

Engage – the SESAR Knowledge Transfer Network

Welcome

Data-driven trajectory prediction
25 January 2021

Dirk Schaefer – EUROCONTROL

Tatjana Bolić, Andrew Cook – University of Westminster

UNIVERSITY OF
WESTMINSTER



FREQUENTIS



engagektn.com
wikiengagektn.com

 twitter.com/EngageKTN

Industry partners – our doors are still open



Advanced Logistics Group (ALG)
 AGIFORS - Airline Group of the International Federation of Operational Research Societies
 Air Traffic Controllers European Unions Coordination (ATCEUC)
 airBaltic
 Airport Regions Conference (ARC)
 American Airlines
 ANS CR
 Aslogic
 Association for the Scientific Development of ATM in Europe (ASDA)
 Autoridade Nacional da Aviação Civil (ANAC)
 Barcelona Supercomputing Center (BSC)
 Boeing Research and Technology Europe (BR&T-Europe)
 Bundesaufsichtsamt für Flugsicherung (BAF)
 Cirium
 Civil Aviation Authority (CAA)
 COOPANS Consortium
 Department for Transport (UK)
 Direction des Services de la Navigation Aérienne (DSNA)
 Direktorat civilnog vazduhoplovstva Republike Srbije (DCV)
 European Meteorological Services Network (EUMETNET)
 European Passengers' Federation (EPF)
 Executive Airlines
 Ferrovial Agroman
 Finnair
 Flughafen München / Munich Airport
 Gestair SL
 Heathrow Airport Limited
 Helios
 HEMAV - High Endurance Multipurpose Aerial Vehicles
 Honeywell Aerospace
 HungaroControl
 Icelandair
 IFSTTAR - Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux
 INFORM - Institut für Operations Research und Management GmbH
 International Air Transport Passenger Association (IATPA)
 International Federation of Air Traffic Controllers' Associations (IFATCA)
 International Federation of Air Traffic Safety Electronics Associations (IFATSEA)
 Irish Aviation Authority (IAA)
 LFV - Luftfartsverket
 London Luton Airport
 Lufthansa Systems
 Manchester Airport
 NATS
 Naviair
 Network Manager - nominated by the European Commission
 NEXTOR II Consortium - University of California, Berkeley and University of Maryland
 PACE Aerospace Engineering & Information Technology
 Pegasus Airlines
 QinetiQ Ltd
 Raytheon UK
 Sabre Airline Solutions
 skyes
 SWISS - Swiss International Air Lines
 TÜBİTAK - The Scientific and Technological Research Council of Turkey
 Turkish Airlines

engagektn.com

Core activities: 2018 – 2021

- 
- Thematic challenges
- ‘One-stop’ European knowledge hub, concepts roadmap, research repository
 - 4 series of SESAR Innovation Days (non-disruptive; industry)
 - **3 series of thematic challenge workshops; plus *ad hoc***
 - 3 European summer schools (Belgrade ‘19, virtual event ‘20, Trieste ‘21)
 - 10 PhDs (interdisciplinary); 18 catalyst fund projects (TRL pipeline)
 - Future ATM skilled work-force; student mobility
 - under-/post-graduate teaching & training initiatives
 - internships & employer links
 - journal publication grants; travel grants

35% of €4m as
consortium effort

SESAR Digital Academy



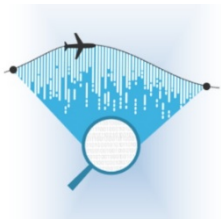
Integrate IR and ER

Thematic challenges – chosen by community

Thematic challenges



#1. CNS vulnerability and security *Paula López, Innaxis*
Last: November 2020 (Innaxis, virtual); next: late 2021



#2. Data-driven trajectory prediction *Dirk Schaefer, ECTL*
Last: December 2019 (Athens SIDs); **25 January 2021**



#3. Efficient use of MET data *Tatjana Bolić, Uni. Westminster*
Last: November 2019 (SJU, Brussels); **27 January 2021**



#4. Novel market mechanisms in ATM *Andrew Cook, Uni. Westminster*
Last: July 2020 (Nommon, virtual); next: **May^{TBC} 2021** (RoMiAD, Think Research)



