



D5.14 Engage SESAR Summer School 2021

Deliverable ID:	5.14
Dissemination Level:	PU
Project Acronym:	Engage
Grant:	783287
Call:	H2020-SESAR-2016-2
Topic:	SESAR-ER3-01-2016 Knowledge Transfer Network
Consortium Coordinator:	University of Westminster
Edition date:	15 March 2022
Edition:	01.01.00
Template Edition:	02.00.02

Founding Members



Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Lorenzo Castelli / University of Trieste	Consortium member	14 March 2022
Graham Tanner / University of Westminster	Consortium member	14 March 2022
Andrew Cook / University of Westminster	Project coordinator	14 March 2022

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Lorenzo Castelli / University of Trieste	Consortium member	15 March 2022
Graham Tanner / University of Westminster	Consortium member	15 March 2022
Andrew Cook / University of Westminster	Project coordinator	15 March 2022

Approved for submission to the SJU By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
Andrew Cook / University of Westminster	Project coordinator	15 March 2022

Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
N/A		

Document History

Edition	Date	Status	Author	Justification
01.00.00	07 October 2021	Release	Engage Consortium	New document for review by the SJU
01.01.00	15 March 2022	Release	Engage Consortium	New document for review by the SJU

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Engage

THE SESAR KNOWLEDGE TRANSFER NETWORK

This deliverable is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 783287 under European Union's Horizon 2020 research and innovation programme.



Abstract

This report describes the third edition of the Engage SESAR summer school, which was held as a virtual event, between 30th August and 2nd September 2021.

The opinions expressed herein reflect the authors' views only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein.

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1 Introduction

1.1 Engage support for the summer school

Engage is the SESAR Knowledge Transfer Network (KTN), established to promote and facilitate the development of air traffic management research in Europe. The organisation of the summer school received support and expertise from Engage consortium members (led by the University of Trieste), from initial planning through to post-summer-school activities.

The third Engage SESAR summer school took place between 30th August and 2nd September 2021 as a virtual event.

Almost 100 participants from 20 countries participated in the summer school. These included nine Engage-funded PhD students, as well as two EUROCONTROL-funded PhD students and one PhD student from the University of Trieste: each of them presented their PhD topic and the findings obtained thus far. Each presentation was discussed by an industry panel. Panellists represented various air traffic management (ATM) stakeholders including skyguide, CRIDA, NATS, Heathrow Airport, MetSafe, EASA, EUROCONTROL, and the SESAR Joint Undertaking. Over four days, two presentations on new features of the Engage wiki were given, along with a description of novel opportunities for all PhD students such as the SESAR Digital Academy and the SESAR Young Scientist Award, and an overview on future research horizons in ATM.

1.2 Objectives of this document

This document describes the 2021 edition of the Engage SESAR summer school.

1.3 Scope of D5.14

The following sections describe the:

- Summer school programme;
- Participants;
- Participants' feedback;
- Conclusions, lessons learned and outlook for SESAR 3.

2 Programme

2.1 Building and publicising the 2021 summer school programme

As envisaged in the Grant Agreement [1], the Engage summer schools *have the purpose of providing high quality education and training in the field of ATM, gathering together PhD students, experienced researchers and industry representatives.*

The third Engage summer school was originally scheduled to be held in summer 2021 at the University of Trieste's premises in Trieste, Italy. The programme was designed with a strong focus on the Engage PhDs' technical results, as most candidates were by then near the end of their PhD studies. Consequently, no time was devoted to tutorials on ATM concepts and research methodologies, as in the previous summer school editions, with more time devoted to PhDs presenting their near-final work and obtaining targeted feedback from the industry.

Industry involvement was in fact set to be mandatory to offer insight on each of the Engage PhDs, with particular focus sought on how the work of the PhD could be taken forward in an operational / more applied setting.

Due to the Covid-19 pandemic, the Engage KTN had to cancel the Trieste event in April 2021. This resulted in alternative hosting options for the summer school being given consideration. It was decided and subsequently announced (to Engage PhDs and supervisors on 10th May 2021) that it was to be held as a virtual event during the week 30th August-2nd September 2021.

To maximise the interaction and PhD students' involvement during the virtual event, the 12 PhD presentations were divided into six sessions to group similar topics. Each session was moderated by an Engage representative, and followed by a discussion panel with invited industry members (students were informed of this on 13th August 2021; full details sent on 24th August 2021) – see Table 1.

Table 1: PhD sessions and associated panellists

Session	Panellists from
Airline and airport operations centres	SESAR JU, Heathrow Airport, EUROCONTROL
Signal processing for trajectory prediction	SESAR JU, skyguide, EASA, EUROCONTROL
DCB hotspot detection and machine learning for traffic demand prediction	NATS, skyguide, CRIDA
Machine learning and traffic deconfliction	SESAR JU, CRIDA, NATS
Weather prediction / forecasting models	SESAR JU, MetSafe, NATS
Flight prioritisation, UDPP and route charging	SESAR JU, skyguide, CRIDA, EUROCONTROL

More specifically, all Engage PhDs and one EUROCONTROL PhD had 30 minutes for presentation, with five minutes for any brief technical clarification questions. The remaining two PhDs had 20 minutes for

presentation (including any brief technical clarification questions), due to the lower maturity level of their research activity. Deploying Engage PhD mentors, a moderated one-hour discussion panel with invited industry members followed each set of PhD presentations. In the unique session where only presentation took place, the panel discussion lasted 30 minutes.

