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Dear reader,
Welcome to this new 2021 Blueprint edition, Skyguide’s technology outlook.

Covid-19 has changed all our lives to some greater or lesser degree and for Skyguide the lessons of the pandemic are clear: transforming our technological and operational frameworks is a must if we are to meet the demands of this extraordinarily volatile aviation market.
In this edition CEO Alex Bristol explains how the Virtual Centre Programme is at the core of this transformation path towards higher scalability, reliability and cost-efficiency, all increasingly important capabilities in a post-Covid-19 aviation world.

Eric Nantier from Swiss International Air Lines stresses how the airline puts the needs of the passenger into focus and how future air traffic management will be a critical element in this information sharing process enabled by open, inter-connected digital services.

Florian Guillermet, Single European Sky ATM Research Executive Director, connects Skyguide’s Virtual Centre programme to a wider European plan. The crisis has given renewed momentum to move towards more horizontal communications and information transfer, he believes, with the focus on flows and trajectories rather than sectors.

And Iacopo Prissinotti, Director of Eurocontrol’s Network Manager, explains why the Network Manager supports Skyguide’s Virtual Centre model, as it is closely aligned to its own Integrated Network Manager (iNM) programme.

The good news is that we have already made important progress in transforming key areas of our enterprise, as Joël Jordan and Olivier Perrin from Skyguide describe on pages 12 and 13. In April 2020, the second phase of the New Route Handling concept was successfully deployed in the Zurich Area Control Centre - another vital step towards the “one-sky” concept of the Virtual Centre to operate effectively as a single system but based in two locations.

But it is also clear that we cannot undertake this urgent transformation alone. Skyguide’s Philippe Chauffoureaux shows how with the Coflight Cloud Service (CCS) concept Skyguide and DSNA are pioneering new ways of delivering essential flight data information across borders. Marie-Laure Glassey from Skyguide and Damien Plaignaud from Airbus explain how Skyguide and Airbus plan to integrate real-time aircraft performance and position data with advanced ATM simulation tools.

Nicole Leyre, chief financial officer, says that focusing on new automated open-architectures around transversal services will deliver important short-term cost savings while increasing the company’s flexibility to manage the kind of crisis which confronts us today without generating massive losses.

Thank you for joining us on our path towards the future. I appreciate your continuous support in this endeavour.

Sincerely,
Klaus Meier
Chief Technology Officer (CTO), Skyguide
Virtual Centre

Innovation is helping deliver efficiency gains at a critical time for the industry

Skyguide’s pioneering Virtual Centre programme will transform the company’s operations by exploiting the potential of new open-architecture digital technologies. Replacing the concept of local air traffic control (ATC) with a location-independent air traffic management (ATM) of one single sky will deliver new levels of scalability, reliability and cost-efficiency – increasingly important capabilities in a post-Covid-19 aviation world. Skyguide CEO Alex Bristol explains more.

Why are you running the Virtual Centre programme? I joined this company in 2011 and one of the things that I liked about Skyguide was its ability to think innovatively and to implement innovation in an ATM environment. I became CEO in 2017 and one of the first questions I wanted to answer was: what would give Skyguide the right to exist in 2035?

That led to the creation of “vision 2035” by the Executive Team, Board of Directors and the Government. We have concluded that part of what we are doing today is not core and we should strip back the operational side of our business to its essentials. Much of our thinking has gone into the Airspace Architecture Study (AAS) and a lot of AAS thinking has come back into our strategy. The two dovetail very nicely.

In June 2020 Skyguide’s Board of Directors approved tranche three of the Virtual Centre concept. This will deliver a pioneering and radical transformation of the company’s operations, which will allow different air traffic services units operating from different locations to provide core ATM services.

We commissioned an independent study to validate our conclusions and this has shown us that our benefits-driven – rather than technology-driven – strategy is coherent and makes sense. But it will only make sense if we can develop it with partners, and within a performance scheme which incentivises operational performance rather than owning assets.

Has Covid-19 sped things up or slowed things down? I’ve been really impressed by the way we’ve been able to manage some of the early implementation programmes and how colleagues have been able to find new ways of bringing programmes online. We have been able to speed certain things up and we understand that the strategy has to be underpinned by technology and we have to be more responsive and agile as an organisation.

Our strategy is not locked into a single potential scenario and we have worked to future-proof it against many scenarios. This gives us a decent level of confidence that we will be able to flex it and react to changes we can’t foresee today. I think that Covid-19 reinforces the need for us to get certain parts of the strategy implemented, to make us less vulnerable to these kinds of events.

“We will only make sense if we can develop it with partners, and within a performance scheme which incentivises operational performance rather than owning assets.”

We can now demonstrate that we can deliver benefits from the Virtual Centre without needing such considerable reserves and without being as susceptible to external events. Until now, the conversation in Europe has been around delivering more capacity (ideally) without massively increasing
the costs and we’ve turned that around to ask: how do we deliver ATM safely with fewer people? The strategy will be rolled out over 10 to 15 years, allowing normal employment cycles to take their own course and avoiding mass redundancies.

