier and adhering to them as much as possible

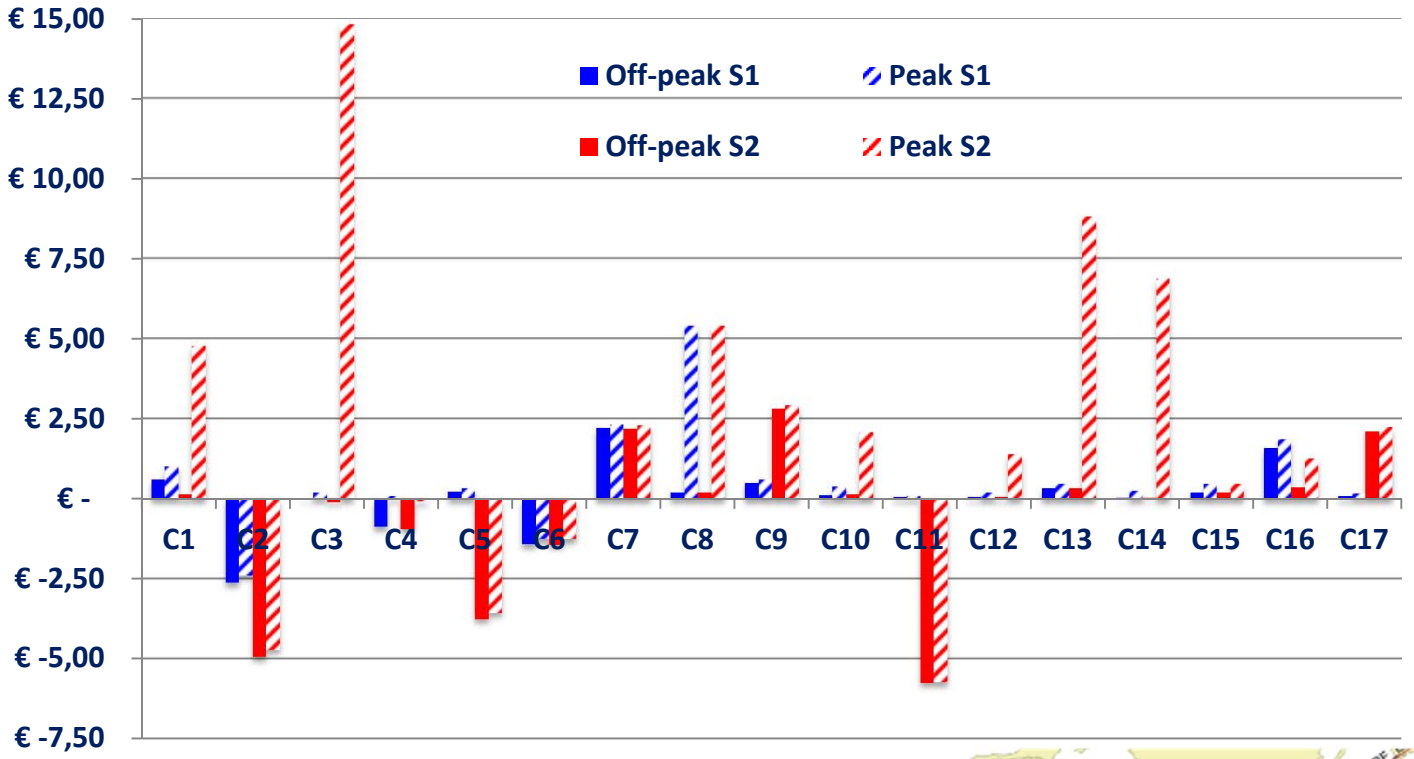
Experimental design

- Whole European airspace modelled (30 000 flights, busy day in September 2014)
- Aircraft clustering (15 aircraft types)
- 2014 fuel and aircraft costs (Cook & Tanner, 2015)

Cost profile	Flight categorisation	Percentage of flights
LOW	All low cost carriers' flights	30%
HIGH	Full service and regional into a hub	20%
BASE	All other flights	50%

