Airbus technical magazine
April 2020

#65

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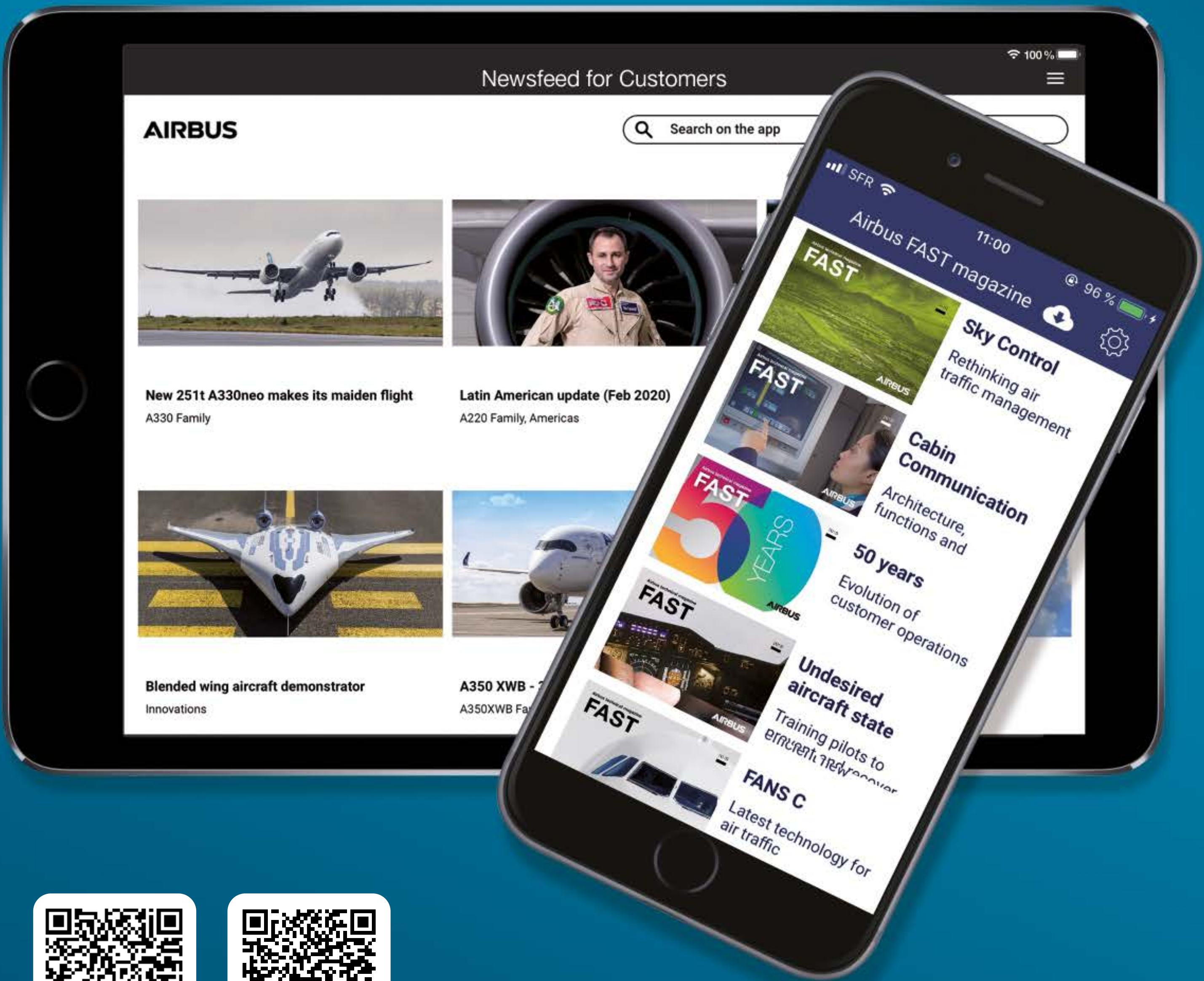