We are currently completing the end of tranche two of the programme, in which we have developed a harmonised flight information data-centre feeding both Zurich and Geneva centres. Tranche three will see us starting to deliver operational benefits on this new platform. At the same time, we need to redesign the new Zurich terminal manoeuvring area (TMA) so that required navigation performance (RNP) routes can be used as standard - separating inbounds and outbounds in three dimensions. The need for controllers to intervene with every single aircraft taking off or approaching the airfield is reduced hugely. And that enables us to introduce a far more standardised operation, which ultimately requires fewer controllers.

Can you give any cost-benefit estimates for the Virtual Centre programme? The payback time should be this side of 2030. As the programme goes up until 2024, to have a payback time that’s probably four years from end of programme in the ANSP world is remarkable. Some of that comes from additional capacity, and some of it comes from productivity and efficiency gains. If we can bring in more automation tools we don’t need to increase the number of controllers so significantly if we start facing a capacity issue.

What can other ANSPs learn from what you are doing? We can help others not make the same mistakes again. We can show that this can be done. Many of the key things revolve around benefits - if we make investments which don’t demonstrate benefits to the customer then we should not be making those investments. So we need to know where we can add value to the operations of our customers. Safety is clearly unnegotiable. But capacity is key. If we can’t deliver the capacity they need, especially in the first rotation, it doesn’t matter how much we reduce our user charges or how cost-efficient we become as a company, that delay will generate a cost which cannot be recouped. We are investing now to be able to deliver what our customers need in 10 years’ time.

“Covid-19 reinforces the need for us to get certain parts of the strategy implemented, to make us less vulnerable to these kinds of events.”
Airline expectations

Reshape the ATM system around passenger priorities

We now have the technology available to refocus the air traffic management system around the needs of passengers, according to Eric Nantier, Senior Director, OPS Optimisation and Development, SWISS International Air Lines Ltd. But before we can achieve this we will have to ensure all the relevant stakeholders are digitally connected and share the same business objectives.

What are the main operational challenges at the SWISS’s transfer hubs?
Both Zurich and Geneva airports and their associated terminal manoeuvring area (TMA) airspaces have in the past reached the limit of their capacity, leading to missed connections and late evening departures – inconveniencing our passengers and airport neighbours.

Do we have the technology to meet this challenge?
There has been an important evolution in technology over the last few years. Working with partners – notably Skyguide, Zurich Airport and Eurocontrol – we have already demonstrated progress in this area. For example, the “Greener Wave” and iStream projects, supported by the SESAR Joint Undertaking (SESAR JU), have given us the ability to precisely manage our intercontinental flights, reducing holding times by more than 96% in the morning wave and generating important environmental savings.

We have also improved our European early morning connections by setting flight priorities for arrivals, making it easier for our passengers to transfer between flights and reducing the workload of ground agents. Our operations controllers can now be far more proactive in managing departing and arriving flights.

What is SWISS doing to improve its passenger transfer operation?
SWISS is using extremely sophisticated artificial-intelligence decision-support tools to plan our flight schedules up to 48 hours in advance, analysing the impact of weather on movements, for example, identifying potential delays and developing mitigation measures. At the start of 2020 we began to integrate historic and real-time data on weather, passengers, aircraft, crew, maintenance and runway operations. With this data our network operations controllers can develop more precise plans but the amount of data is increasing constantly and we need to develop new dynamic methodologies to exploit it.

“This starts by developing a new way of prioritising flights and ensuring the controllers understand the pilot’s operational strategy.”

Eric Nantier, Senior Director, OPS Optimisation and Development, SWISS International Air Lines Ltd.
What role does air traffic management play in improving the operations further?
The European Union has set a target to allow passengers to travel door-to-door within four hours on the European continent. To achieve this, we will have to improve our connecting performance and move away from the current “first come first served” aircraft-based protocols – which generate too many en-route and arrival delays – to prioritising the most critical flights based on the needs of passengers. We have to understand the priorities of each of our passengers, so airlines, pilots, controllers and ground personnel can together frame the operation around them. If Air Traffic Controllers are empowered with the final decision, the system in use should deliver them the flight prioritisation, allowing them to understand the consequences of their decisions on the needs of passengers, the overall network, and the environment.

“We have to understand the priorities of each of our passengers, so airlines, pilots, controllers and ground personnel can together frame the operation around them.”

How close are we towards developing such a system?
Last year we began work on associated proof-of-concept research projects such as First Rotations Operational Trial (FROT) and Strategic Slot Swap, to demonstrate the benefits that this passenger centric approach will bring to our operations. We demonstrated the use of the User-Driven Prioritisation Process (UDPP) and iStream within a very large-scale demonstration, which produced excellent results. I am convinced that further collaboration with different airports and Eurocontrol will allow us to extend these results and offer airport users, passengers and residents real benefits in the next few years.