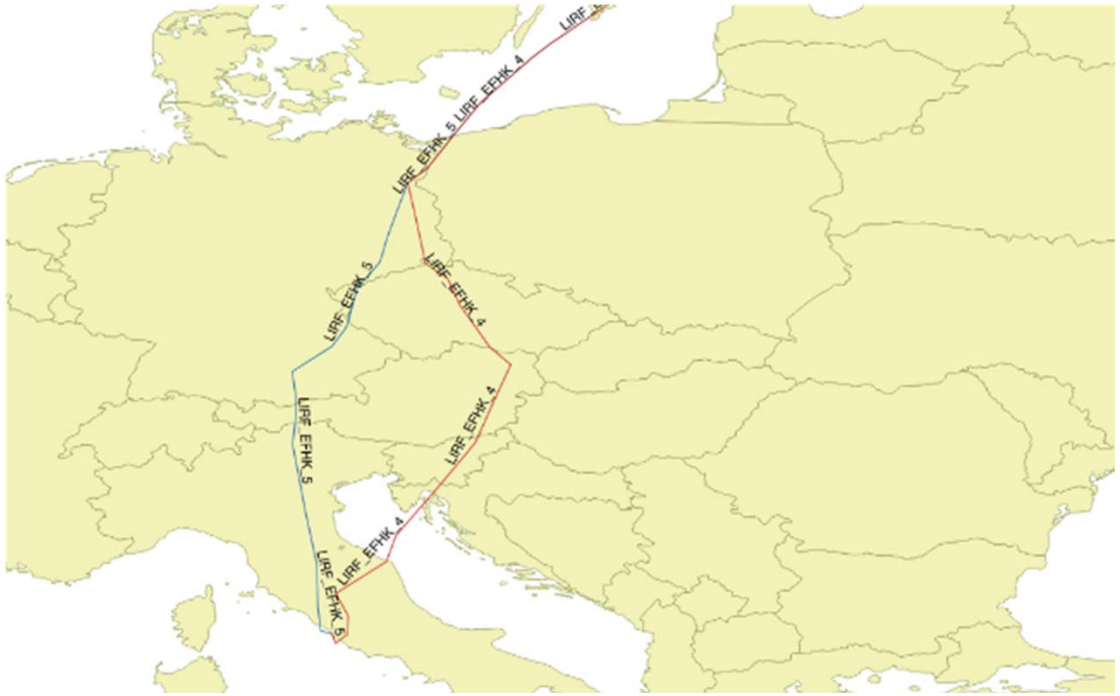
Key benefits demonstrated

- Peak pricing is a viable option to redistribute traffic, respecting ANSP revenue neutrality
- More balanced traffic distribution (utilisation of available capacities) possible at no extra cost
- About 9% of sector-periods were heavily loaded (> 90% utilisation) on test day. SATURN mechanisms reduced this to 5%



Peak and off-peak rates for selected ANSPs, w.r.t. September 2014 unit rate

Charges modulation on LIRF-EFHK route



Extensive stakeholder consultation

Two workshops London, 20 MAR 2014 & 21 APR 2015	Large attendance from regulators, the Network Manager, airlines and ANSPs
Invited presentations	MUAC ENAV NLR
SJU external consultation	IFACTA IATA
Academic presentations	ICRAT 2014 SIDs 2014 & 2015 ATM Seminar 2015

Conclusions

SATURN shows that modulation of en-route charges, as advocated by EC Regulation 391/2013, could be applied to improve:

- capacity-demand balancing & capacity usage
- trade-offs between flexibility (for AUs) and predictability (for ANSPs)

SATURN provides a methodology to quantify the impact of certain modulations of charges on :

- AUs' costs, route choices, network management, charging mechanisms, incentives, ANSPs' regulations

The scope include an a priori understanding of the future traffic pattern, not tactical actions on the day of operations

Future work

Using AUs' initial-filed flight plans	EUROCONTROL's Integrated Initial Flight Plan Processing System (IFPS)
Incorporating AUs' network impacts into KPIs	Assessment of impacts (e.g., the 'arrival shift'), through network effects dependent on passenger and crew connectivities, turnaround buffers and airport slot availabilities
Enhanced pricing flexibility	More rates applied than simpler peak and off-peak

Future exploratory research

Exploring flexible capacity provision
Evaluating cost-efficiency, quality of service and other SES Performance Scheme target impacts (including related changes to planned capital expenditure by ANSPs).
Improved Airspace Users' choice determinants
Better modelling of AUs' route options and choice determinants would allow better representation of demand options
Including estimates of AUs' elasticities & tactical delay costs

Thank you
for your attention

More information:

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ERAINT: EVALUATION OF THE RPAS-ATM INTERACTION IN NON-SEGREGATED AIRSPACE

Enric Pastor,

Technical University of Catalonia

Barcelona (Spain)

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Amsterdam, 14-16 June 2016

Project overview and strategy

Goal of the ERAINT project:

- Investigate the practical implications/limitations of a **RPAS** operating under an **IFR-ATM environment**, and the **benefits** that **data-link** technology and **automation** could bring to both the pilot and the ATC.

Strategy:

- Reproduce in real-time / fast-time simulation, complex RPAS operational scenarios as close as possible to a foreseen non-segregated airspace.

Participants:

- UPC: RPAS experts and simulation infrastructure.
- Levelco: active duty ATC consultants.
- Nexo: retired airline pilot.

