PJ.33 FALCO Newsletter

Content

Editorial

Dear Readers,

the first year of our SESAR Wave 3 Project PJ.33 FALCO is over, and it has been an exciting year full of interesting exchanges, discussions and achievements with various experts and scientists who have comprehensive knowledge in the field of increased flexibility of ATCO validations on one hand, and in the field of the new digital air-ground datalink technology LDACS on the other hand. Although it's also been a first year full of challenges, the PJ.33 consortium can be proud of the progress it achieved regardless of the still ongoing COVID-19 pandemic, and we can look forward to even more in 2022. We may also welcome LFV as new project partner, an ANSP with a lot of experience in flexible ATCO endorsements, and a SESAR project veteran in this topic. Once more I thank all project partners for the strong engagement being spent in the project.
We hope you will enjoy this interesting second newsletter reporting on the latest developments in the project, and again, feel free to share it largely!

Michael Finke

PJ.33 FALCO Project Coordinator

PJ.33 FALCO in brief

Grant Number:	101017479
Duration:	30 months
Budget:	7 593 152,51 €
Project Lead:	Michael Finke German Aerospace Center, DLR e.V.
Project Website:	sesarju.eu/projects/FALCO

PJ.33 continues to be full of...

Progress of Solution 1

Since the publication of the first newsletter a large amount of scientific research has been conducted.

The project consortium has identified, described and grouped technical and procedural enablers, which were then combined to different variations of the proposed new flexible endorsement strategy for ATCOs. Within this process first feedback from operational staff could be gathered as well. The design and functions of technical enablers as well as safety, security and human performance issues and aspects have been discussed, requirements have been collected, Use Cases have been established and the planning of the validations are on the finish line while this is being written.

Regarding Solution 01b, researching about a fully generic controller validation, the first two iterations of questionnaires have been executed. This will help to build up a common view of how a fully generic controller validation could be achieved and what this will entail. The results of the research conducted will be summarised on the final white paper.

Concomitant documentation tasks represented by several deliverables have been completed.

Those who want something find ways; those who don't want something find reasons. – Götz Werner

Definition of Sector Types as one Enabler for Flexible ATCO Endorsements

Through our engagement with operational experts, it's become clear that different 'types' of sectors exist. These types could be, for example, lower-level highly tactical sectors, high-volume streaming sectors, or even high-level planning style sectors. The reasons for this are numerous, as explained below, but what it means for the operation is that ATCOs learn to manage traffic by employing different 'styles' of controlling.

Therefore, grouping sectors based on their operational characteristics is one procedural enabler that could mean that controllers could hold a 'validation by sector type' rather than specific geographic areas as today. This could increase the number of sectors that a controller can work on, by allowing an ATCO who holds a unit endorsement for any sector to be quickly validated to work on other sectors of the same type due to the similarity in controlling styles required, therefore making it easier for them to add additional unit endorsements to their licence.

At NATS, the team has conducted analysis across our London Area Control sectors to firstly identify which sector types exist within the centre, and secondly to categorise those sectors which have similar characteristics and traffic behaviour.

The approach taken to create Swanwick AC sector groups followed a commonly used machine learning approach called K-means clustering. These algorithms work by grouping data points with the aim of reducing variation within each group.

In this analysis, the team worked with ATCOs and subject matter experts to select the chosen data set, which is made up of 8 variables describing the sectors and how traffic behaves within them. These variables have been derived from data which was recorded in 2018 over 40 days throughout the year. They include general sector information such as the area and number of aircraft per hour, as well as more specific data points like the speed difference between the fastest and slowest moving aircraft.

The K-means clustering algorithm starts with a number (k) of random data points within the data set, where 'k' is the number of desired groups, in this case k=4. Each of the sectors is then assigned to one of the 4 points to which it is most similar, i.e., the point which has the closest mean. When all the sectors are assigned, 4 new mean points are calculated for each group and the algorithm runs again assigning data points to their new nearest mean point. This process is repeated until the means and data groups converge on a final result.

The results of the Swanwick AC analysis are shown in the figure below. Principal Component Analysis