The Memorandum of Understanding we signed earlier this year will lead to an exchange of business-to-business data between SWISS, Zurich Airport and Skyguide, an area where we have helped lead pioneering research within the SESAR JU with air navigation service providers and Eurocontrol.

We are currently experiencing an information technology revolution, and it is of utmost importance to understand that the first priority is to develop new tools, that give the right data, at the right time, to the right people. Until now, the objective has been to optimise the flow of aircraft but in future it will be more important to manage the needs of passengers. After all, we don’t just fly aircraft, we move passengers.

I am convinced that a better coordination between SWISS, Skyguide, Zurich Airport and associated partners in collaboration with Eurocontrol could eliminate a large part of the current bottlenecks and reduce unnecessary aircraft movements, thereby improving the overall impact of aviation on the environment and giving a better quality of life to people living near the airport. This starts by developing a new way of prioritising flights and ensuring the controllers understand the pilot’s operational strategy.
The lessons of Covid-19

Building scalability into European ATM

Europe’s ATM system can be reconfigured to cope more flexibly with sudden changes in demand if services can be provided via more horizontal communications and data transfer, rather than vertically and in silos. According to Florian Guillermet, SESAR Joint Undertaking’s executive director, the technology is available to make this shift, but to do so mindsets need to change.

What has the current crisis revealed about ATM?
The current crisis is bringing further into focus the limitations of the air traffic management (ATM) system, in terms of its ability to handle disruptions of this nature and to scale up or down its operations according to the traffic demand. Despite the drop in traffic, ATM must continue to serve the civil and military aircraft that are still flying. That means that the same structures and processes have had to remain in place to ensure the traffic is managed safely, both on the ground and in the air. While air navigation service providers (ANSPs) have managed to adapt their operations to meet the social distancing requirements while maintaining their service provision, the crisis is challenging the economic and operational viability of the underlying infrastructure to support more flexible ways of working and cope with varying levels of traffic in the long term.

What is stopping us rethinking ATM and resilience?
What might a rethought ATM industry look like?
The biggest sticking point is the traditional structure of ATM in Europe. Traditionally, ANSPs have worked vertically, with little interaction with neighbouring ANSPs other than at a tactical, operational level. To be resilient ATM will need to be less geographically specific. That will call for significantly more horizontal interaction between ANSPs and the Network Manager (NM). The pandemic has already shown us that a number of processes can be done remotely with no loss of productivity. Going forward, the focus will need to be on flows and on trajectories, rather than sectors. That will require effective data transfer between stakeholders, and that in turn will require standards to allow seamless connectivity.

What are the most pressing priorities for action?
The crisis is being felt equally by all parts of the ecosystem: airports, airlines and ANSPs have all suffered significant losses due to the drop in passengers and in traffic. Starting now, we must work together to restore confidence in flying, assuring passengers that the journey end-to-end is coordinated and safe. That means bringing to market solutions like the SESAR airport operations centre (APOC) to improve data sharing between airlines, airports, and other stakeholders to manage passenger flows and sanitary measures. We need to use this opportunity to implement the solutions (e.g. automation, virtualisation and trajectory-based operations) that we have proven will make ATM more resilient to disruptions, building in flexibility to shift capacity in line with demand, rather than managing demand to fit available capacity. Although published prior to the pandemic, the Airspace Architecture Study and the follow-up Transition Plan capture many of these solutions and offer a pathway to recovery in the
short term, while also laying the foundations for a more far-reaching transformation of ATM.

**What is the role of technology and the various partners (SESAR JU, NM, stakeholders) in bringing about change?**

The issue is not technology, since the necessary solutions are already available. Rather, we need to address the procedures and the relationships between the stakeholders. That will require recasting incentives between those stakeholders. Some ways of doing that include building horizontal connections; developing standards to facilitate horizontal communications; and redesigning sectors along trajectories and in accordance with traffic flows.

**How can we do this reboot sustainably?**

With the low levels of traffic in recent months, people have grown accustomed to clearer skies and less noise, and are calling on the aviation sector to reassert their commitment to making flying more sustainable. Strong cooperation and investment in innovation will be needed over the next 10 years if we want to meet the ambitions set out by the European Green Deal. We have to redouble our efforts to improve the fuel efficiency of flights through optimised “greener” trajectories. It means as well as focusing on network centricity, we need new ways of flying taking advantage of advances in avionics, and emission-free taxiing techniques.

**How can such a change happen at a time when in the short term, the industry is struggling to keep its head above water?**

The crisis calls for sensible and focused investment, and hard-nosed prioritisation agreed between stakeholders across the entire aviation value chain. It is only by working together in this way that we will be able to deliver a system that is more scalable, economically sustainable, environmentally efficient, and resilient in the long run.

“It is by working together that we will be able to deliver a system that is more scalable, economically sustainable, environmentally efficient, and resilient.”