Project methodology

Reproduce RPAS operations in real-time, under laboratory conditions:

- Airspace structure, traffic, available systems, comm latency, etc.
- Define experimental CoOps for the RPAS insertion.
- Analyze ATC subjective workload and taskload under various scenarios.

Project focuses on:

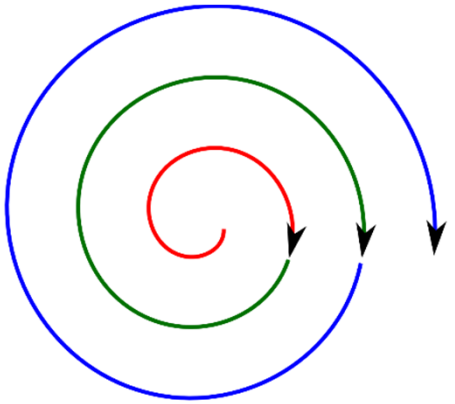
- Unrestricted access to all airspace, full non-segregated operation.
- Reproduce the whole RPAS mission process: from design, to negotiation and approval, real-time operation and evaluation.
- Separation, contingencies, comm latency, lost-link, ATC workload and impact on airspace efficiency.
- NOT ON: collision avoidance, airport operations, VFR.

Spiral project development

Step-A: Integration and en-route separation management with open instructions and mission-oriented active RPAS operation.

Step-B: Contingency management with automatic/autonomous operation by the RPAS (engine failure, lost-link) with RPAS-ATC negotiation of routes.

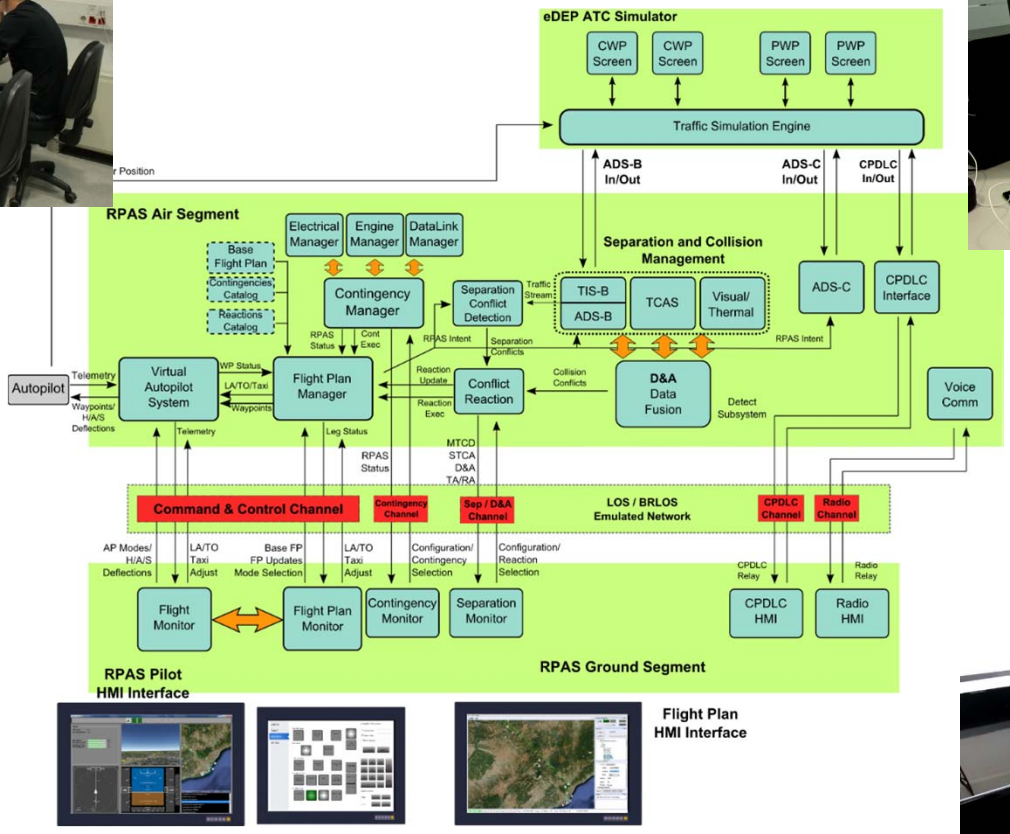
Step-C: Strategies to access non-segregated controlled airspace executing highly dynamic missions including reference trajectory changes during execution.



