

D3.4 Thematic challenges priming report for first workshops

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Engage

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Engage

THE SESAR KNOWLEDGE TRANSFER NETWORK

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Abstract

This document describes the process used by the Engage KTN to select the thematic challenges central to the network and how these are being used to define its first set of workshops.

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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Executive summary

Engage is the SESAR 2020 Knowledge Transfer Network (KTN). It is managed by a consortium of academia and industry, with the support of the SESAR Joint Undertaking, to promote and facilitate the development of air traffic management research in Europe. Its focus is two-fold: inspiring new researchers and helping to align exploratory and industrial research, through a wide range of activities and financial support actions. This document describes the process used by the KTN to select the thematic challenges central to the network and how these are being used to define its first set of workshops.

This document serves primarily as a record for the SESAR JU of the selection process of the thematic challenges, and an update on the planning of the associated workshops. The timing of its delivery is intended to inform the process of the on-going definition of ER4 by the SESAR JU.

The thematic challenges will address research topics not currently (sufficiently) addressed by SESAR, and will be supported by dedicated workshops. The call for thematic challenges was open on the Engage website between January and March 2018, with proposals submitted *via* an on-line form. All 54 proposals were subsequently evaluated by members of the Engage Awards Board. Evaluation criteria including weights and thresholds are presented.

Six priority themes were identified, from which the top four were selected; two remaining themes are maintained as candidate future themes. The four themes cover ten out of the top (ranked) twelve individual proposals. The four selected themes are: (1) cybersecurity; (2) data-driven trajectory management; (3) managing meteorological uncertainty; (4) economic mechanisms for trajectory management. These are not necessarily the precise nomenclature that will be adopted for the thematic challenges into which they will be developed, as minor adjustments may be made as they are further matured, but these titles remain useful descriptions of the selected challenges.

The next steps are detailed herein, regarding the further maturation of the definitions of the thematic challenges, publication of the corresponding texts on the Engage website, and launching the corresponding workshops sufficiently in advance of the SESAR Innovation Days (taking place in early December 2018).

1 Introduction

1.1 The Engage KTN

Engage is the SESAR 2020 Knowledge Transfer Network (KTN). It is managed by a consortium of academia and industry, with the support of the SESAR Joint Undertaking, to promote and facilitate the development of air traffic management research in Europe. Its focus is two-fold: inspiring new researchers and helping to align exploratory and industrial research, through a wide range of activities and financial support actions.

1.2 Objectives of this document

This document serves primarily as a record for the SESAR JU of the selection process of the KTN'S thematic challenges, and an update on the planning of the associated workshops. The timing of its delivery is intended to inform the process of the on-going definition of ER4.

1.3 Engage's exploratory research heritage

Between 2010 and 2016, SESAR WP-E managed a portfolio of long-term and innovative research activities that fell outside the main SESAR industrial work programme. It operated through open calls, not restricted to SJU members, for projects and research networks. Evaluation and selection of tenders was done by independent review in line with standard EC practice. In total, WP-E managed two research networks, 40 projects and 20 PhDs. Some 75 organisations (mainly academia and research centres) received funding. In addition, WP-E initiated and managed the SESAR Innovation Days; WP-E was managed by EUROCONTROL on behalf of SESAR. There were two sub-workpackages, as indicated below.

1. Networks were designed to provide a structured way to build research knowledge, competence and capability to serve the industry in the long term. Each network comprised members and participants from academia, research centres, industry and SMEs that shared a common expertise and interest in a particular air traffic management or transportation domain. Two networks were built: ComplexWorld focused on the potential and application of complexity science and HALA! addressed higher levels of automation in ATM.

2. Projects were oriented towards a specific research question or challenge and were hence much more focused than the networks. Projects explored new ideas oriented to the long term but also produced innovative solutions applicable in short- and mid-terms. Interdisciplinary approaches were explicitly encouraged to help enrich projects with innovative solutions. A total of 40 projects with an average duration of 30 months were executed in five areas:

- Towards higher levels of automation in ATM;
- Mastering complex systems safely;
- System architecture and system design;
- Information management, uncertainty and optimisation;
- Enabling change in ATM.