Integrate IR and ER



Discussion slot @1600

- heads-up on some questions, in next slide
- insights into Engage wiki, at end of workshop:
 - public repository (data, code, etc.)
 - ATM concepts roadmap (future research)
 - dedicated discussion fora

Discussion – future research priorities, filling the gaps

- Are there short-term, quick-win collaborative actions to support research needs?
 - e.g. a shared problem where collaboration / extra support could fix it more readily
- Are there specific data challenges that need resolving? Timescale? Who leads?
- What are the priorities for further research development and exploitation?
 - catalyst fund projects – what if a further packet of funding was available?
 - PhDs – are there challenges taking shape that might not fit into your dissertation?
- What are the barriers to implementing some of the ideas we heard today?
- Are there gaps in the industrial research programme that are not being addressed?
 - cf. are new directions/requirements being driven by e.g. emerging CNS standards & solutions?
- What would the ideal 'ER5' collaborative project / topic call look like?



'time'

Some History



- Data-driven Trajectory Prediction defined as one of the Engage Thematic Challenges (TC2)
- This is the third workshop
- First workshop on 6 November 2018 at UPC Barcelona, Castelldefels
- Second workshop 2 December 2019 at National Centre of Scientific Research 'Demokritos' Athens

Some Logistics



- This is a Zoom webinar, i.e. there are
 - panellists
 - participants
- Session chair will introduce speaker and manage Q&A
 - Please use Q&A for questions
 - Use chat (sparingly) for other matters, including announcements
- Presentations will be available for download on Engage website
- No video-recording will be published

Agenda



1000-1015 **Welcome and overview from the Engage KTN; overview of TC2 and previous workshops** - *Dirk Schaefer (EUROCONTROL), Tatjana Bolic (University of Westminster) and Andrew Cook (University of Westminster)*

SESSION 1 (1015-1155, chair: Dirk Schaefer)

- 1015-1040 **Uncertainty modelling and data assimilation to propagate aircraft trajectory uncertainties using polynomial chaos expansions** - *Andrés Muñoz (Boeing) and Manuel Soler (University Carlos III Madrid)*
- 1040-1105 **Prediction of propagation and evolution of delays with machine learning** - *Ramon Dalmau Codina (EUROCONTROL)*
- 1105-1130 **Trajectory Prediction via Imitation Learning** - *George Vouros (University of Piraeus)*
- 1130-1155 **Clustering & Complexity measures of European traffic** - *Didier Dohy (NeoMetSys)*

1155-1300 **Lunch**

SESSION 2 (1300-1440, chair: Tatjana Bolic)

- 1300-1325 **A Data-driven approach for dynamic and Adaptive trajectory Prediction ('DIAPasON')** - *Jose Manuel Cordero (CRIDA)*
- 1325-1350 **Probabilistic information Integration in Uncertain data processing for Trajectory Prediction** - *Francesco Martone, CIRA*

1350-1415 **An interaction metric for an efficient traffic demand management: requirements for the design of data-driven protection mechanisms** - *Juan José Ramos (Aslogic)*

1415-1540 **PJ18.W2 4DSkyways – Solution 53. Current Research Activities** - *Christian Verdonk Gallego (CRIDA)*

1440-1500 **Coffee break**

1500-1530 **OpenSky: Crowdsourcing Data Collection for ATM Research** - *Martin Strohmeier, University of Oxford*

SESSION 3 (1530-1645, chair Andrew Cook)

1530-1600 **Engage PhD presentations**

- **Machine Learning Applications to Extend AGENT's conflict resolution capabilities** - *Ralvi Isufaj (Autonomous University of Barcelona)*
- **Advanced statistical signal processing for next generation trajectory prediction** - *Homeyra Khaledian (Technical University of Catalonia)*
- **Data-based Pre-tactical Trajectory Prediction** - *Manuel Mateos (Nommon)*

1600-1630 **Discussion**

1630-1645 **Wrap-up and close-out** - *Dirk Schaefer (EUROCONTROL) and Andrew Cook (University of Westminster)*