Step A: Separation management
Step B: Contingency management
Step C: Dynamic missions in SESAR

Real-time simulation infrastructure

RPAS, RPAS-GC, C3-datalink, eDEP ATC and pseudo-pilots:

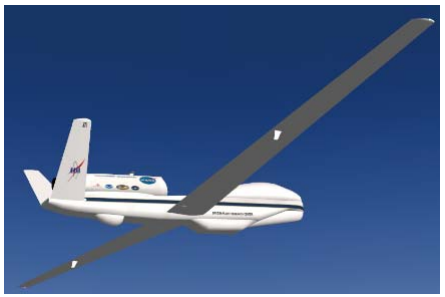


Focus on two RPAS vehicles

High Altitude Long Endurance (HALE): RQ-4A

Medium Altitude Long Endurance (MALE): MQ-9

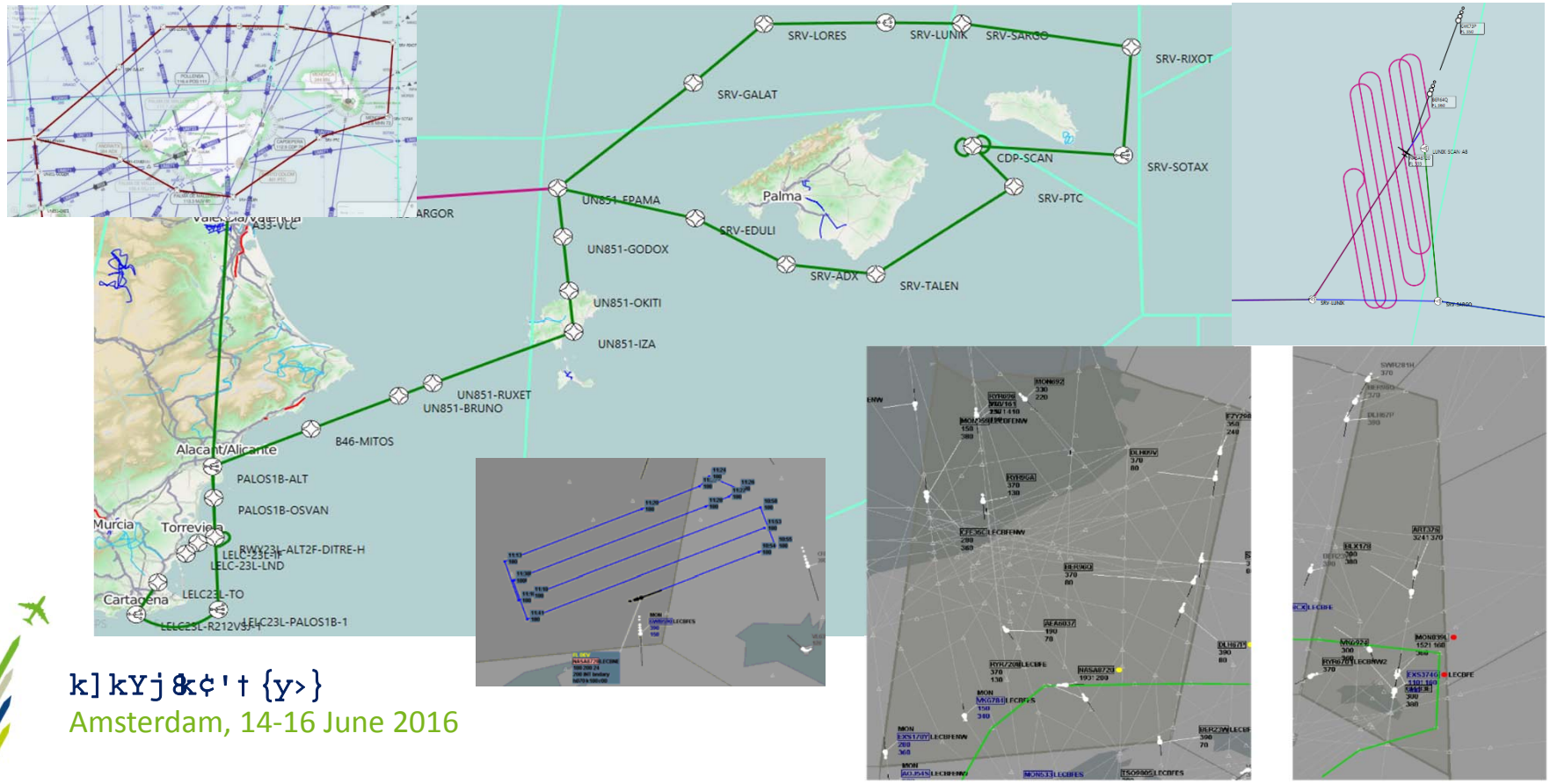
– Extensive analysis of performance leading into public BADA models for both vehicles.