Florian Guillermet, Single European Sky ATM Research Joint Undertaking Executive Director

“Starting now, we must work together to restore confidence in flying, assuring passengers that the journey end-to-end is coordinated and safe.”
Network Manager

Transforming relationships, network scalability

Jacopo Prissinotti began work as Director of Eurocontrol’s Network Management (NM) Directorate in July 2019. Since then, he has started to build new relationships between NM and other aviation stakeholders in order to agree new ways of introducing digitally based technologies and procedures which will allow Europe’s ATM system to manage demand volatility in a more flexible and scalable manner.

How do you see the relationship between the NM and individual air navigation service providers changing?
It has been vital that we establish a single value chain and gain new levels of trust with our stakeholder colleagues. It is our role as Network Manager to support our industry, to enable the industry to make key decisions about improving the performance of the network at their local level. Trust also means transparency, giving stakeholders access to all the relevant data they need. We have a clear roadmap for improving the performance of the network, which breaks down the programme into five-year tranches. For the next five years we will be focusing on our Operational Excellence programme to deploy new operational and technical services in sequence. This will be supported by regular stakeholder coordination through the Collaborative Decision Making (CDM) process to ensure the priorities are shared and supported by the operational stakeholders. We are constantly considering projects for Network improvement such as the Virtual Centre, the Ground-Based Augmentation System (GBAS) and the data link, to ensure the right priorities as agreed with the operational stakeholders. It is very important, for example, that we recognise the Virtual Centre as a concept that we need to foster and in particular understand the operating expenditures (OPEX) benefits as well as the capital expenditure (CAPEX) issues. There are cultural challenges with this that we need to address.

The biggest challenge we all face is the high level of comfort that some organisations feel with the status quo and not seeing the importance of moving to the next level.

And your relationship with the SESAR Joint Undertaking, SESAR Deployment Manager, airlines and airports?
We are working in an excellent way with the SESAR Joint Undertaking to create all the links between the operational excellence work plan and the research and development (R&D) programme. With regard to the SESAR Deployment Manager, during the summer we negotiated with the SESAR deployment alliance consortium – which includes Europe’s major airlines, airports and ANSPs – an agreement to integrate our efforts. We identified the major areas where we will work together.

Since I arrived in summer last year, my main priority was and is to focus on partnering with all the operational stakeholders. The output is that now the airlines and the airports are completely engaged together with the ANSPs and military in the operational stakeholders CDM process. This is a must if we want to ensure the successful modernisation of the air traffic management infrastructure.

“It is our role as Network Manager to support our industry, to enable the industry to make key decisions about improving the performance of the network at their local level.”
How should ANSPs and NM ensure programmes like the Virtual Centre can be developed in a coordinated manner and not delayed?
The NM has the strategic and technical competence to facilitate it, but at the end of the day it needs to be the industry, ANSPs, that develops these ideas. We need to understand the level of support there is for particular programmes. The NM’s role is to ensure this discussion takes place then enable the technical and operational coordination. We want to facilitate the decision-making but not impose a decision on anyone.

We are very supportive of the Virtual Centre model conceptually as it is very closely aligned with NM’s approach to developing its own integrated Network Manager (iNM) programme.

Are Europe’s ANSPs ready to deploy an ATM system where much of the critical infrastructure is owned by an industry service provider and located remotely? In terms of convincing the slow movers it’s a question of demonstrating the facts. Facts are the only response to the status quo. Some ANSPs are already heading towards a digital platform concept but may not be culturally ready to accept another organisation taking ownership of infrastructure. So we are very keen to see how Skyguide – a mature and conscientious ANSP – will develop service-level agreements and resilience policies to make the concept work.

What have been the lessons of the Covid-19 pandemic for Europe’s ATM service providers? The problem for Europe’s ATM system has never been with capacity but with scalability: how can the ATM infrastructure meet the needs of an aviation industry which by its nature is volatile? We first need to move towards a common operational way of working, standardising human machine interfaces (HMIs), for example, and developing common working practices in cross-border sectors which account for 30% of European airspace. I believe digitalisation will help here, encouraging ANSPs to develop common standards and procedures.

“We are very keen to see how Skyguide – a mature and conscientious ANSP – will develop service-level agreements and resilience policies to make the concept work.”

We must use this crisis to develop a single workplan which everyone can commit to, using the best-in-class experiences. A network approach will guarantee a bright future for aviation and ANSPs. The old model is no longer sustainable and we must work together to adapt it – the alternative is centralisation, which no-one wants. *
“This level of enthusiasm and focus has underlined to us just how much the significance of the programme has been recognised.”

Enabling free route operations

A major first step towards “One Swiss Airspace”

On 28 April 2020, the second phase of the New Route Handling concept (NRH2) was successfully deployed in the Zurich Area Control Centre. It will help controllers manage Free Route Airspace operations in a safer, more flexible way and is a major milestone for the Virtual Centre programme. Joël Jordan, VCT2 Programme Director and Olivier Perrin, Head of the ATM Virtual Centre, discuss the next steps to implementing the programme and the long-term benefits that will be delivered.