The projects and networks have led to some valuable results, in many cases driven forward in other research or applications. Apart from its scientific results WP-E has managed to create a healthy network of academics and researchers, thanks to initiatives such as the SESAR Innovation Days.

The lessons learned in SESAR WP-E were captured in the following four recommendations:

1. Whilst most workpackages and projects in SESAR tried to bring concepts and tools to successful implementation that had themselves been subject to research at an earlier stage, WP-E aimed to 'fill the research pipeline' with new ideas and concepts, producing an output that was at a much lower Technology Readiness Level (TRL). Such research may sometimes produce innovative concepts to address known ATM problems; it may also produce promising new approaches the potential and limitations of which have yet to be better understood; and it may often explore avenues that, although initially promising, turn out to be dead ends. Such is the nature of innovative and long-term research, and trying to harness it *too* tightly towards existing ATM challenges may deprive it of the liberty it requires to explore uncharted territory. That doesn't mean that long-term and innovative research should be disconnected from the rest of the programme, quite the contrary: the potential of WP-E and similar future research projects should be systematically assessed and transferred to other parts of the programme.

Recommendation 1: *Strengthen the transfer of long-term and innovative research results to higher maturity levels.*

2. Not all long-term and innovative ('blue-sky') research projects will lead to solutions that are directly applicable, and hence a relatively large portfolio of projects is desirable. On the other hand, this type of research is significantly less expensive than research at higher maturity levels which often require complex software and hardware implementations (instead of mock-ups and simulations) and high-fidelity validation exercises (instead of simple experiments). As a consequence, the ideal size of a long-term and innovative research project is much smaller than that of other research projects. Much larger projects are likely to generate larger consortia with obvious disadvantages in flexibility and efficiency.

Recommendation 2: *Maintain a portfolio with a large number of relatively small research projects, aiming at 2-4 entities and maximum funding of EUR 1m or less.*

3. Long-term and innovative research calls will mainly attract interest from academia and research centres, sometimes teaming up with industry and ANSPs (for example). Attracting researchers from new disciplines and application areas other than ATM is very desirable and

should be encouraged. However not all project teams will be equally familiar with ATM and in these cases it is vital to invest effort to help them learn about the sector.

Recommendation 3: Provide full, active and on-going support to projects new to ATM to ensure their work is relevant. Provide ATM familiarisation for research project team members on a request basis, e.g. ATM initiation training.

4. To ensure relevance and test the applicability of concepts, the vast majority of long-term and innovative research projects is driven by real data, both in the exploration and concept evaluation phase. This includes flight plan data, radar tracks, aircraft performance data, delay data, etc. Accessing such data is often cumbersome and time-consuming; in some cases expensive data purchases were necessary. Ways of redressing this situation would be very worthwhile, not only because presently project effort and sometimes budget is dedicated to obtaining data, but also because the quality of the research results themselves depends on the quality of the data used.

Recommendation 4: Facilitate access to data for research purposes (e.g. flight plan data, radar tracks, aircraft performance data, delay data etc.). This includes ready access to current SESAR documentation.

WP-E has also inspired the successor of SESAR WP-E, namely SESAR 2020 Exploratory Research. SESAR 2020 Exploratory Research (ER) was launched in 2015 and is based on a total of four calls with a significant increase in overall budget in comparison to SESAR WP-E.

The first call (ER1), launched in 2015, led to a total of 28 research projects, all concluding in the first half of 2018; the second call was dedicated to UAVs; call three led to the creation of the Engage Knowledge Transfer Network and a small number of research projects all kicking-off in 2018; call four will be published in early 2019.