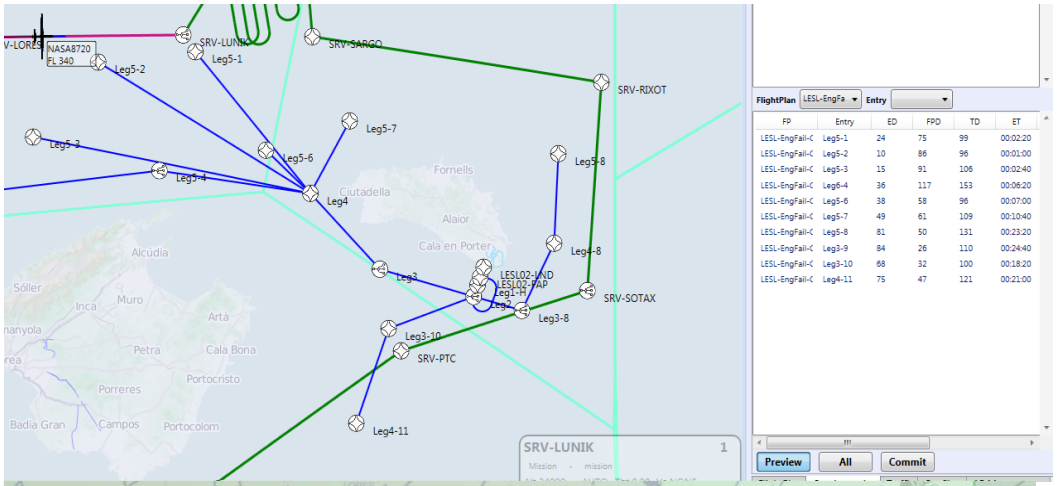
MALE Surveillance Mission in TMA

Complex RPAS surveillance operations.

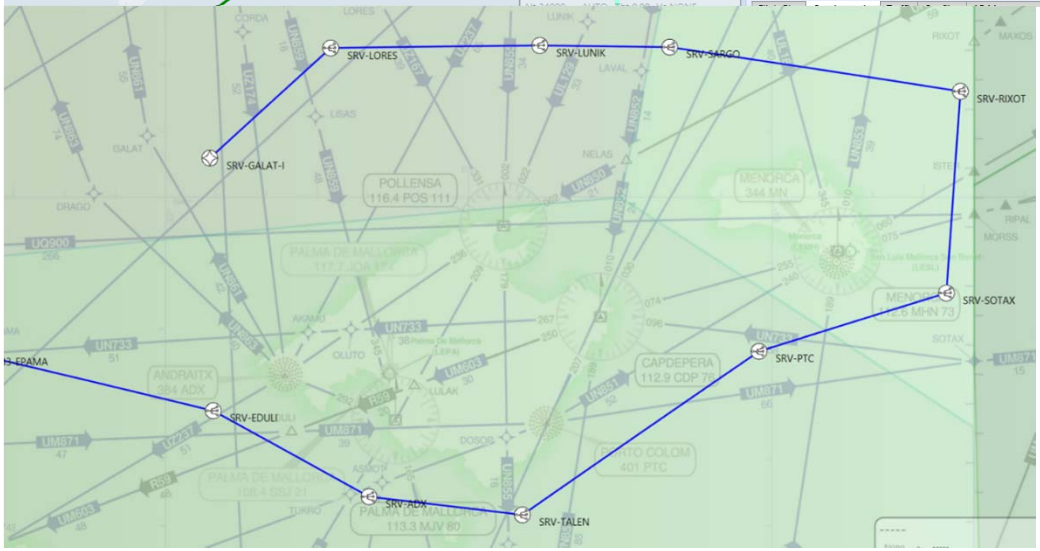
Crossing busy departure and arrivals within Palma's TMA area.