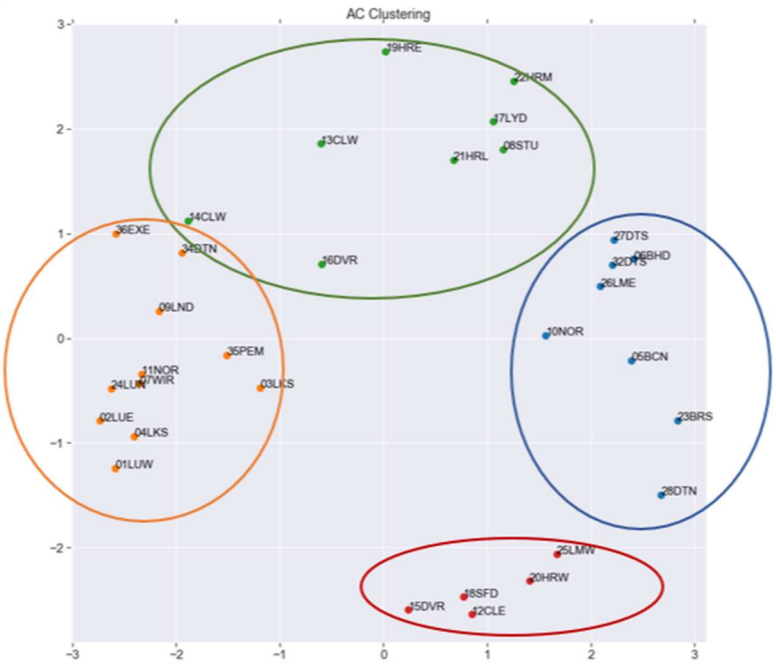

Figure 1: Swanwick Centre En-Route Sector Type Clustering

has been used to reduce the dimensionality of the data set whilst minimising information loss. The x- and y- axis represent the two 'Principal' components and each point represents a sector. The different sector groups are illustrated by colour in the graph.

This analysis shows that there could be considerable benefit in enabling ATCOs to work on more sectors than they do in current operations, by increasing how many unit endorsements they would hold, through the introduction of 'validation by sector type'. This change could lead to improvements in rostering efficiency, ATCO productivity as well as a possible reduction of training costs.

These results will be validated for operational feasibility in both PJ.10 IFAV and PJ.33 FALCO to assess how they could support the concept of increasing controller flexibility.

Progress of Solution 2

Since the publication of the first newsletter a lot of important activities have been conducted in Solution 2:

In the first Thread (Planning and Execution of LDACS Flight Trials), the test plan describing the activities to be carried-out during this technological validation exercise was completed and essential progress was made with the definition and development of the validation environment. The LDACS radio prototypes are available and the LDACS airborne radio that will be installed in the test aircraft needs to be certified (together with the airborne router and the measurement equipment). The certifications activities are ongoing and shall be concluded in July 2022 to allow for starting the measurement campaign.

The second Thread deals with the development of LDACS Digital Voice. Activities continued with the development of operational requirements for LDACS Digital Voice, considering the concept of operations that is currently used for the analogue VHF communications. Based on these operational requirements, functional requirements were derived and an LDACS architecture that supports the exchange of digital voice was elaborated. During the last months special emphasize was put on the development of a Business Case for LDACS, as a whole.

LDACS Cost Benefit Analysis

The current Air-to-Ground (A/G) communication technologies for the Air Traffic Management (ATM) services, i.e. the analogue VHF voice, the VDL (VHF Datalink) Mode 2 and the current version of the Satellite Communications (SATCOM) technology are not sufficient to support Airline Operational Control (AOC) and Air Traffic Control (ATC) services both in the future. There is a need for a new communication infrastructure and technologies that will provide the expected level of performance to support new airspace designs and applications.

Thus, the Future Communications Infrastructure Business Case (FCI-BC) shall analyse the costs that would be required when implementing a new communications technology. Four different Solutions have been proposed, and one of them is LDACS. Moreover, the Business Case shall not only look at the cost impact of implementing each technology scenario separately, but will also take into consideration other qualitative elements that are key for the decision-making process. Among other criteria, the Business Case will consider the capability of the Solution to evolve, to be scalable, and to support future services, including navigation and surveillance services and digital voice.

For the cost estimate, just the European airspace (see Figure 2) is taken into account and it is assumed that the introduction of LDACS on the ground will begin in 2024 and that the first aircraft will be equipped with LDACS from 2025 onwards. LDACS airborne radios shall only be installed in new aircraft. It is not planned to retrofit aircraft with LDACS, just the forward-fit option has been considered for the estimate of the airspace users' costs. These costs include LDACS data link usage for ATC and AOC communication, whereas on the ground only the annual fees for Air Navigation Service Providers (related to ATC communication) are considered. The estimated costs were discussed and agreed with the relevant stakeholders (Airlines, Communication Service Providers, Radio Manufacturers) and will be summarized in the "FCI-BC" document in which all four scenarios are compared and conclusions shall be drawn.

Figure 2: European Domestic Airspace

Interview – Solution 1: Jenny Eaglestone (NLR)

The Royal Netherlands Aerospace Centre NLR is the aerospace research organisation of The Netherlands. It is one of its major technological institutes and aims at making aerospace more sustainable, safer, more efficient and more effective.

Jenny Eaglestone is a senior consultant with the Royal Netherlands Aerospace Centre (NLR) where she works on a broad range of projects within the training and simulation department. Prior to joining NLR last year, she worked for many years as a selection expert at Air Traffic Control the Netherlands (LVNL). Alongside her work with NLR she is also currently a board member of the European Association of Aviation Psychology (EAAP). Jenny holds an MSc in Organisational Psychology from Utrecht University.

1 Why do you see a need for this project?

We feel that the need for this project is twofold. Firstly, the foreseen shortage of controllers in the future and the change in controller tasks. A change to a more monitoring focused role could possibly entail a more flexible ATCO environment. Secondly, we feel that this project fulfils the need to explore procedural (non-technical) enablers as in the past there has been more focus on technical solutions.