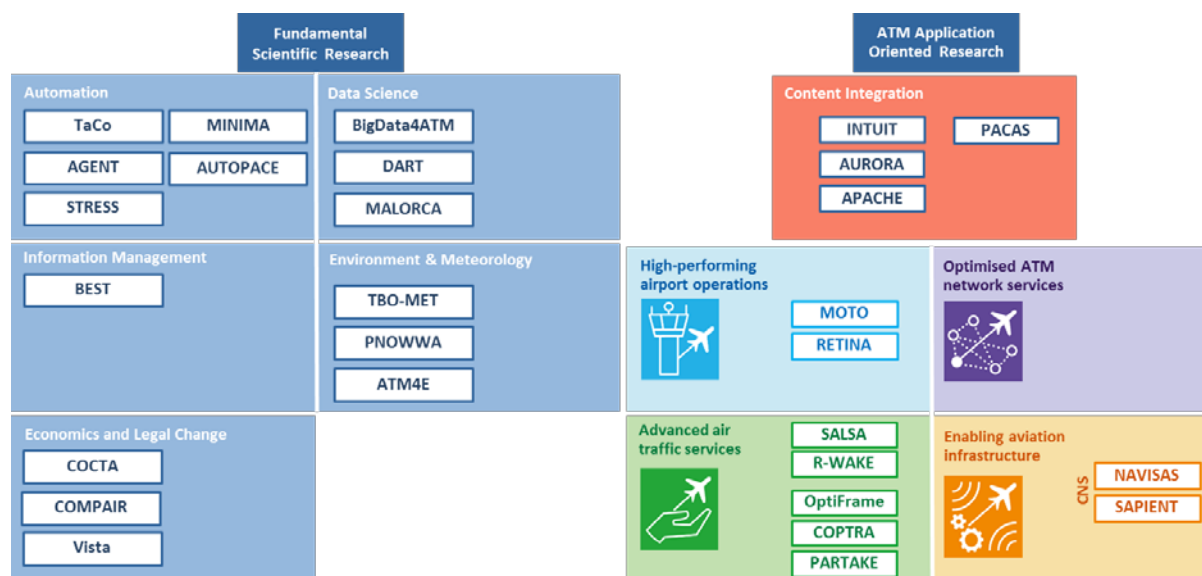


Figure 1. ER1 projects

To facilitate the transfer of research results to higher concept maturity levels, SESAR 2020 Exploratory Research applies the Technology Readiness Level model. Fundamental Scientific Research (up to TRL1) and ATM Application-Oriented Research (up to TRL2). Fundamental Scientific Research projects (TRL1) are funded in the areas: automation; data science; information management; environment and meteorology; and, economics and legal change. These areas clearly suggest a continuity from WP-E’s research.

Application-Oriented Research (TRL2) is structured along the same research areas as SESAR 2020’s Industrial Research in order to facilitate transfer of ER research results into higher maturity levels. Figure 1 shows the 28 projects funded as a consequence of SESAR 2020’s ER1 call. Since the second ER call was limited to UAVs it will not be elaborated upon here.

The third call led to the creation of the Engage Knowledge Transfer Network and 7 research projects, as shown in Figure 2. More information on all exploratory research projects can be found on the SJU website – see <https://www.sesarju.eu/activities-projects>.