Interactions with the audience were facilitated by the session moderator using the Zoom Webinar Q&A panel.

Most PhD students (9 out of 12) presented live, by sharing their screen. In the remaining three cases a pre-recorded video was shown. At the end of the video, the students participated live in the panel discussion.

The summer school was publicised via the SESAR JU website, SESAR e-newsletter (July 2021 edition), Twitter, LinkedIn and the Engage website [2]. Registration via the Engage website was open from late July.

Attendance at the summer school was free of charge.

2.2 Delivering the 2021 programme

The Zoom Webinar platform was used to facilitate the virtual event. Key features included:

- up to 100 participants per session;
- attendees communicating with panellists via the Chat panel.

The PhD sessions were run as follows: the session moderator opened the session, then the PhD student started his/her presentation. In case of pre-recorded video, this was run from Trieste (summer school organiser). After the presentation, the moderator facilitated questions and comments from the audience to the candidate via the Zoom Chat panel. When all students of the session ended their presentations, the industry panel discussion started. The Engage moderator introduced each panellist and then give them the floor to make their feedback or suggestions. There was not a pre-defined session format, but this was adapted to panellists' preferences. In some cases, the panellists one after the other made his/her comments and questions to the PhD students who, in turn, answered. In other cases, there was a more general discussion among the panellists, the PhD students and the session moderator on the topic of the session. Comments from audience were possible through the Zoom Chat tool during the panel sessions too.

The other sessions were run differently:

- the “SESAR Young Scientist award”, the “Engage wiki”, and the “Future research horizon” sessions consisted of a presentation by a speaker;
- the “Teaching resources in the wiki” was coordinated by the University of Belgrade – FTTE and consisted of three presentations describing the teaching material available in the Engage wiki;
- the “Shaping a future European ATM Academy” session was coordinated by the SESAR Scientific Committee. PhD students were encouraged to share their opinions about the following questions:
 - *Internationalisation and connecting students across Europe;*

- A standard platform for ATM learning and resources;
- Career shaping and connecting to industry and other ATM stakeholders.

In all cases, there was the opportunity for Q&As at the end. Furthermore, an “Engage PhDs Q&A” session was run by the University of Westminster (Engage coordinator) and was an interactive session with all Engage PhD students.



Engage 3rd Summer School Programme, 30 August – 02 September 2021

(Programme v1.5; all times CEST; virtual event)

	09.15-10.00	10.00-11.15	11.30-12.30	13.30-14.10	14.10-14.45	15.00-15.30
MON 30AUG	Opening Andrew Cook (UoW) & Lorenzo Castellani (University of Trieste)	Airline and airport operations centres Jonas Langner (TU Braunschweig), Sashiko Shirai Reyna (Amsterdam UAS/ENAC)	Panel discussion Moderator: <i>Bojana Mirkovic</i> (University of Belgrade-FTEE)	Signal processing for trajectory prediction <i>Hameyra Khaledian</i> (UPC Barcelona)	Panel discussion Moderator: <i>Junzi Sun</i> (TU Delft)	SESAR Young Scientist Award <i>Junzi Sun</i> (TU Delft)
TUE 31AUG	11.15-12.00 The Engage wiki <i>Pablo Hernandez</i> (Inaxis)	Teaching resources in the wiki <i>University of Belgrade-FTEE*</i>	12.00-12.30 DCB hotspot detection and machine learning for traffic demand prediction <i>Sergi Mas Pujol</i> (UPC Barcelona), <i>Manuel Mateos</i> (Norman/UPC Barcelona)	15.00-16.00 Panel discussion Moderator: <i>Lorenzo Casarelli</i> (Univ. of Trieste)		
WED 01SEP	10.00-11.15 Machine learning and traffic deconfliction <i>Alevisos Bastas</i> (University of Piraeus), <i>Baivi Istifaj</i> (UAB Barcelona)	11.30-12.30 Panel discussion Moderator: <i>Fedja Netjsov</i> (Belgrade-FTEE)	13.30-15.30 Shaping a future European ATM Academy SESAR Scientific Committee	15.30-16.00 Engage PhDs Q&A UoW		
THU 02SEP	10.00-11.15 Weather prediction / forecasting models <i>Anastasia Lemetti</i> (Linköping University), <i>Eduardo Andrés</i> (Universidad Carlos III Madrid)	11.30-12.30 Panel discussion Moderator: <i>Tatjana Bolc</i> (University of Westminster)	13.30-14.45 Flight prioritisation, UOPP and route charging <i>Jon Eiler</i> (TU Dresden), <i>Andrea Gasparin</i> (University of Trieste), <i>Natalia Sołarska</i> (University of Trieste)	15.00-16.00 Panel discussion Moderator: <i>Andrew Cook</i> (University of Westminster)	16.15-17.00 Future research horizons <i>Dirk Schaefer</i> (EUROCONTROL)	17.00-17.15 Close and what's coming next <i>Andrew Cook</i> (UoW)

*Bojana Mirkovic, Fedja Netjsov, Danica Babic



Friday 03 September, follow-on workshop: Machine learning, AI and automation in ATM Registration details for all events here.