What is the aim of NRH and what benefits will it bring? Olivier Perrin: The main driver is a business one, giving our controllers new tools to manage aircraft flying Free Route Airspace (FRA) trajectories. In legacy flight data management systems controllers see the route that an aircraft will most probably fly, but it may not be the actual one; with this new system pilots and controllers work on the same flight plan, with the same data. This increases safety, reduces workload – the controller no longer has to spend time interpreting conflicting data – and introduces new levels of autonomy and flexibility.
The system is far more integrated into the flight planning process so if there is a change to a route to avoid bad weather, for example, the flight plan is easily amended.

In the frame of the Virtual Centre programme, NRH is also a powerful instrument to harmonise technology and operations between Geneva and Zurich centres – a step towards the “One Swiss Airspace” concept to operate effectively as a single system but based in two locations. This will help us to do that. With the recent decisions to decommission the legacy flight data processing (FDP) system in Geneva we have been able to design and build an FDP system, based on a service-oriented architecture (SOA) and reusing existing components where possible.

Joël Jordan: It will also be a major help in ensuring business-continuity solutions so if a major disaster takes out one of our en-route centres we would still be able to provide an ATM service from another location. It is a major benefit of the Virtual Centre concept. NRH is an essential part of this programme and will significantly contribute to enhancing data transparency at a national level and our ability to adapt rapidly to volatile air traffic demand patterns. It will also open the door to integrating more controller-pilot data-link communications services and new conflict detection and resolution tools.

The work we are doing in Switzerland on developing the Virtual Centre concept could, we think, be an important intermediate step towards the realisation of a more European-wide solution.

What is the timetable for NRH implementation?
Joël Jordan: We started the implementation of the system in Zurich in April 2020 and we have been making incremental improvements there over the last few months. The next major phase (NRH3) will see the system introduced into Geneva in 2021. Beyond that, all Skyguide ATM units, including approach and departure control centres, will eventually be equipped with it, although there are more constraints to flexibility once you move from upper airspace into more geographically constrained sectors.

Olivier Perrin: We have had to incorporate innovative ways of thinking. FRA airspace operations impose on the air navigation service provider a more flexible way of envisaging trajectories. So instead of predicting trajectories around a precise point in space and time we had to invent new concepts for allowing more variations into the flight plan. This resulted in us developing the new “gate” concept – a volume of airspace where you can accept far more variations and flexibility into the flight plan.

“The work we are doing in Switzerland on developing the Virtual Centre concept could be an important intermediate step towards the realisation of a more European-wide solution.”

What has been the response of controllers to the new technology?
Olivier Perrin: The feedback from Zurich is that controllers have a lot more information about planned routes and it has been made available to them in an intuitive, very understandable way. So the level of acceptance has been very high from the very beginning. We have already undertaken some validation exercises with colleagues in Geneva and they are very eager to get this tool. The user feedback has been overwhelmingly positive and this is a crucial step confirming that we are operationally and technically on the right track.

What has been the impact of Covid-19 on the programme?
Joël Jordan: NRH2 was implemented in April, when the pandemic crisis was at its peak. But we were surprised by how the organisation – and all stakeholders – reacted to the lockdown in exemplary and creative ways. The development and deployment team comprised around 150 people, who had to undertake the work totally remotely. We switched rapidly and extensively to Skype for teamwork and we speedily enabled a large use of remote access to conduct development and testing work. This level of enthusiasm and focus has underlined to us just how much the significance of the programme has been recognised by colleagues.
Flight data information

Pioneering the ATM Data Service Provider concept

With the Coflight Cloud Service (CCS) concept Skyguide and partners are pioneering a new way of delivering core ATM services which Philippe Chauffoureaux, Skyguide Chief Information Architect, believes will offer the right levels of scalability, cost-efficiency and flexibility for the future evolution of ATM services in Europe.

**Please describe the Coflight Cloud Service (CCS) concept.**

The Airspace Architecture Study defines a new type of independent, remotely located information service provider, or ATM Data Service Provider (ADSP), who will deliver core CNS/ATM services to several air navigation service providers (ANSPs). The CCS concept is a pioneering example of this: a single organisation delivering essential flight data information to multiple ANSPs via the system wide information management (SWIM) network.

The concept has been developed by DSNA, ENAV and Skyguide and comprises five services among which the operational service provides ATC centres with the information and support needed for real-time service delivery. This delivery is an important and direct contributor to the services of an ATM Data Service Provider according to the model from the Airspace Architecture Study. Skyguide intends to be in a position to effectively use this operational service by end 2025.

**What is the time scale for development and deployment?**

The concept was first proposed in 2015 and a feasibility study was finalised in 2018, to confirm it was technically achievable and would deliver the hoped-for benefits. Later that year the green light was given for the project and the first phase, a technical integration service project to provide CCS services from Paris to Geneva, was completed earlier this year. CCS programme staff are currently working on the design and launch of the service validation and preparatory work on this will take place until the end of 2020. This validation step is important: it enables live tests to be implemented with air traffic controllers who check the consistency of the information transmitted and adjust the trajectory calculations made by the Coflight system. It will incorporate upgraded versions of the underlying Coflight platform planned for the last quarter of 2020.