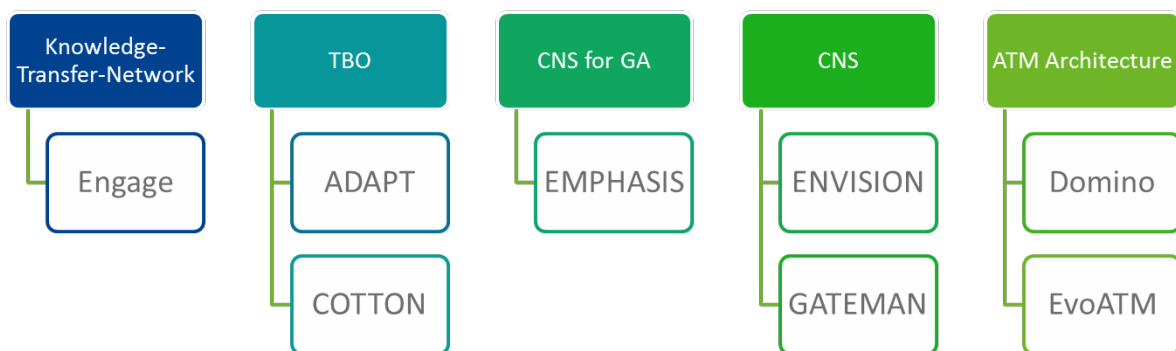


Figure 2. ER3 projects and KTN

The ER projects have all benefited from a review and feedback provided by the SESAR Scientific Committee, which advises the SJU on scientific aspects of the SESAR Work Programme.

As noted above, the material in this deliverable, regarding the proposed topics for future research, may also be considered by the SJU in the context of finalising the ER4 call.

2 Thematic challenges and selection protocol

2.1 Purpose of the Engage thematic challenges

At the core of the KTN are ‘thematic challenges’, for research topics not currently (sufficiently) addressed by SESAR, to be supported by dedicated workshops. These challenges may embrace two areas. Firstly, whereby problems and needs exist for operations and policy development, more aligned with applied research¹. Secondly, other thematic challenges may be more aligned with exploratory research. Over the duration of the KTN, domination of the former type will be supported, since the latter area will also be addressed by the PhDs/theses supported by the KTN.

To further promote cooperation between industry and academia, between ER and applied research, ‘catalyst’ funding will support focused projects, stimulating the transfer of exploratory research results towards ATM application-oriented research. This funding will be awarded to groups (e.g. an industry partner leading a thematic challenge, and two academic institutions working in an area bringing potential solutions to this thematic challenge) to conduct and fast-track specific activities in support of developing solutions to the challenges and moving closer towards industry goals and objectives, and towards higher TRLs. (In certain cases, catalyst funding may be awarded to develop more exploratory concepts, where these show particular promise and are not suitable to be addressed by a PhD or thesis.) The launch for calls for catalyst funding and the precise relationship with the thematic challenges will be detailed in subsequent KTN reporting.

2.2 Thematic challenge call

The call for thematic challenges was open on the Engage website ([1]) between January and March 2018, with proposals submitted *via* an on-line form.

Notifications of this opportunity were sent to over 7 800 contacts directly by the KTN, the ASDA newsletter, various partner/SJU social media accounts and through a link distributed in the February 2018 edition (#80) of SESAR e-news.

Table 1 shows the requested information for each proposed thematic challenge.

¹ The call for proposals (H2020-SESAR-2016-2), to which the Engage KTN CSA proposal was submitted, asked for coordination between exploratory research and “industrial research”. We consider the latter to cover “industrial research and validation (IRV)” but we do not exclude potential coordination at higher TRLs.

Table 1. Required information per proposed thematic challenge

Form field	Description (<i>required/optional information</i>)
1. Your suggestion for a thematic challenge	Outline of the proposed idea; no more than 120 words (<i>required</i>)
2. Your name	Proposer's name (<i>required</i>)
3. Institution name	Proposer's organisation (<i>required</i>)
4. E-mail address	Proposer's contact (<i>required</i>)
5. List of other partners potentially interested (if any) (names of institutions only)	Other parties who might be interested; not binding at this stage, however at least one partner is needed to apply for catalyst funding at a later stage (<i>optional</i>)
6. I confirm that I have checked for duplication or undue overlap with current or previous SESAR research activities	Yes/no self-declaration (<i>required</i>)
7. We could host a workshop	Yes/no answer; being unable to host a workshop did <u>not</u> affect the selection process (<i>required</i>)

54 proposals were received from 33 organisations, covering:

- Industry (including airspace users and ANSPs);
- Research institutes;
- Universities;
- Consultancies.