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 783287.

The programme (Figure 1) kicked off on Monday, 30th August 2021, with presentations from three Engage-funded PhDs (“Airline and airport operations centres” and “Signal processing for trajectory prediction” sessions, Figure 2), and the “SESAR Young Scientist Award” session to close the day (Figure 3).

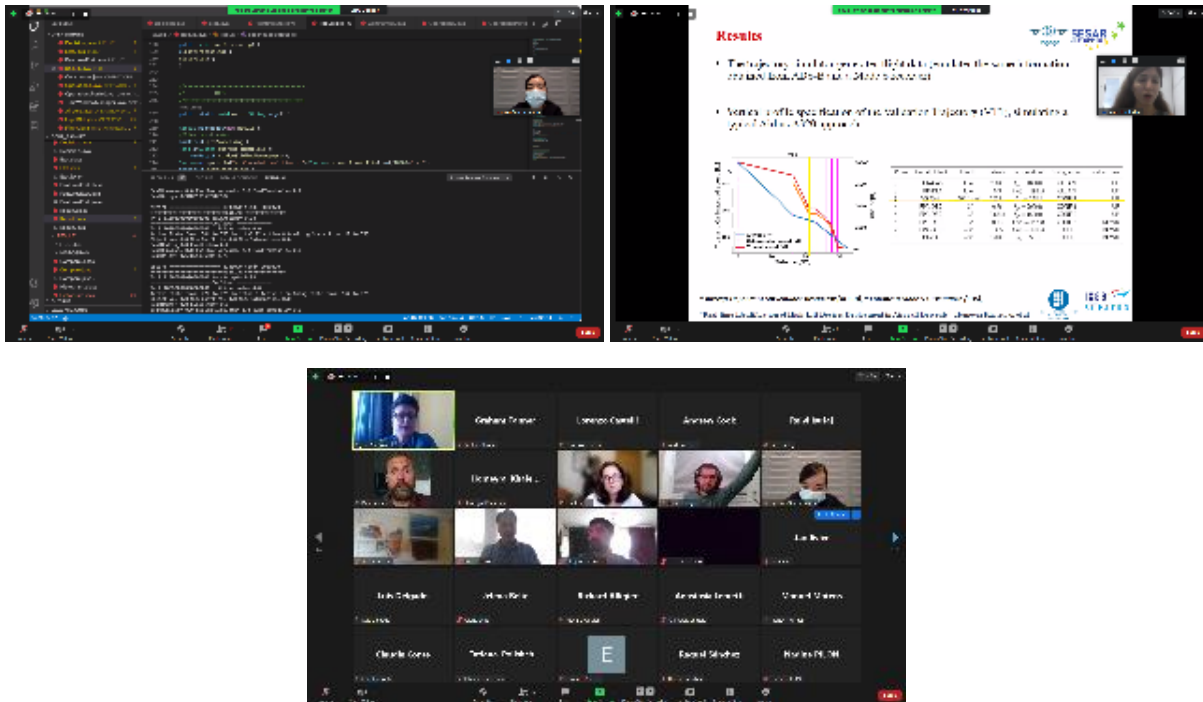


Figure 2: Screenshots of Monday PhD sessions

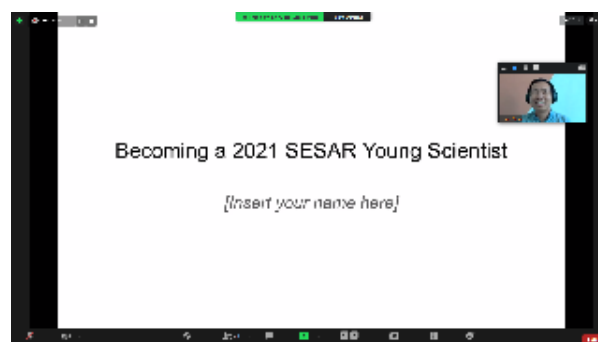


Figure 3: Screenshot of the SESAR Young Scientist Award session

Tuesday morning was devoted to the Engage wiki presentations (Figure 4), whilst in the afternoon the “DCB hotspot detection and machine learning for traffic demand prediction” PhD session comprised of two presentations (Figure 5).