MALE Surveillance Mission in TMA

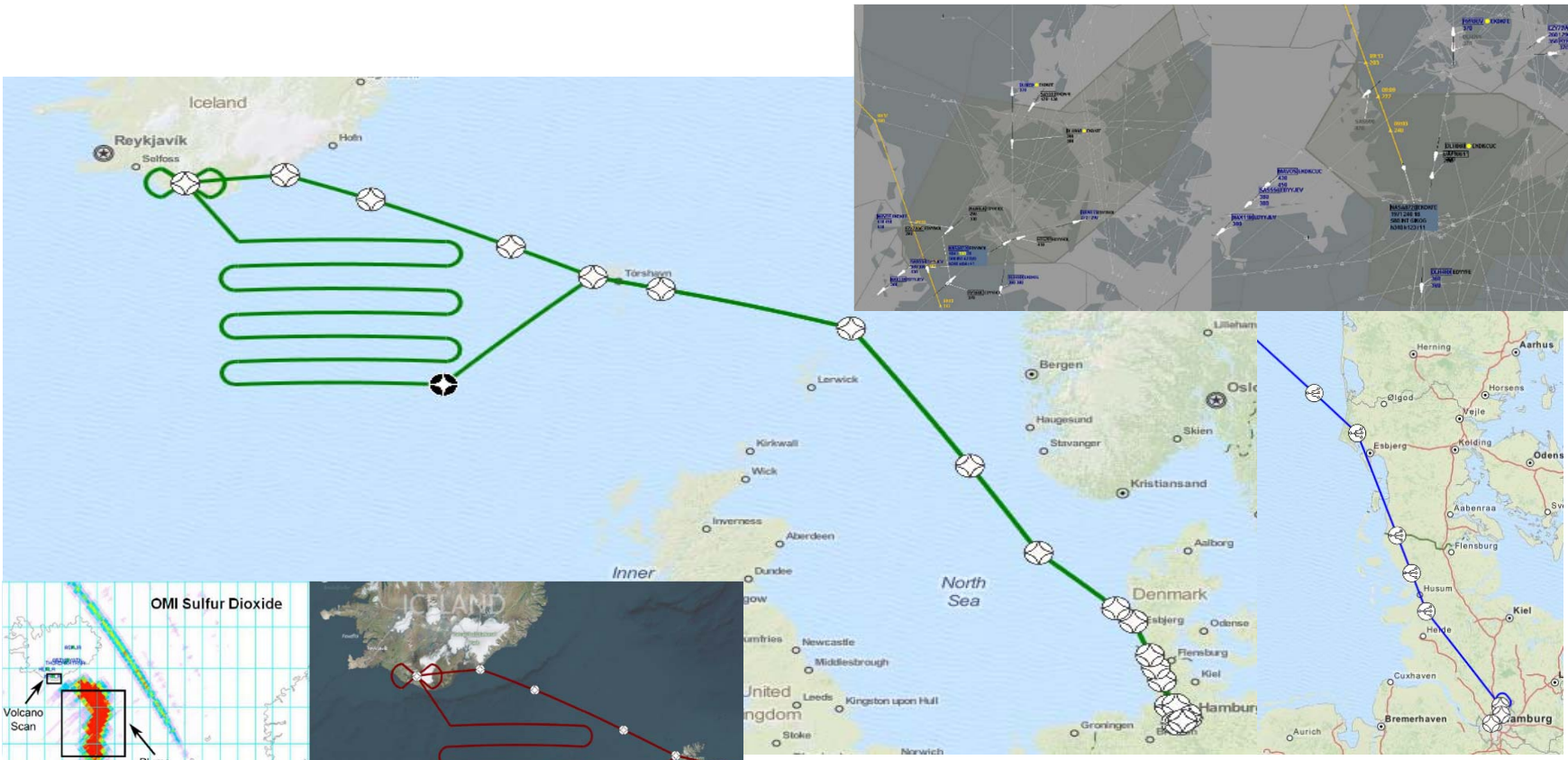


Engine failure pre-defined routes



Command and Control failure pre-defined route

HALE Volcano Mission

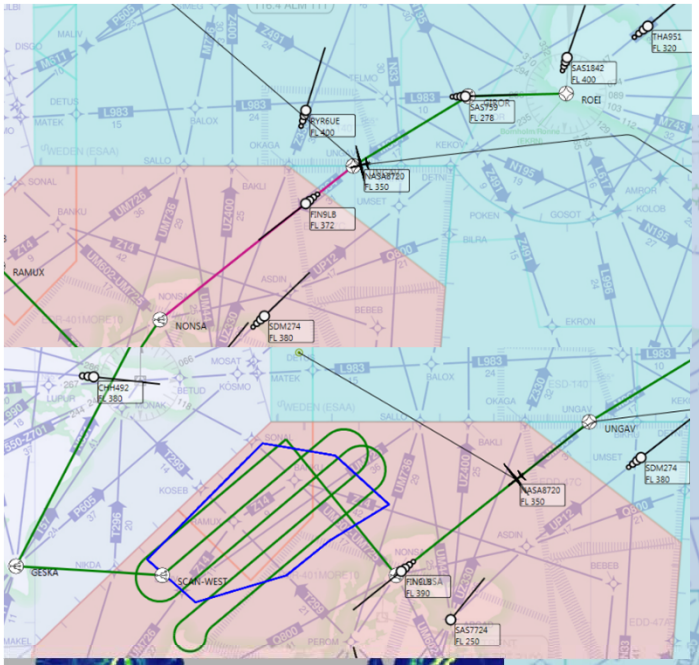


RQ-4A operations from Hamburg area.

Depart and arrival within German and Danish airspace.

MALE SAR Mission

MQ-9 operating maritime surveillance, to SAR support within Baltic Sea area.