Just over half of the proposals suggested other partners who might potentially be interested in the proposed challenge, whilst two thirds included an offer to host a workshop.

2.3 Selection criteria

All 54 proposals were subsequently evaluated by members of the Engage Awards Board – note that in accordance with Article 35 of the Grant Agreement ([2]), members with potential conflicts of interest abstained from the decision-making process. Evaluation criteria including weights and thresholds are depicted in Table 2.

Table 2. Selection criteria

Criteria	Threshold	Weight	Comments
Operational relevance	3/5	40%	-
Focus of challenge	3/5	30%	Is the challenge sufficiently focused/clear so we can hope to take it forward/solve it?
Capability of network and/or proposer	3/5	30%	Is the challenge likely to generate sufficient interest for a workshop and dedicated SIDs session ² ?

In addition to evaluation scores, members could provide free-text comments. Such comments were optional, but for example, could highlight opportunities to merge similar challenges or, conversely, flag challenges that duplicate existing research. This process was managed by EUROCONTROL, as Chair of the Board, and a total of eight sets of evaluations were received from Awards Board members.

In a first step, the individual proposals were ranked in the following way:

1. The number of occurrences in which a proposal was scored less than the threshold of 3/5 in any of the three categories was counted;
2. Proposals which were scored below the threshold in at least one third of the cases were removed (there was not a single proposal which did not score below the threshold at least once);
3. The overall score per remaining proposal was calculated and ranked accordingly (skipping step 1 and 2 would very likely have led to a similar ranking since overall low scores correlated, with higher numbers of scores below threshold).

² See Table 9 for details.

3 Final selection

As expected, there were several links between the 54 proposals; we attempted to identify these links so as to group the challenges into ‘themes’. With eight evaluators providing feedback on 54 proposals it was not obvious that this would readily fall into place, although it eventually did so. We took the highest scoring individual proposal and identified related proposals further down (lower ranked) the list based on the challenge description and the evaluators’ comments. In this fashion, six themes were identified, from which the top four were selected; two remaining themes are maintained as candidate future themes. The four themes cover ten out of the top twelve individual proposals. The four selected themes are:

- Cybersecurity;
- Data-driven trajectory management;
- Managing meteorological uncertainty;
- Economic mechanisms for trajectory management.

The following tables list the twelve selected suggestions, anonymised and grouped into the four themes. Along with the evaluation ranking, three of the submitted form fields are shown (refer back to Table 1): “your suggestion for a thematic challenge”, “I confirm that I have checked for duplication or undue overlap with current or previous SESAR research activities” (i.e. self-declared) and “we could host a workshop”. The last row notes whether any other proposals are related to the theme. *Note that Tables 3 to 6 have been removed from the public version of this report.*

As discussed in Section 4, these themes are not necessarily the precise nomenclature that will be adopted for the thematic challenges into which they are developed, as minor adjustments may be made as they are further matured, but these titles remain useful descriptions of the selected challenges.

Table 3. Selected suggestions: theme 1 – “Cybersecurity”

Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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Table 4. Selected suggestions: theme 2 – “Data-driven trajectory management”

Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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Table 5. Selected suggestions: theme 3 – “Managing meteorological uncertainty”

Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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Table 6. Selected suggestions: theme 4 – “Economic mechanisms for trajectory management”

Rank	Suggestion for a thematic challenge	Checked for duplication	Host a workshop
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4 Priming the workshops

After consolidating the selection outcome during an Engage conference call, the following further steps were decided:

1. A small team, including individuals who have submitted the top proposals related to each theme (typically three or four people) and one or two Engage members will be set-up, leading to a team of typically four to six members per topic; this team comprises the challenge ‘champions’;
2. The teams will re-scope the themes into the final thematic challenges, potentially with (minor) changes to the titles, with a view to operational relevance and specific focus, with guidance on re-scoping being provided by the Engage partners;
3. The topics will be published on the Engage website³ (followed by details of the corresponding workshops, once decided upon) and disseminated accordingly;
4. Dedicated workshops will be held for each challenge with open participation and an emphasis on industry involvement (see also Table 9). Where possible, synergies with other planned workshops and conferences will be exploited. To this end, a dynamic list is maintained within the Engage development tool (‘inGrid’ – see Grant Agreement [2]) of other corresponding activities that should be borne in mind, on a challenge-by-challenge basis⁴.