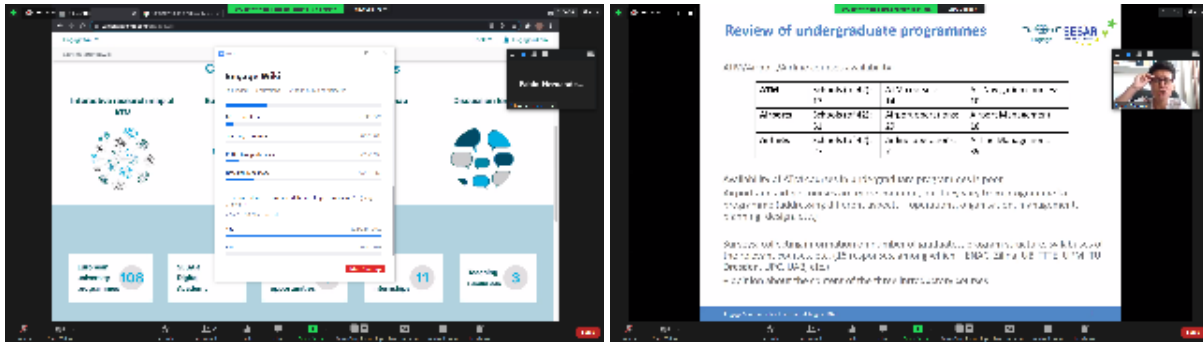


Figure 4: Screenshots of the Engage wiki sessions

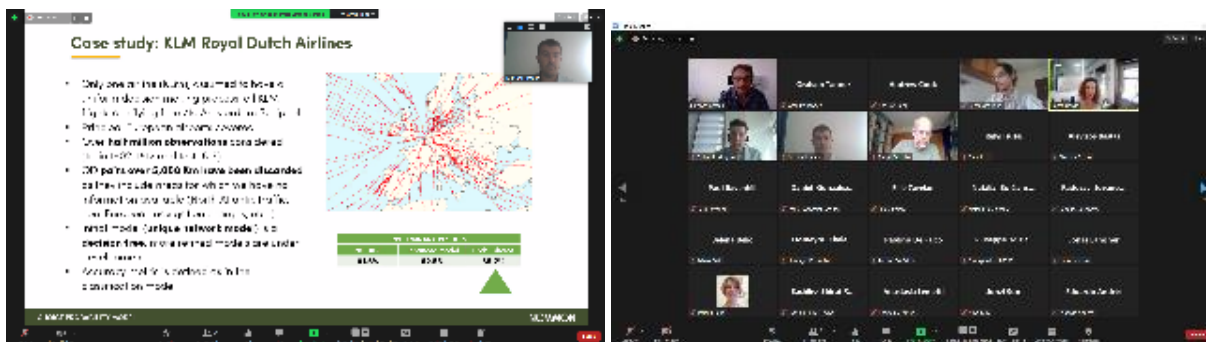


Figure 5: Screenshots of Tuesday afternoon PhD session

The programme continued on Wednesday morning with the “Machine learning and traffic deconfliction” PhD session (again with two presentations). The afternoon instead was devoted to SESAR Digital Academy session, run by the SESAR scientific Committee, and the Engage Q&A session (Figure 6).



Figure 6: Screenshots of the SESAR Digital Academy and Engage Q&A sessions

On Thursday the last two PhD sessions took place, in the morning the “Weather prediction / forecasting models” session (Figure 7) and in the afternoon the “Flight prioritisation, UDPP and route charging” session (Figure 8), respectively, complemented by two final “way forward” sessions, setting the scene for Future research horizons in the ATM context, and closing the event (Figure 9).