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- Design: Pont Bleu
- Cover images: A. Tchaikovski and H. Gousset, Master Films
- Printer: Amadio
- Authorisation for reprinting FAST magazine articles: fast.magazine@airbus.com

FAST magazine availability:
On the FAST app (see QR code opposite page)
Airbus website:
www.aircraft.airbus.com/support-services/publications/

ISSN 1293-5476

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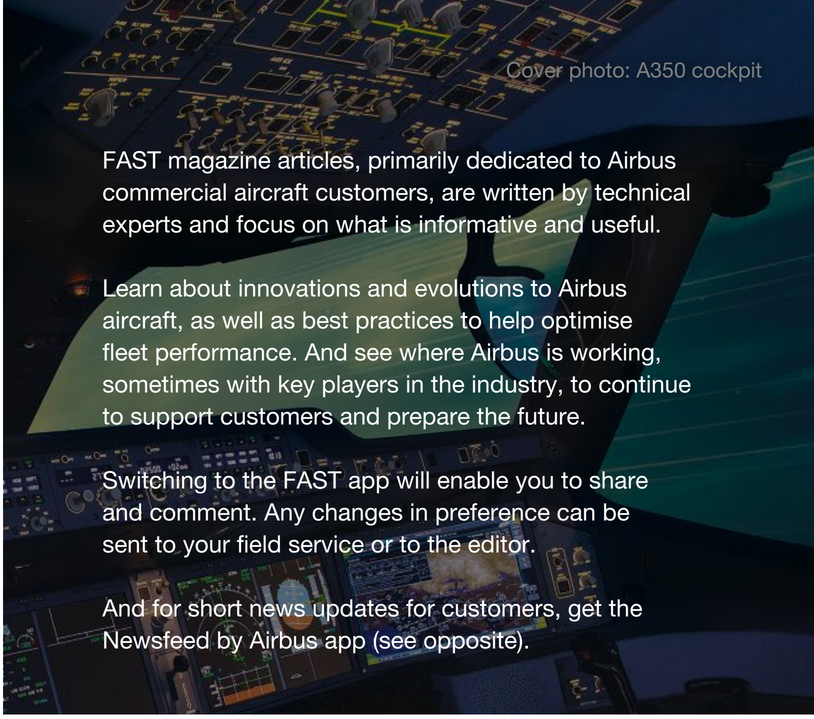

Cover photo: A350 cockpit

FAST magazine articles, primarily dedicated to Airbus commercial aircraft customers, are written by technical experts and focus on what is informative and useful.

Learn about innovations and evolutions to Airbus aircraft, as well as best practices to help optimise fleet performance. And see where Airbus is working, sometimes with key players in the industry, to continue to support customers and prepare the future.

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Propulsion system integration

From design to entry-into-service

Article by (left to right)

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The propulsion systems have a major impact on an aircraft's safety and on its environmental and economic performance. These are key criteria for the operator. From design to entry-into-service, integrating the propulsion system requires a multidisciplinary approach and close cooperation between Airbus and its suppliers.

Creating an aircraft engine: a journey from pre-development to entry-into-service