Discussion

Discussion – future research priorities, filling the gaps

- Are there short-term, quick-win collaborative actions to support research needs?
 - e.g. a shared problem where collaboration / extra support could fix it more readily
- Are there specific data challenges that need resolving? Timescale? Who leads?
- What are the priorities for further research development and exploitation?
 - catalyst fund projects – what if a further packet of funding was available?
 - PhDs – are there challenges taking shape that might not fit into your dissertation?
- What are the barriers to implementing some of the ideas we heard today?
- Are there gaps in the industrial research programme that are not being addressed?
 - cf. are new directions/requirements being driven by e.g. emerging CNS standards & solutions?
- What would the ideal 'ER5' collaborative project / topic call look like?



'time'

Wrap up

Next steps



EngageWiki ▾

Tools ▾

Log in

Request account

Search EngageWiki



Welcome to the EngageWiki


The one-stop European knowledge hub

A repository and interactive research map for exploratory and industrial research in ATM, also compiling European events and learning opportunities, and hosting discussion fora.

wikiengagektn.com

Tools ▾ ➔ Log in 👤+ Request account

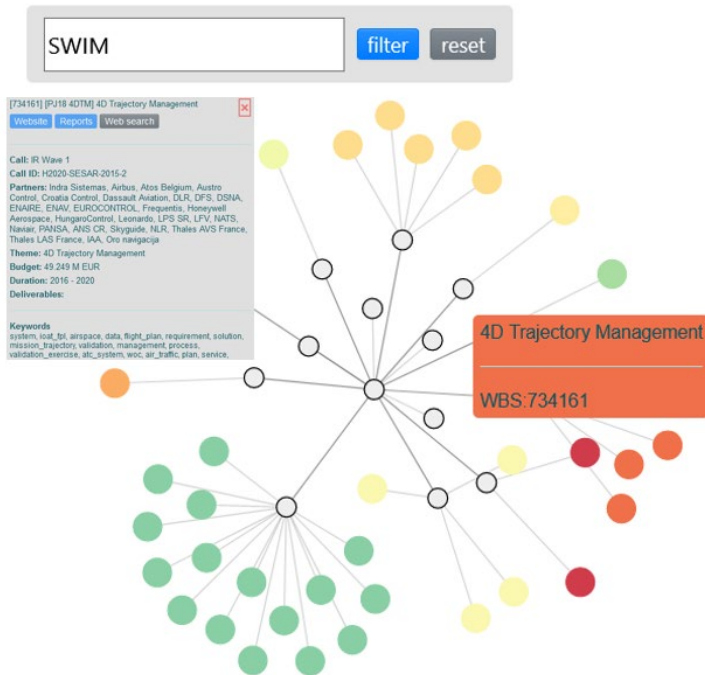


- 
1. Request account (simple form)
 2. Edit away and get involved!