“CCS is an essential part of Skyguide’s ‘assets-to-services’ evolution – one of the first, major elements in the company’s strategy to realise its ‘Vision 2035’.”

When the first two steps have been completed, and the system has been shown to be technically connected and validated, CCS will start offering training service options.

**What has been Skyguide’s role in the project?**

Skyguide was the first CCS customer and is a key partner, developing the components to connect the interoperable CCS system to the legacy flight data processor. When completed in 2024 all flight data – including flight plans and surveillance data – will be retrieved, merged and shared via the CCS platform.

Many of the technical elements of the system were researched as part of the SESAR B04.04 and SESAR2020 PJ16.03 projects; the CCS was part of the demonstration platform and in PJ16 Skyguide was a major contributor to the work to inject SWIM implementation into the network.
CCS is not an entirely location-independent model; Skyguide has been working on connecting the remote service with local air traffic service (ATS) units to develop integrated local decision support tools, developing governance and procedures for the system to function within an agile framework.

And what will be the benefits?
CCS is an essential part of Skyguide’s “assets-to-services” evolution – one of the first, major elements in the company’s strategy to realise its “Vision 2035”.

Ownership of software and hardware as assets will become less important in the digitalised world – we want to focus more on service delivery, at the controller working position, where we can directly influence the capabilities of our controllers.

We anticipate there will be significant economies-of-scale savings. Flight data processing (FDP) currently takes place at 30 or so different places in Europe with different suppliers using different software. If we could cut this number to a few it would make innovation easier – with fewer partners to synchronise – and deliver more flexible airspace management as core data can be exchanged more easily and capacity added quickly to the system. With several ANSPs remotely using the same FDP system this offers a new economic model for sharing investment and operating costs. CCS also brings top-level modern trajectory prediction and conflict resolution tools, allows more flexible trajectory planning, supports free-route operations, reduces flight time and CO2 emissions, lowers electricity consumption at ATC centres and simplifies logistics management.

The CCS system has been developed to guarantee immediate service availability in the event of a failure. Operational service will be certified by the Federal Office of Civil Aviation (FOCA) to operate in line with safety regulations. Security and resilience of the system will be tested extensively to ensure continuity of service provision in case of cyber-attacks.

We think that by building open-architecture, modular, common and interoperable ATM systems – where customers can define service levels according to requirements – we will be able to deliver the expected level of service in the next decade at a much-reduced cost.

“With several ANSPs remotely using the same FDP system this offers a new economic model for sharing investment and operating costs.”

Philippe Chauffoureaux, Chief Information Architect (CIA), Skyguide
Collaboration brings simulation trials close to reality

Marie-Laure Glassey,
Head of International Initiatives, Skyguide

“The results of this research will increase predictability of trajectories, reducing the need for capacity-buffers and improving the environmental performance of aircraft flying through European airspace.”
The collaborative agreement between Skyguide, Skysoft-ATM, Airbus Commercial Aircraft and Airbus Defence & Space to integrate real-time operational aircraft data with advanced ATM simulation tools is giving Single European Sky ATM Research (SESAR) experts highly accurate trajectory predictions as part of their work to research an improved 4D trajectory management concept, according to Damien Plaignaud, Airbus ATM Programme and Marie-Laure Glassey, Head of International Initiatives in Skyguide’s technical department.

**What will be the results of this research collaboration?** Marie-Laure Glassey: The results of this research will increase predictability of trajectories, reducing the need for capacity-buffers and improving the environmental performance of aircraft flying through European airspace. The pioneering agreement integrates the Airbus GENETICS aircraft operational data platform with the Skysoft-ATM SKYSIM simulation platform, to create a new research and development (R&D) platform called SKYTICS.

Integrating the RASIM platform developed for the Virtual Centre Tranche 2 (VCT2) programme, research into SKYTICS will allow us to perform our research and development (R&D) on a platform very close to the VC (Virtual Centre) operational system, shortening development and deployment timescales. At the start of the SESAR Wave 1 work we faced some challenges with the data we were using so the collaboration has helped us increase the accuracy of the data. SKYTICS will also help Skyguide to generate simulation scenarios which are much closer to real operations.

It gives us real operational data to plot more accurate predicted trajectories and is one of the cornerstones of the SESAR Wave 2 PJ18¹ Project. SKYTICS will integrate downlinked aircraft operational data and advanced controller pilot data link communications (CPDLC) clearances to simulate improved 4D trajectory management operations (trajectory management to improve predictability). For Skyguide and Skysoft-ATM, it means researchers and engineers have access to more representative flight data while Airbus can access real controller responses which are then used to mature the capabilities of the GENETICS platform, which simulates the data exchange between the aircraft’s flight management system and the flight data processing system.