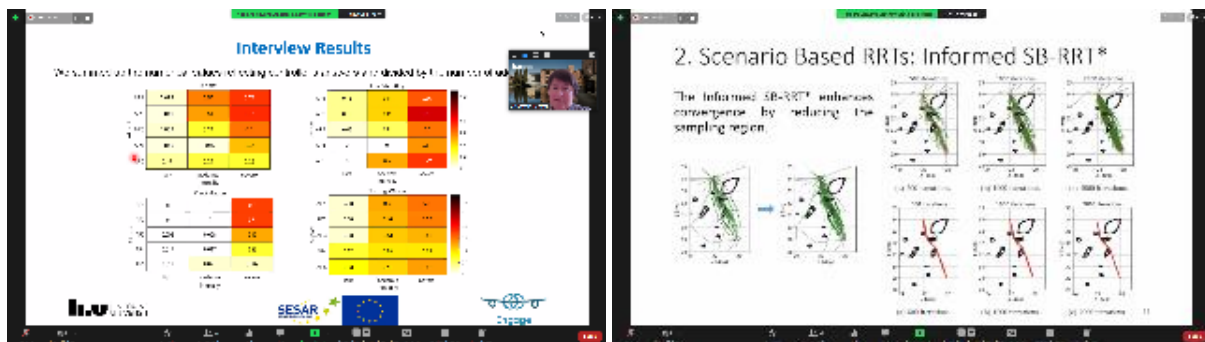


Figure 7: Screenshots of Thursday morning PhD session

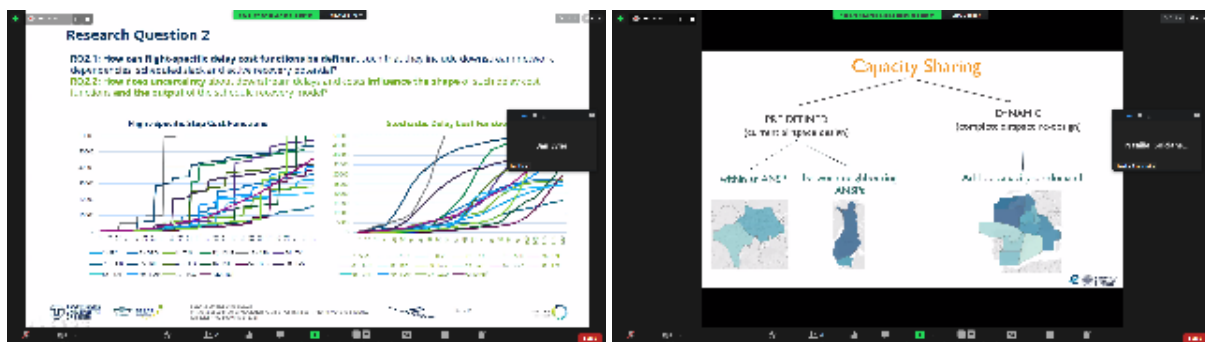


Figure 8: Screenshots of Thursday afternoon PhD session

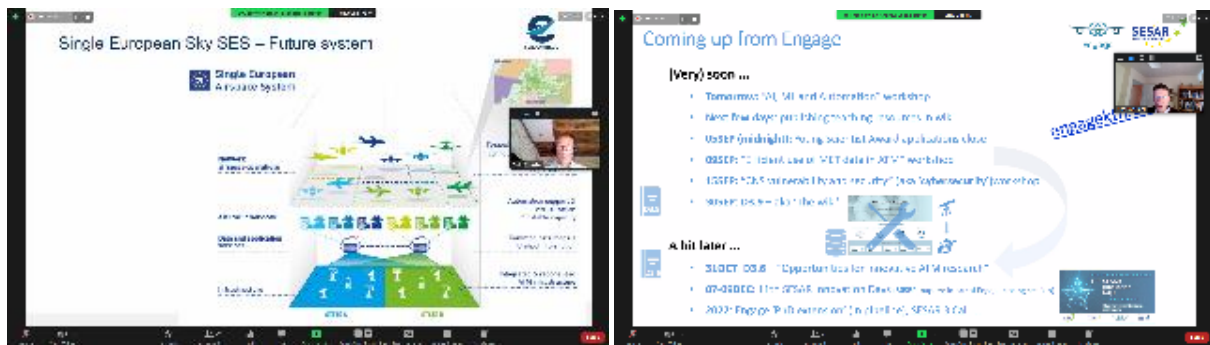


Figure 9: Screenshots of ‘way forward’ sessions

During the opening and closing sessions, and, where appropriate, throughout the PhD presentations, references were made to relevant Engage thematic challenges and forthcoming workshops¹, as well as to the SESAR Innovation Days 2021 conference (set for December 2021).

All sessions were recorded for internal purposes only (participants were notified at the start of each session). After the conference, each PhD participant received the link and the password to replay the video of their session.

2.3 Published material

The summer school programme and presentations have been published on the Engage website and can be downloaded from <https://engagektn.com/summer-school-2021/>.

¹ Particular promotion was made for the workshop taking place on the final day of the summer school week, as an independent, follow-on event, entitled: “Machine learning, AI and automation in ATM”. This workshop was selected for the same week because it reflected core elements of a number of the PhD topics, notably applying machine learning to ATM data environments, and most of the PhDs attended the workshop, with extra participants joining from industry (as will be reported upon in Engage Deliverable 2.7: *Annual combined thematic workshops progress report (series 3)*).

3 Participants

The total number of participants at the summer school was 97. This comprised 50 self-registered attendees, 19 panellists, 12 PhD candidates, 4 SESAR Scientific Committee members, and 12 Engage consortium members.

The following summaries relate to the 50 *self-registered attendees*.

The largest number of registered participants came from the United Kingdom (7), followed by France and Germany (6 each), Serbia (5), Spain and the United States (4 each), Belgium, Poland, and Sweden (3 each), with 1 each from Cyprus, the Czech Republic, Hungary, India, Ireland, Italy, Saudi Arabia, Switzerland, and Vietnam (Figure 10).