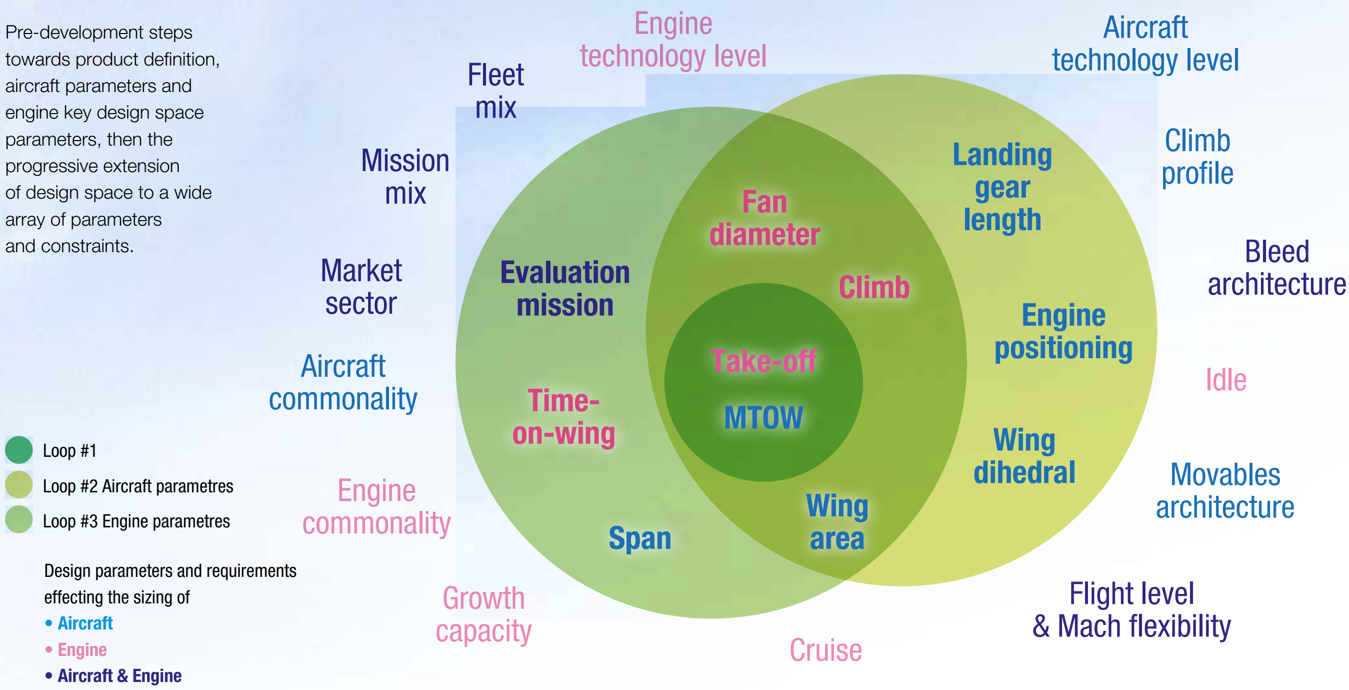
The propulsion system – including the engines, nacelles and pylons, and the controls integrated into the aircraft – has a significant impact on the aircraft safety, its economic performance as well as its environmental and acoustic efficiency. Fuel burn, for example, makes up 40-50% of an aircraft's cash operating cost. Operational performance, reliability and direct maintenance costs must also be taken into consideration. This makes engine manufacturers a natural partner in aircraft development, who provide valuable input from a very early stage.

Airbus regularly studies architecture and technology options with engine manufacturers as part of its product strategy investigations. Before launching a new programme, a joint study will enter a decisive pre-development phase, which will define the following aspects:

- Choice of propulsion architecture, including turbomachine and nacelle
- Engine integration, including mounting concepts, aerodynamics and aircraft systems such as electrical, pneumatic and hydraulic systems and avionics
- Aircraft and engine optimisation to achieve the right balance between take-off performance, climb and cruise performance, as well as acoustics

Once the key characteristics are settled, Airbus involves the nacelle manufacturer in a three-way discussion with the engine manufacturer to finalise the overall concept for the integrated propulsion system.

Pre-development steps towards product definition, aircraft parameters and engine key design space parameters, then the progressive extension of design space to a wide array of parameters and constraints.



This pre-development phase usually takes around a year but can last longer for a completely new aircraft model. The aim is to finalise a robust engine, nacelle and integration concept before agreeing a development plan which includes design, testing, verification, validation and maturity. Both the engine and nacelle manufacturers make commitments on key performance and economic elements, enabling Airbus to provide overall aircraft guarantees to its customers.

This process is similar for both a completely new aircraft/engine configuration and a new engine option (NEO) developed for an existing aircraft.
Five* new propulsion systems were certified between 2014 and 2018.