**How have the partners worked together?** Damien Plaignaud: As part of the research (SESAR Very Large Demonstrator “DIGITS² / DIGITS-AU”), Airbus has equipped close to 100 A320 aircraft flying regularly in European airspace with a FANS-C (“4D”) data-link capability. At the same time, Airbus Defence & Space has developed an advanced ATM environment simulator (GENETICS) able to simulate real-time trajectory data of 4D-equipped aircraft and integrate it within the advanced SKYSIM ATM simulator, so end-to-end operational scenarios can be accurately simulated.

¹ sesarju.eu/sesar-solutions/trajectory-based-operations
² sesarju.eu/projects/digits
SKYTICS will then allow simulation of hybrid fleet operations with aircraft equipped, or not, with 4D datalink technology. It will provide a representative picture of how controllers could exploit better trajectory performance in terms of conformance monitoring, conflict detection and resolution. It will also allow identification of the key operational and environmental benefits of 4D trajectory management from an integrated ATM system perspective. This cooperation between Airbus Commercial Aircraft, Airbus Defence & Space, Skyguide and Skysoft-ATM paves the way to an acceleration of innovation and digitalisation of ATM, targeting the operational benefits expected from 4D Trajectory Based Operations.

**What has the timeline for collaboration been and what are the future plans?**

Damien Plaignaud: Research began during the Wave 1 stage of PJ18 and work started in 2017. A joint exercise completed and coordinated by Eurocontrol in late 2019 involved Skyguide, Skysoft-ATM and Airbus using the SKYSIM ROSE platform and Airbus aircraft simulators coupled with new software to develop highly realistic end-to-end scenarios. It was, for Airbus, one of the key achievements of SESAR 2020 Wave 1 and was a trigger to accelerate the collaboration between the four partners. Since the beginning of Wave 2, GENETICS has been an important enabler to help researchers better understand the environmental benefits expected from more predictable 4D trajectories. By using more accurate trajectory data, unnecessary buffers can be removed and tactical instructions given to an aircraft can be reduced, leaving it flying its most efficient trajectory. We can now look at this data not
just from one aircraft at a time but we are also able to simulate 4D capable traffic at network level thanks to GENETICS advanced capabilities provided to SKYTICS. We are now looking forward to further improvements of GENETICS as part of SESAR 2020 Wave 2 and Wave 3, paving the way to wider cooperation with SESAR partners among which, of course, are Skyguide and Skysoft-ATM.

Marie-Laure Glassey: Skyguide and partner researchers are developing SKYTICS as part of SESAR Wave 2 (2020-2022) research to help validate more advanced trajectory predictions, with further and wider cooperation between the partners planned for potential SESAR Wave 3 work. Despite the financial and organisational pressures which Covid-19 has placed on all the project’s stakeholders, given the strategic importance of the research in delivering more efficient trajectories in European airspace, collaboration on the project continues to deepen. This platform will also be used to validate improved air-ground datalink future operating methods (such as CPDLC clearances in advance and route conformance checks), the Virtual Centre concept - in delegation of airspace studies - and potential new controller attention guidance research. In the longer term, the SKYTICS platform will be the basis for the next SESAR R&D phase and continue to be closely linked to VC future development. *
The Covid-19 crisis has created immense challenges – and opportunities – for all aviation stakeholders. Nicole Leyre, Chief Financial Officer (CFO) at Skyguide, believes that refocusing activities on accelerating the implementation of digital and automated open-architecture technologies will enable the company to develop new levels of scalability and flexibility. It will also allow Skyguide to better manage highly volatile market conditions.

What are the financial consequences of Covid-19 to Skyguide?
Covid-19 has had a huge impact on Skyguide’s revenues. In terms of traffic, we expect that en-route and international airport traffic levels – which together represent 80% of our revenues – will fall 70% in 2020 and 30% in 2021 over 2019 levels. Unfortunately, because we have very limited flexibility in our operational framework we cannot adapt our capacity and costs in line with this reduced demand. This will translate into huge losses in the next two years, assuming we do not apply the risk-sharing mechanism with our users, as foreseen in the European regulation.

Without the help of our State shareholder we would be running out of money. We are very fortunate that the Confederation has agreed to a capital increase and to the implementation of a short-term credit line to manage the cash shortage. However, this recapitalisation does not come for free and we are required to implement stringent measures to improve our structural cost.

An important part of these improvements will be possible with the introduction of the Virtual Centre, by consolidating activities into a single system and by implementing the location independence concept of a single sky. It will also deliver the flexibility that we are currently missing to cope with the crisis.

Nicole Leyre, Chief Financial Officer (CFO), Skyguide

“We need to reshape European regulations so they reward ANSP investments in new, more efficient, digital technologies such as virtual centres, which stress service delivery over ownership of assets.”

Covid-19 – a catalyst to business transformation
How should Skyguide’s corporate framework be re-framed to ensure finance and operations remain sustainable in highly volatile market conditions?