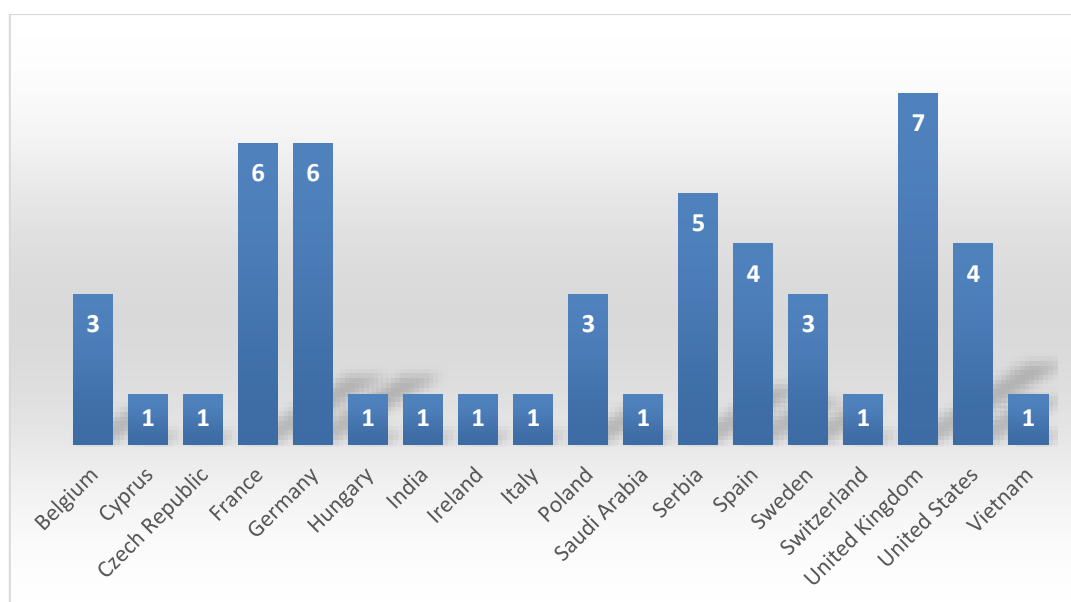


Figure 10: Self-registered participants' countries of residence

Of the 50, 15 registered as undergraduate/postgraduate/PhD students, 10 as researchers/postdocs, 3 as apprentices/trainees, 20 were employed, and 2 did not specify their status ("other"). In summary, approximately half were students.

28 of the self-registered attendees were affiliated with a university. Nearly three quarters of attendees (36) belong to the scientific community and one sixth of attendees (8) were from industry and consultancies, including Nommon Solutions and Technologies, PANSA, SITA, Spire Global, Think Research, and Innov'atm.

Approximately one third were female and two thirds male, which was a similar distribution to the 2019 and 2020 summer school [3],[4], see Figure 11.

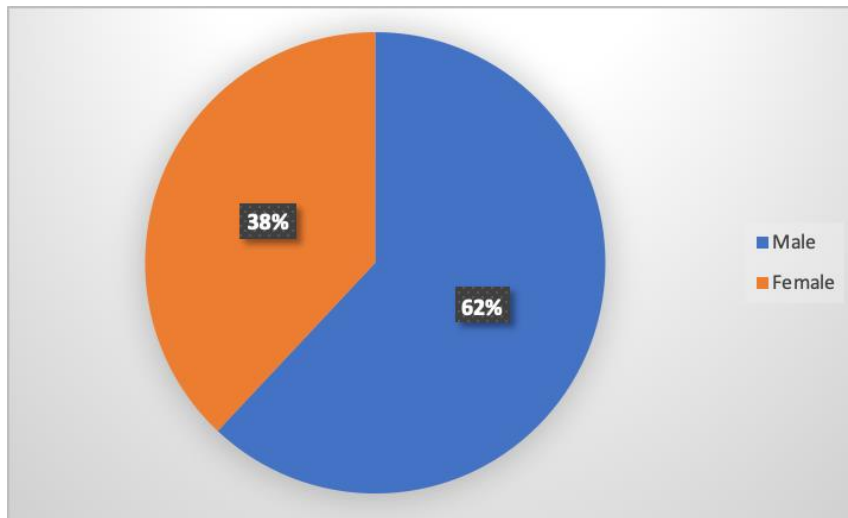


Figure 11: Participants' gender

Whilst the total number of participants at the summer school was 97, a maximum of 100 participants were recorded as some people logged in more than once during the day, e.g. logging out for the lunchbreak and re-joining for the afternoon session. Table 2 summarises the attendance per day.

Table 2: Zoom participant reporting

Meeting ID	Start time	End time	Duration (minutes)	Participants	Source
658 6512 5139	30/08/2021 09:10:06 AM	30/08/2021 03:51:37 PM	402	100	Zoom
658 6512 5139	31/08/2021 10:48:01 AM	31/08/2021 04:08:51 PM	321	86	Zoom
658 6512 5139	01/09/2021 09:29:13 AM	01/09/2021 04:54:10 PM	445	91	Zoom
658 6512 5139	02/09/2021 09:07:03 AM	02/09/2021 05:23:51 PM	497	81	Zoom

4 Feedback from participants

Engage summer school organisers have received several e-mails of appreciation in the days that followed the event. These can be distinguished as messages coming from PhD students and from panellists.

4.1 Feedback from PhD students

There was a widespread consensus on the helpful insight that the industry panel provided to the students:

“Thank you all very much. I think that yesterday’s panel was very interesting and it did help us to have a broader perspective.”

“I found it really useful in all possible aspects. It is always very enriching to see the point of view of experts in the field.”

“Many thanks for the amazing opportunity, it was a really wonderful panel discussion.”