**A350-900 RR Trent XWB, A320neo PW1100G, A320neo CFM LEAP-1A, A350-1000 RR Trent XWB-97 and A330neo RR Trent 7000*

Mastering extremes through development and verification

After all conditions are met, the next phase begins, with the focus on achieving the optimum time to market to satisfy customer needs. During a 'make or buy' analysis, Airbus will decide which components it produces in-house and which to source. Supplier selection starts early on for key systems including the engines, and can be completed later for shorter lead-time components.

Preliminary and critical design reviews are key milestones in defining the final design. Indeed, in a first step, key functions and physical interfaces are defined and these data are shared with the stakeholders. The design freeze is validated by the critical design reviews which fix the definitions of the engine, nacelle, pylon and various systems and their interfaces, as well as the performance of the integrated propulsion system and the associated means of verification. After these have been agreed, the suppliers begin manufacturing, including the tooling and the parts needed to build the first prototypes.

The verification phase starts as soon as the first parts are available. Engine prototypes are tested at the manufacturer on a ground test bed, as well as at Airbus in both ground and flight testing. A flying test bed to de-risk the propulsion system may be used ahead of the flight test campaign, especially if the engine is a new development. This was used on recent programmes such as the A320neo and A350 XWB.

Verification demonstrates that the propulsion system complies with all the applicable specification and certification requirements. Part of this involves proving it can operate correctly and safely across a range of extreme conditions such as hot and cold weather, ice, high-altitude airports, windy conditions, flooded runways and lightning strikes. It will also demonstrate that the engine can safely contain a fan blade release event* and will deliver the required thrust in case of bird or hailstone strike. The robustness to other failure cases is also demonstrated, like the correct drainage of fluids within the propulsion system. Engine characteristics are measured throughout the ground and flight test campaigns to ensure fuel consumption, emissions and noise levels adhere to specified levels. The final phase of engine verification is intensive endurance testing.

** A fan blade release event is when a blade detaches from the rotating engine fan.*

From certification to aircraft delivery

Following verification at both the engine manufacturer's and at Airbus, test and analysis reports are sent to the authorities to obtain type certification.

First, the engine is certified by the engine manufacturer complying with the engine specific regulations (CS-E and FAR Part 33 respectively for EU and US). Then the propulsion system installation into the aircraft is certified by Airbus, complying with aircraft regulations (CS-25 and FAR Part 25).

Serial manufacturing and assembly are already underway, with the first serial engines fitted to the serial nacelles and delivered to the final assembly line. After type certification is granted, customers can take delivery of their aircraft and begin to operate revenue flights – the start of an in-service life that can last 25 years or more.

Engine types per aircraft models

A380	Engine Alliance GP7200 Rolls Royce Trent 900
A350 XWB Family	Rolls Royce Trent XWB*
A330neo	Rolls Royce Trent 7000*
A330ceo	General Electric CF6-80E1 Pratt & Whitney PW4000 Rolls Royce Trent 700
A320neo Family	Pratt & Whitney PW1100G* CFM LEAP-1A*
A320ceo Family	CFM56-5B IAE V2500-A5

* Most recent developments certified since 2014

Cold conditions

Certification on flooded runway

Airborne test bed

How propulsion system integration delivers optimum

Integrating an aircraft's propulsion system requires a multidisciplinary approach covering the different functions and systems involved, which goes far beyond purely producing thrust.

Engines

including their own systems

- Valves
- Fuel and oil pump
- Engine control computer

Engine build-up

- Hydraulic system
- Electrical generator
- Engine bleed for cabin air conditioning
- Fuel line

Airbus cooperates with both the engine and nacelle manufacturers to ensure the final aircraft meets regulatory requirements as well as its own programme objectives.