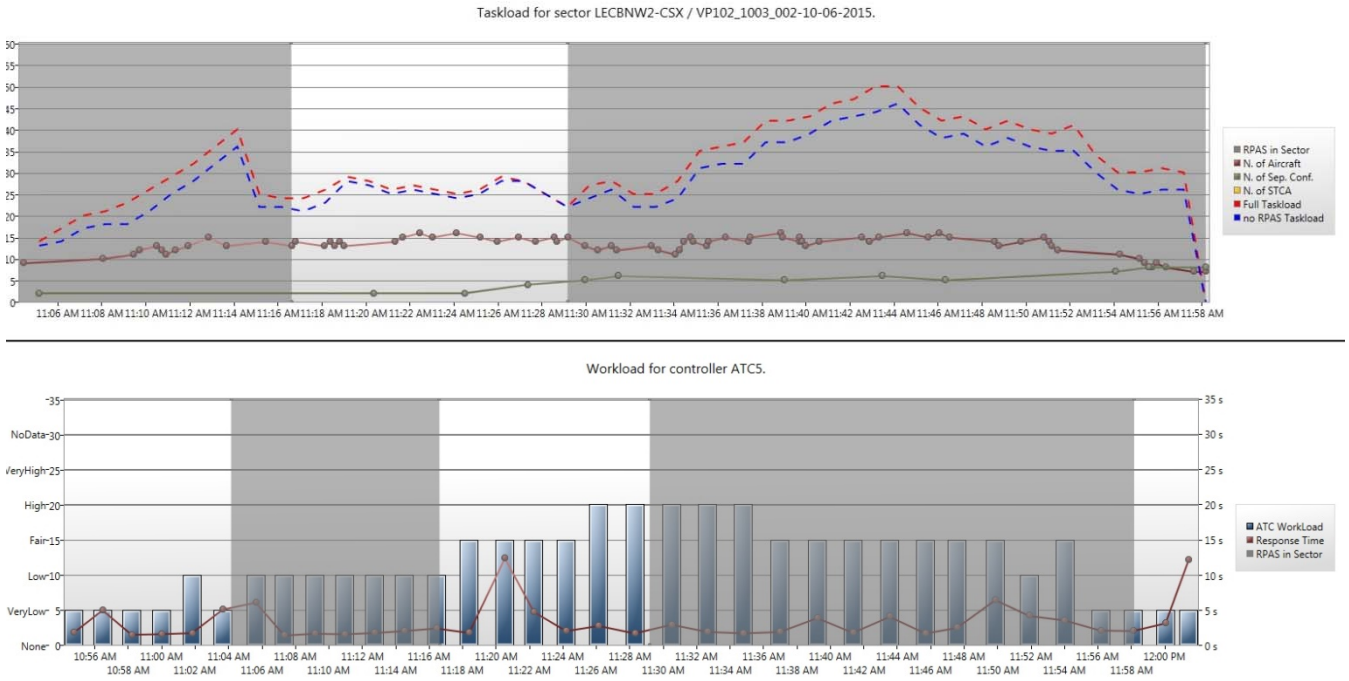
ERAINT exercise results

Step-A/B/C total number of successful simulations and flight time per scenario.

Scenario	Simulations	RPAS Time (min)	Simulation Time (min)
Step-A VP101	4	40	235
Step-A VP102 Run1	9	284	586
Step-A VP102 Run2	24	781	1345
Step-B VP201/202 Run1	23	557	897
Step-B VP201/202 Run2	29	786	1664
Step-C VP301	11	347	756
Total (min)	100	2795	5483
Total (hr)		46.6	91.4

ERAINT exercise results

Taskload evaluation was performed through CAPAN, and Workload evaluation through ISA. RPAS impact is separated from other vehicles. Periods within active sectors are also isolated.