Further confirmation of the students’ appreciation of the opportunity they had in presenting their research activity to a panel of experts came when some of them explicitly asked to access the video recordings of their panel to understand more deeply the discussion and the observations made on their work.

“Thank you very much for the video, we received very helpful feedback indeed and I am sure I would not be able to remember everything.”

“I would like to revisit the details of the comments made by the experts during the panel session, as the information is really valuable to us. So I would like to ask you if the recordings of the sessions will be made available to us and how we will be able to access them.”

“I would like to ask when the recording of the presentations will be available. We wish to share it with my ‘mentors’ from EUROCONTROL as they did not attend the Summer School, but they are curious about the feedback and questions I received after my presentation.”

This last comment indicates that there is a clear intention from the students to follow up on the feedback received. The main objective of this summer school (“offer insight on each of the Engage PhDs, with particular focus sought on how the work of the PhD could be taken forward in an operational/more applied setting”, see Section 2) can therefore be considered as achieved, as also proved by the following messages:

“I would like to organize a meeting with my advisors to discuss challenges raised from the panel discussion (also, regarding the concept of "cooperative processing" or "cooperative robust filtering" as you mentioned) to have a better perspective, then being in contact with panelists.”

“In any case, now I am fully aware that ANSP's needs are quite different from the Network Managers. This is very valuable feedback and I am sure that it can lead my research to real world applications in the short and medium term. As I said, the basic research is there, we just need to adapt it to solve particular problems.”

“I also believe that putting our work in a broader context and highlight possible improvements (and limitations) is always useful and interesting. We have a lot of things to learn.”

“I have taken notes about the feedback received and added it as a new path to extend the work done after completing the expected studies”.

Engage PhD students were asked (in advance) to include a summary of the comments received from the panel in their next periodic report.

4.2 Feedback from panellists

Participation in the panels was a much-appreciated experience. Many panellists were pleasantly surprised by the academic research and gave very helpful advice based on their professional knowledge.

“I would like to take this opportunity to thank you again for having me as panellist in this edition of the Engage Summer School. I hope that both you and the PhD students found the comments and feedback provided useful, and always constructive.”

“It was my pleasure to attend the summer school and hopefully give my little contribution to make the event a success, as it undoubtedly was given the positive feedback, both internal and external, I received.”

“Whilst I have probably given hundreds of presentations over the years, the fact of being on a panel was quite a new dimension for me so I am happy it met the expectations of both yourselves and the students.”

“I most appreciated the industry panel”

“It has been a pleasure to assist and see the effort and interesting work developed by the PhDs in particular and by the whole Engage group”

“... and I'd like to say that I was impressed by the quality of the PHD works presented”

“it was my pleasure to attend and support the students...after all we all have been students!”

“thank you for organising the Engage summer school programme which in my opinion is a fantastic initiative ... I have found [such] positive energy and enthusiasm amongst your students ...”

Some panellists have also expressed:

- their availability to be contacted further by the student(s) to provide additional advice;
- their interest in following up some PhD activities.

“I really enjoyed participating. I was wondering if it would be possible to have the slides that were presented, will they be made available? [...] I also wanted to share that I would be interested to see how the research of [names removed] progresses.”

“Is there a plan for a follow-up once their PhDs are completed, potentially an event, but maybe just publish a short summary and a link to the PhD on the ENGAGE website?”

“I was very impressed with the variety of research programmes being undertaken, and I look forward to seeing how they progress”

NB. The slides are to be posted on the Engage website along with updated PhD reports.

To express their appreciation, summer school organisers sent a letter to each individual panellist (Figure 12).



Figure 12: Letter of appreciation

5 Conclusions and outlook

5.1 Conclusions

This third edition of the Engage summer school aimed to provide PhD students with an overview of some perspectives that are open to them at the end of their studies. On the one hand, the widespread involvement of industry representatives to provide feedback on how their findings could be taken forward in an operational and professional setting. On the other hand, the sharing of some initiatives that would allow them to obtain recognition and continue the research activity started so far. The combination of these two aspects was certainly one of the keys to the success of the event.

A large number of applications from a number of European countries, USA, Saudi Arabia and Vietnam were received and accommodated. The total number of attendees has slightly increased with respect to the 2020 edition. This led to a final group of 97 participants, with varied backgrounds and a largely common, strong interest in air traffic management.

Overall, despite the inability to have the planned physical event, valuable support has been provided for the future career of Engage PhDs, and useful lessons learned for the continuation of the Engage KTN and its possible follow-ups.

5.2 Lessons learned

From this four-day event, some useful lessons can be drawn.