wikiengagektn.com

Check out the main wiki features

Interactive research map of ATM



Discussion fora



European university programmes



ATM concepts roadmap



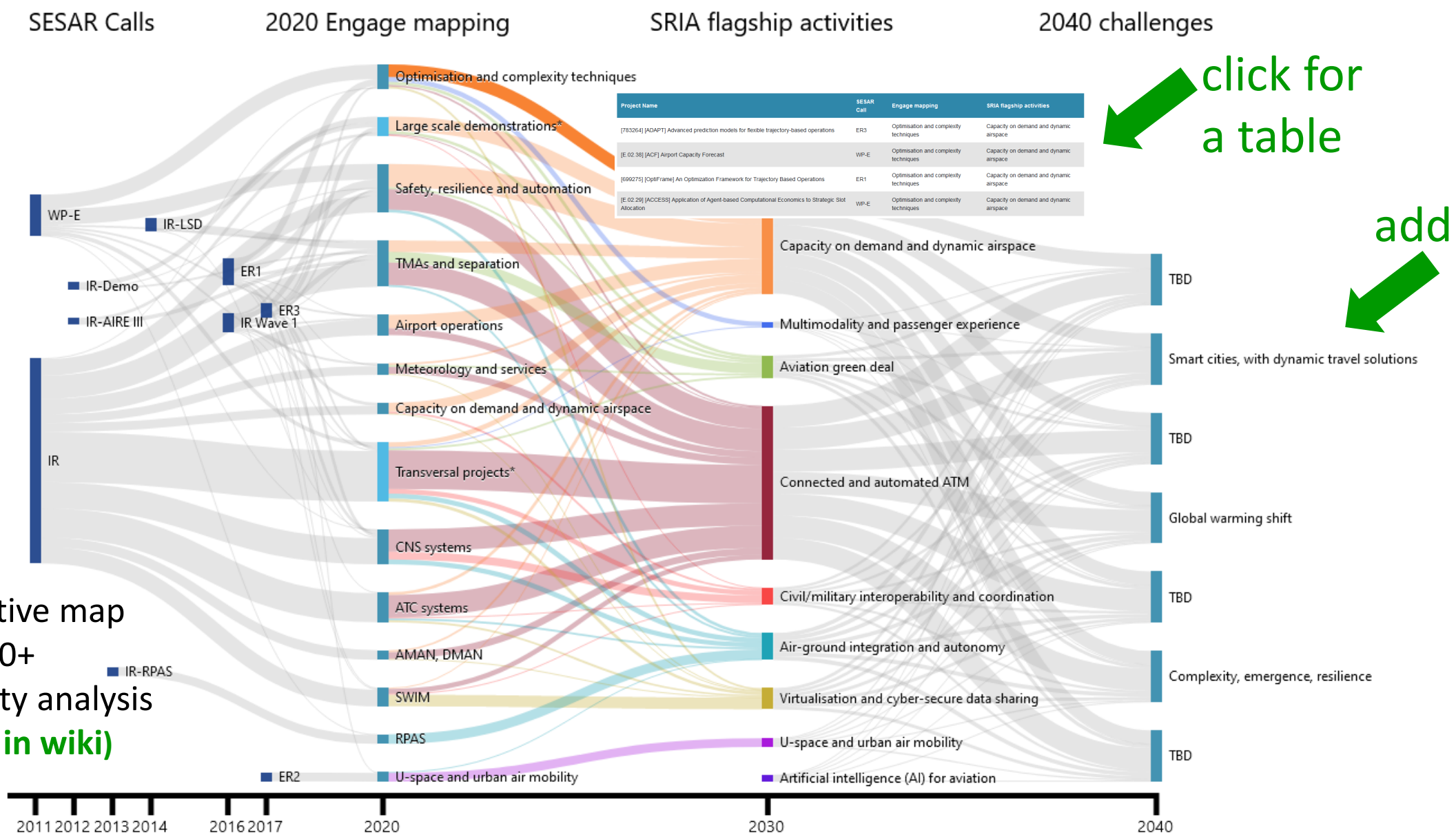
share thoughts / make suggestions

wikiengagektn.com

ATM concepts roadmap



builds on interactive map
 SRIA 2020 ... 2040+
 semantic similarity analysis
 (descriptive text in wiki)



click for a table

add

one-stop
hub

Coming soon!

Research repository

Engage



- SESAR 1, SESAR 2020, SIDs papers
- Appx. 1500 dels / papers
- More to come (permissions)

your space



- Code (e.g. useful R scripts for PRISME data)
- Data (e.g. common (synthetic) models)
- Video

Next steps

- Simple survey to participants
 - help Engage with future planning; further opportunity to flag your ideas for new research
- Writing up today's outcomes (plus other recent workshops)
 - Engage consortium and SJU working together on future workshop design
 - further dedicated workshops by thematic challenge (autumn 2021 + SIDs)?
 - and/or more integrated workshop on research needs (e.g. July 2021, CF2s closing)?
- Further work on Engage wiki's ATM concepts roadmap
 - analysis of further ER/IR outputs (incl. SIDs 2020); strategic documents & initiatives (e.g. Pathfinder)
 - possible analysis of significant ER4 research gaps (unfunded topics)
 - promotion seeking [your further engagement](#) in the wiki forum (previous slide) (e.g. SJU e-news)
- Feeds various Engage deliverables in 2021; keen eye on legacy for 2022+
- Listening mode, do drop us a line anytime:
engagektn.com or EngageKTN-Coordinator@westminster.ac.uk



Thank you