The definition of a new target operating model and the implementation of the Virtual Centre are two key elements to ensuring Skyguide’s sustainability. Covid-19 has underlined the fact that we are in an era of volatility, uncertainty, complexity and ambiguity – or VUCA. We have defined our 2035 vision and have built a strategy for achieving it. Implementing a new streamlined Operating Model will bring clarity and efficiency. Moving to a location-independent Virtual Centre based on open-architecture systems and using data from independent Air Data Service Providers (ADSPs) will give us the scalability and flexibility to manage even highly volatile peaks and troughs of demand.

We should also consider introducing a European remuneration scheme which supports this strategy and which gives the right incentives to work as a network. Different possibilities are at stake and have to be further studied.

What are the dangers and consequences to service provision of not making these changes?

The danger in the long term could be that ANSPs are marginalised and could even disappear. If ANSPs are not able to move from air traffic control to air traffic flow management, airlines will look for other ways to fly safely, efficiently and in an environmentally responsible way without using ANSP services.

Technology is evolving at a high speed. Navigation, surveillance and communications are now all possible via satellites and 5G services are entering the market. Drones could be major disruptors, bringing a change to operational procedures and to the aviation mindset.

So transforming Skyguide’s operating model is a must. Implementing the Virtual Centre is a must. With this, we can decrease our costs and deliver a safer and better service to our customers, securing the company’s future.

“If ANSPs are not able to move from air traffic control to air traffic flow management, airlines will look for other ways to fly safely, efficiently and in an environmentally responsible way without using ANSP services.”

How should we reform the current European performance reporting system, especially in terms of negotiating a new RP4 framework?

We need to reshape European regulations so they reward ANSP investments in new, more efficient, digital technologies such as virtual centres, which stress service delivery over ownership of assets. RP4 should also reward ANSPs who provide an improved service for the entire network, not just for their own airspace.

If we design systems to calculate the best trajectory for the aircraft and let the system manage the route across the whole network, we will start to make the Single European Sky vision a reality. Currently, controllers are focused on the ATM picture just within their own sectors.
## Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAS</td>
<td>Airspace Architecture Study</td>
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<tr>
<td>ADSP</td>
<td>ATM Data Service Provider</td>
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<td>AIM</td>
<td>Air Information Management</td>
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<tr>
<td>ANSP</td>
<td>Air Navigation Service Provider</td>
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<tr>
<td>APOC</td>
<td>Airport Operations Centre</td>
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<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
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<tr>
<td>ATCO</td>
<td>Air Traffic Controller</td>
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<tr>
<td>ATM</td>
<td>Air Traffic Management</td>
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<tr>
<td>ATS</td>
<td>Air Traffic Service</td>
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<td>CAPEX</td>
<td>Capital Expenditure</td>
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<td>CCS</td>
<td>Coflight Cloud Service</td>
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<td>CDM</td>
<td>Collaborative Decision Making</td>
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<td>CNS</td>
<td>Communication Navigation Surveillance</td>
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<tr>
<td>CPDLC</td>
<td>Controller Pilot Data Link Communications</td>
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<tr>
<td>DSNA</td>
<td>Direction des Services de la Navigation Aérienne</td>
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<td>ENAV</td>
<td>Ente Nazionale per l’Assistenza al Volo</td>
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<tr>
<td>FDM</td>
<td>Flight Data Management</td>
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<td>FDP</td>
<td>Flight Data Processing</td>
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<td>FOCA</td>
<td>Federal Office of Civil Aviation</td>
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<td>FRA</td>
<td>Free Route Airspace</td>
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<td>FROT</td>
<td>First Rotations Operational Trial</td>
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<tr>
<td>GBAS</td>
<td>Ground-Based Augmentation System</td>
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<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
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<tr>
<td>INM</td>
<td>Integrated Network Manager</td>
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<td>NM</td>
<td>Network Manager</td>
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<tr>
<td>NRH</td>
<td>New Route Handling</td>
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<td>OPEX</td>
<td>Operating Expenditure</td>
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<td>PJ</td>
<td>Project</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RNP</td>
<td>Required Navigation Performance</td>
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<tr>
<td>RP</td>
<td>Reference Plan</td>
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<tr>
<td>SES</td>
<td>Single European Sky</td>
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<td>SESAR</td>
<td>Single European Sky ATM Research</td>
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<tr>
<td>SESAR JU</td>
<td>Single European Sky ATM Research Joint Undertaking</td>
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<tr>
<td>SOA</td>
<td>Service-Oriented Architecture</td>
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<tr>
<td>SWIM</td>
<td>System Wide Information Management</td>
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<tr>
<td>TMA</td>
<td>Terminal Manoeuvring Area</td>
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<tr>
<td>UDPP</td>
<td>User-Driven Prioritisation Process</td>
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<tr>
<td>VC</td>
<td>Virtual Centre</td>
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<tr>
<td>VCT</td>
<td>1 / 2 / 3 Virtual Centre Tranche 1 or 2 or 3</td>
</tr>
<tr>
<td>VUCA</td>
<td>Volatility Uncertainty Complexity Ambiguity</td>
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