Thematic challenge refinement and maturation actions are indicated in Table 7. The Engage partners currently involved in supporting each challenge are indicated in Table 8. The submitters of all 54 proposals have been notified of the final selection outcome, and the Engage partners in Table 8 have launched the communication process with the submitters of the top proposals, as per the template message indicated in Table 9.

³ Thus also potentially providing inspiration and a supporting context of activities for PhD / thesis proposals, in the corresponding Call due ASAP, although it is *not* a requirement for the submitted PhDs / theses to be aligned with the thematic challenges.

⁴ Such considerations have been flagged in the initial communications distributed to the selected proposal submitters, as per Table 9.

Table 7. Thematic challenge refinement and maturation actions

Thematic challenge development actions
Decide upon the Challenge ‘champions’
<ul style="list-style-type: none"> Selected proposal submitters 1-2 Engage members Industrial / operational partner (ideally; added if not included as a submitter)
Produce a description of problem and motivation from an industrial / operational point of view
Identify what has been tried before and why has it failed?
Produce abstract 100-150 words (to appear on Engage website)
Produce 2 page challenge description (to be available as a document on the Engage website)
Identify issues - e.g. potential existing research / workshop activity overlap
Develop a common (across all challenges) set of measures (metrics) for quantifying success
<ul style="list-style-type: none"> How to quantify the contribution of the research to solving the challenge?
Develop a proposal for a workshop location, topic and date
Consider (top) contacts – people / organisations / projects that should be involved
Consider target groups to contact and potential (ER) project collaboration opportunities

Table 8. Engage partners supporting challenges

Challenge no.	Challenge title	Engage partners supporting (no implied order)
1	Cybersecurity	Innaxis EUROCONTROL Frequentis
2	Data-driven trajectory management	University of Belgrade EUROCONTROL
3	Managing meteorological uncertainty	University of Trieste Technical University of Delft
4	Economic mechanisms for trajectory management	University of Westminster University of Trieste

Table 9. Communication template message used with selected proposal submitters**Communication template message**

Thank you once again for submitting your challenge to the Engage website. We are very pleased that your suggestions have been selected for investigation. The next steps are as follows:

- Partners from the Engage consortium have each opted to support taking particular suggestions forward. For your challenge, *[insert Engage partners]* would like to support you.

Your suggestions have currently been grouped into a theme entitled "*[insert thematic challenge]*", although this title is by no means cast in stone. I would like to ask if you would be happy for me to put your challenge proposal text in a private Google doc, shared between us only. The idea would be to agree on a final name for the challenge, fully embracing your suggestions, to determine what the key priorities for investigation should be, and to agree a common text describing the challenge for publication on the Engage website (hopefully by the end of June). We may also decide between us to have a WebEx or Skype, of course, to support this.