1. The virtual format worked well given the circumstances. However, a great deal of the feedback received clearly suggests that **a physical event is still preferred to the virtual one**, and that networking and physical interaction are highly valued elements of events of this kind, as also highlighted by some panellists:

“If Engage is able to organise some kind of ‘non-virtual’ event in the coming years, then I will happily attend”

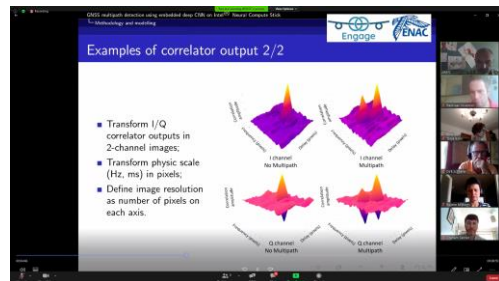
2. Involvement of industry experts to discuss PhDs’ academic research and results was highly appreciated from both perspectives. Contacts were established between Engage PhD students and relevant industry experts.
3. Although primarily aimed at Engage PhDs, the programme proved to be attractive to other PhD/MSc students and young researchers, as well as to a number of industry participants.
4. Understanding of the Engage wiki contents and coordination with SESAR Digital Academy activities strengthened PhDs’ knowledge on existing initiatives to support their future academic or professional career.

5.3 Broader review and outlook for SESAR 3

2019



2020



2021



Panellists from	
SESAR JU, Heathrow Airport, EUROCONTROL	
SESAR JU, skyguide, EASA, EUROCONTROL	
NATS, skyguide, CRIDA	
SESAR JU, CRIDA, NATS	
SESAR JU, MetSafe, NATS	
SESAR JU, skyguide, CRIDA, EUROCONTROL	

Figure 13: Evolution of the summer schools – pedagogical approach

Figure 13 illustrates the evolution of the pedagogical approach across the series of summer schools. In 2019 (the only physical summer school), the focus was very much on teaching the PhD candidates some of the fundamentals of ATM and wider research practice. This was highly valued by the students, many of whom had no background in ATM, and these materials now form the basis of the lecture courses published in the Engage wiki for the benefit of future students, and as a contribution to the SESAR Digital Academy (for details, see Engage Deliverable 3.9: *The Engage wiki - an update on the KTN's knowledge hub functionality, research maps and repository*).

This evolved in 2020 to a split approach, with approximately half of the week allocated to the PhD candidates acting as mutual discussants, in pairs, for presentations of their work, then at a relatively mature stage. The other half of the week comprised an opportunity for a number of industry presentations and methodological tutorials – all of which were closely tailored to the needs of the PhD candidates, based on a survey of the students and supervisors, and on feedback from the Engage mentors assigned to each PhD, who also moderated the PhD discussant sessions.

As discussed in this deliverable, 2021 saw a move to rather longer PhD presentations, grouped largely into thematic pairs, with subsequent extended panel discussions with domain experts from industry. A particular focus was sought on how the work of the PhD could be taken forward in an operational / more applied setting and the Engage PhD students were requested to note in their next periodic reporting how they had used the feedback from the panels.

These combined sessions in 2021 (PhD presentations followed by industry panels) were moderated by a member of the Engage team (a mentor of one or both of the Engage PhDs). This format dominated the summer school, although interspersed with some other sessions, and was met with significant positive feedback, as detailed above. Coordinating the thematic challenge workshop “Machine learning, AI and automation in ATM” on the final day of the 2021 summer school week, as a follow-on, but independent, event, also worked well in that it pursued a number of technical elements of the PhD topics, and attracted a good follow-on audience, plus new participants.

Although the virtual summer schools allowed a wider participation than hosting them as physical events, the interactions with students would have doubtless been richer across the whole cycle, had not the Covid-19 pandemic prevented this. Hosting mixed-mode events in future (i.e. hosting physical events but also streaming them virtually) might be possible, although this generates significant logistical challenges and was thus not adopted for the corresponding SESAR Innovation Days of 2020 and 2021, either. Feedback clearly favours the physical event option for the summer schools.

Overall, the evolving format across the three years, geared to meet the changing needs of the PhD candidates, including other PhD candidates in the same process, and closely knit with the additional, dedicated mentoring support and *ad hoc* technical workshops provided by Engage (e.g. on data sources and data management), has apparently been successful, as reflected in the feedback received, to the extent that the Engage consortium recommends a similar approach to the SESAR 3 KTN, should this also comprise a similar package of supported PhDs.

NB. More broadly, further reflecting on SESAR 3, it is also recommended to bear in mind that even with a prompt Call for PhDs at the early stage of a 4-year KTN, provision needs to be made for the likelihood that many of the cohort will not have concluded their studies by the end of the KTN, as indeed was foreseen by Engage at the outset of its activities, and thus appropriately managed.

6 References

- [1] Engage project, 2017. Grant Agreement 783287, Ref. Ares(2017)6114946 - 13/12/2017.
- [2] Engage website, 2021. <https://engagektn.com/summer-school-2021/>.
- [3] Engage project, 2020. D5.12 Engage SESAR Summer School 2019, Edition 01.02.00, March 2020.
- [4] Engage project, 2020. D5.13 Engage SESAR Summer School 2020, Edition 01.00.00, November 2020.

7 Acronyms

ATM	Air traffic management
KTN	Knowledge Transfer Network
SESAR	Single European Sky ATM research
SJU	SESAR Joint Undertaking



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