2 What are the biggest challenges you have faced in the first year of the project?

One of the biggest challenges we have faced is the tension between operational/organisational goals and carrying out the research in a methodological sound fashion. A second challenge has been clarification of the content of the different IFAV projects (e.g. PJ.33 & PJ.10). These challenges have taken time and effort but we would very much like to thank everyone for their input and help in dealing with both.

3 What have you gained/learned in the past year?

In this past year we have learned a lot about the broad range of technical and procedural enablers. Furthermore, we have learned the need to clarify ATCO experience and the different factors that play a part in this.

Something that has been more difficult to identify so far is the extent of the need for increased flexibility in Europe and to what extent we will need more generic controllers in the future.

Interview – Solution 2: Christoph Rihacek (FRQ)

Frequentis is an Austrian high-tech company focusing on safety-critical communication and information solutions. The company holds cross-industry experience in civil aviation, defence, public safety, and maritime and public transportation.

Christoph is a Project Manager in Frequentis' Corporate Research Department and has been with the company for more than 20 years. Before joining Frequentis, Christoph completed an M.Sc. at the Technical University of Vienna. He has been involved in the development of LDACS for many years. In PJ.33 he leads Solution 2.

1 How does LDACS support an increase in ANSP efficiency/productivity?

LDACS is a terrestrial-based radio access technology designed for aeronautical communication that offers benefits to airlines, Air Navigation Service Providers (ANSPs) and Communication Service Providers (CSPs). This secure broadband A/G communications system for aviation addresses the limitations of existing technology and provides an invaluable opportunity for modernisation and future-proof aeronautical communication networks. LDACS allows for integration of new CNS services that will enable ATM Modernization leading to more efficient air travel. Thus, with the installation of LDACS many new applications can be supported that in turn allow for introduction of more efficient operational procedures and thus increasing ANSP productivity.

2 What were the biggest achievements of Solution 2 in the first year of the project?

Solution 2 consists of two different and independent activities: First, PJ.33 Solution 2 supports another SESAR Solution PJ.14-W2-60 in its to goal to reach TRL6. For that, flight trials with LDACS equipment are planned and will be carried-out in Solution 2. During the first year of the project, the test cases for the flight campaign have been detailed and the activities needed to certify the airborne equipment have been brought forward. Whereas in the other activity the main focus was on the development of operational requirements for LDACS digital voice and on the design of the LDACS digital voice system.

3 How is the Solution preparing for the upcoming flight tests?

Currently, there are many different activities ongoing. Most important issue is to get the approval for the frequencies to be used in the flight trial that will commence in July in the airspace around Munich. The installation of the ground infrastructure (antennas, ground stations, etc.) has already started and after the certification activities have been concluded the installation of the LDACS equipment in the aircraft can start, too. In order to mitigate the risk that the LDACS equipment does not work as expected in the flight trials, an LDACS radio will be installed in a car and similar test cases with a moving LDACS radio will be carried-out.

Milestones

- **M2 achieved**
  Initial SPR-INTEROP/OSED approved
  31/08/2021
- **M3 achieved**
  1st Management Progress Report approved
  31/10/2021
- **M16 (PMP.004) achieved**
  Initial TS/IRS delivered
  24/02/2022

Events

- **Webinar: Deployment options and transition scenarios**
  Presenting LDACS, 01/07/2021
- **Research Collaboration Conference**
  Virtual conference hosted by NATS,
  20/09 – 15/10/2021

News

Sep.

- **Start of Certification Activities**
  09/2021
- **TVALP for Flight Trials**
  10/2021

Oct.

- **Input to TVALP for Solution PJ14-W2-60 submitted**
  30/09/2021
- **PDR for LDACS airborne equipment**
  11/2021
- **LDACS Business Case**
  12/2021

Dec.

- **Grant Amendment accepted**
  21/12/2021
- **VALP Workshops**
  15/12/2021 – 11/02/2022
- **Safety/HP Scoping Workshop**
  26/01/2022
- **Operational Requirements for LDACS Digital Voice**
  01/2022

Feb.

- **Interim V2 VALP submitted**
  28/02/2022
- **Initial TS/IRS submitted**
  24/02/2022

Outlook

With publication of the third newsletter, the first half of the project duration will have passed and PJ.33 will near the end of its second year.

In spring 2022, Solution 1 will begin with Validation Exercises. These will be conducted in simulation facilities of five different partners with ATCOs from different ANSPs that are participating in the project. The Exercises have the goal of validating the technical and procedural enablers that have been developed in the first phase of the project. By publication of the third newsletter first results from the Validation Exercises are expected.

Solution 2 plans to conduct LDACS flight tests in July 2022. This requires timely and successful completion of certification activities and obtaining approval for transmission in the L-band. Subsequently, the equipment must be installed in the aircraft and the ground infrastructure with two LDACS ground stations must be set up. Another important activity is the technical validation of the LDACS Digital Voice capability that is planned to take place in June 2022 and involves equipment (Voice Communication Systems and LDACS radios) from different companies (Frequentis, DFS and INDRA).

Consortium

Acknowledgement

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