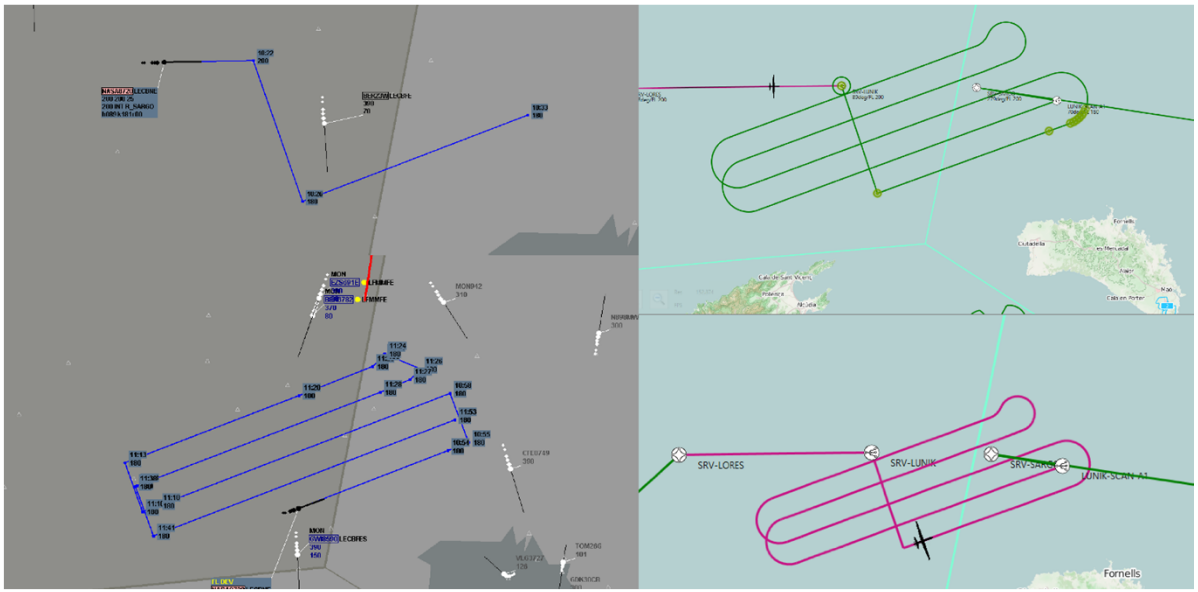
Outline of conclusions

- Viability of the RPAS **mission-oriented operation**
- RPAS given **separation priority** most times
- Separation management is not the issue:
  - ATC can **effectively and safely** manage the **RPAS separation for ONE RPAS**. **Workload increases**, but may be acceptable. Other factors identified as more problematic.
  - **Flight efficiency**: determine the level of delays induced to other traffic that may be acceptable.
  - Characterize the ATC **workload and taskload**: when managing RPAS **need to be better characterized** for extensive operations.

Outline of conclusions

Provide ATC with **tools for RPAS intent exploitation**:

- **Flight intent** may provide ATC with the information required to **understand the RPAS objectives**.
- RPAS operative versus requested intent: ***variable detail.***
- Effectively implemented through **ADS-C EPP message**.
- Intent does not reduce workload but **reduces uncertainty**.



Outline of conclusions

- Viability of the RPAS Contingency Conops:
  - The proposed experimental contingency response concept of operation is considered to be sound to cope with non-coupled non-chained contingencies.
  - The development of contingency RPAS operations individually managed is viable and resulting into limited ATC workload impact when implemented under a reasonable concept of operation.
  - Further investigation is required to evaluate coupled or chained contingencies, especially those related to the loss of the command and control link.
- RPAS Flight Intent Availability:
  - Flight intent has demonstrated as a key mechanism to improve the understanding of the ATC with respect the way the RPAS will respond to the flight contingency.

Outline of conclusions

- RPAS 4D Trajectory Prediction:
  - Flight trajectory predictors and the supporting performance models are necessary to allow all ATM actors maintain a consistent view of the RPAS performance behavior and peculiarities.
  - BADA3 / BADA4 performance modelling
  - Out of the standard envelope modelling for RPAS peculiarities and contingency support
  - Created BADA3 models for MQ-9 and RQ-4A in cooperation with EEC, but not satisfied with some modes (e.g. cruise climb, gliding).
  - Support for STCA / MTCD / Ground Trajectory Prediction.
- Both RQ-4A and MQ-9 BADA3 models implemented and made available in collaboration with EEC.
- All simulation trajectories and scenarios will be made publicly available after project close-out.

ERAINT Exercise Results

Step-A: Mission oriented MQ-9 operation in Palma's airspace.

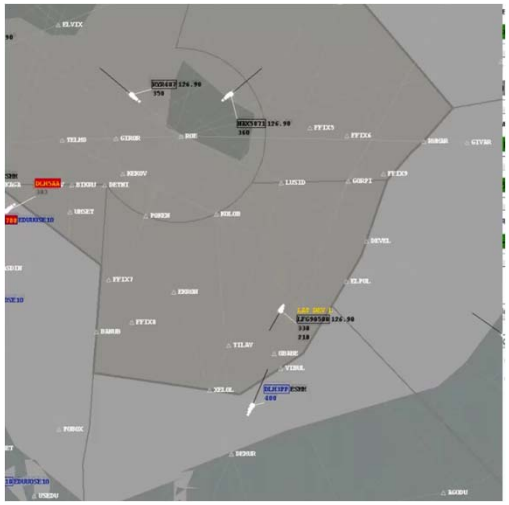
Step-B: RQ-4A emergency in Hamburg area.

Step-C: Flight plan change over the North Sea area.

Step-A

Step-B

Step-C



Thank you for your attention

More information:

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Lessons learned and concluding remarks

David Bowen,
Chief ATM, SESAR JU

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Amsterdam, 14-16 June 2016

OFFIFICAL OPENING OF THE SESAR SHOWCASE EXHBITION

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Amsterdam, 14-16 June 2016