- Kindly bear in mind that a key objective is to jointly organise a workshop, to share your interesting challenge ideas with other academics and industry members. We should (together) develop a plan for maturing the state of the art regarding your challenge, to be further supported by the KTN Call (later this year) for associated proposals for catalyst funding. We should consider in particular what has been tried before, however limited this may be, to ensure that we are indeed maturing the state of the art.
- Regarding the hosting of the workshop, the current possibilities are the *[insert locations]*. The aim would be to hold this sooner rather than later, as we are keen to launch as many workshops as possible well in advance of the SIDs, such that particularly promising workshops may be further explored with the wider community at a dedicated session at the SIDs.
- Funding is available from Engage to support catering at such a workshop, if you are able to host it, or to support a limited number of experts such as yourselves to attend a workshop if that would involve travel for you. *[In this particular case, we might also consider that there may be potential synergies with ... [insert from list]]*. In any case, we would much like to agree the updated text in the next couple of weeks with you, if that suits your agenda - it should hopefully be a fairly quick process.
- Workshops should last one day only, be free of charge to attend, and are expected to be relatively small (around 30 participants) - they will have a strong emphasis on discussion regarding the maturing of the challenge, with facilitated discussion, rather than simply packing in a series of presentations. Interdisciplinarity is strongly encouraged, with limited funds to pay for such speakers' travel.
- You are the owners of the challenge! The Engage KTN (in this case, in particular, *[insert Engage partners]*) are here to support you and do as much of the work as possible, for example regarding the elaboration of a final text and advertising (or even hosting) the workshop, and looking after the registrations and speakers' expenses etc.

Please let me know at your earliest convenience if it's OK for me to put your texts in a private Google doc, and we'll press ahead right away. You may of course have one or two questions on issues that I've omitted to cover above, in which case we'd be delighted to hear from you. Congratulations on having your challenge suggestions selected and we are very much indeed looking forward to supporting and working with you.

5 Next steps and look ahead

The key next steps are mainly as detailed in Table 9, and may be summarised as:

- Mature the definitions of the thematic challenges, as a collaborative exercise between the Engage partners and submitters of the component research suggestions;
- Publish the refined texts on the Engage website, and disseminate this action, thus enabling the wider research community to consider potential contributions to these challenges (e.g. at the corresponding workshops, and through the catalyst funding and PhD / thesis calls) – the target date for this publication is the end of June 2018⁵;
- Decide on the location, date, content and target audiences of the corresponding workshops, mindful of complementary activities (wider research⁶, in particular recently closed SESAR ER1 projects; other workshops), the recommendations summarised from SESAR1 (WP-E) in Section 1.3⁷, and that the Engage workshops should take place sufficiently in advance of the SIDs, such that particularly promising areas of research discussion may be further developed during the planned dedicated sessions at the SIDs in early December 2018;
- Consideration of Table 3 by the SESAR JU (and the corresponding complete list⁸ of submitted research suggestions, in particular, the reserve fifth- and sixth-ranked themes) in the context of developing ER4.

These dynamic processes will be updated in the Engage PMP and on the Engage website.

⁵ Although we are slightly behind schedule for this, the impact is low as long as sufficient workshops are launched sufficiently in advance of the SIDs; this is not thus considered to comprise a new risk.

⁶ Through the expertise of the Engage partners, the Engage Awards Board (which includes the SJU), the Engage industry partners, and the research community and interdisciplinary experts contributing to the development of the thematic challenges.

⁷ To the maximum extent possible within the constraints of the proposed activities of the KTN, e.g. the limits of the catalyst funding.

⁸ Shared with the SESAR JU.

6 References

- [1] Engage website, 2018. <http://engagektn.com/>.
- [2] Engage project, 2017. Grant Agreement 783287, Ref. Ares(2017)6114946 - 13/12/2017.

7 Acronyms

ANSP	Air navigation service provider
ASDA	Association for Scientific Development of Air Traffic Management in Europe
ATM	Air traffic management
CSA	Coordination and Support Action
EC	European Commission
ER	Exploratory Research
H2020	Horizon 2020 research programme
KTN	Knowledge transfer network
PMP	Project Management Plan
SESAR	Single European Sky ATM research
SIDs	SESAR Innovation Days
SJU	SESAR Joint Undertaking
SME	Small and medium-sized enterprise
TRL	Technology Readiness Level
UAV	Unmanned aerial vehicle
WP-E	SESAR Workpackage E (long-term and innovative research)

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