Take the engine oil tank as an example: this is not just the responsibility of the engine manufacturer and is dependent on several aircraft parameters such as operation, flight time and cockpit indication, as well as engine constraints like oil consumption and pump behaviour.

performance

Pylons

- Structural link between the engine and the wing
- Transfer all forces, including the engine thrust propelling the aircraft
- Route all systems between the engine and the aircraft
- Host certain equipment such as fire extinguishing bottles

Propulsion System

integration within the aircraft

- Avionics in interface with engine computers
- Propulsion system cockpit controls
- Propulsion system displays and warnings

Nacelles

- Aerodynamic air ducting through and around the engine
- Acoustic attenuation
- Ventilation
- Thrust reverser
- Anti-icing system to protect the engine

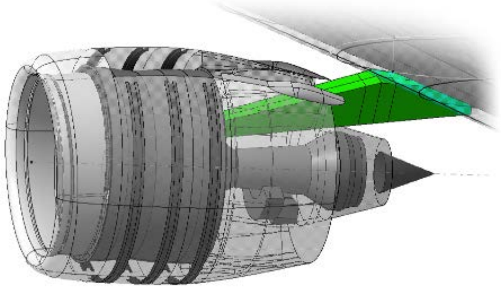
Harmonising physical integration and design

The physical integration of the propulsion system has a huge impact on aircraft performance. Consequently, it is vital to harmonise the pylon and nacelle structure with the aerodynamic shapes of the nacelle, pylon and wing.
One factor behind the improvement in recent generations of engine performance has been the increase in fan diameter, which enables an engine to produce the same thrust with a higher engine airflow and less exhaust velocity. However, this adds weight and aerodynamic drag, making integration more challenging.

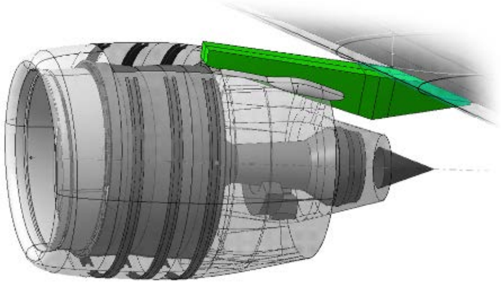
Engine manufacturers, suppliers and Airbus work to develop propulsion systems that can cope with the many technical challenges of the demanding engine environment. These include thermal constraints, congested areas, vibrations and high load concentration. The engine must also be protected against the risk of fire. Very close cooperation is required to freeze the design of certain items with long lead times while the test plan is still progressing.
A typical example is the pylon primary structure as representative parts are necessary for specific engine ground and flight tests as well as pylon rupture testing.

During the development phase, particular attention is given to maintainability and operations. This means selecting materials with robust anti-corrosion performance, creating designs that enable repair work to be carried out easily and simplifying structural inspection wherever possible.

Core Pylon Concept
Front mount on engine core casing



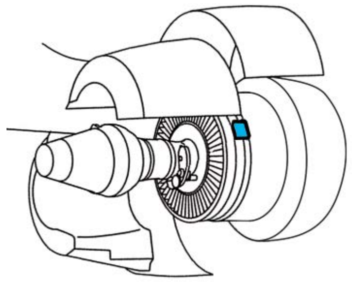
Fan Pylon Concept
Front mount on engine fan casing



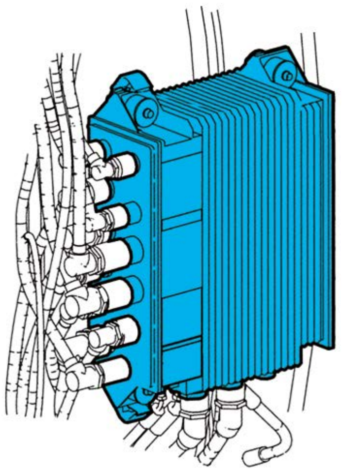
Integrating the engine's brain

The propulsion control system is safety-critical and performs a variety of functions:

- Controls the engine thrust target to manage the aircraft speed, acceleration and deceleration
- Contributes to the optimisation of fuel consumption and emission levels
- Controls actuation and power supply of the thrust reverser system
- Monitors the system behaviour and health
- Detects, accommodates and announces failures, as well as protecting aircraft and engine from malfunctions



Several computers combine to form the control system, with the FADEC (Full Authority Digital Engine Control) acting as the 'brain' of the engine. The FADEC includes engine sensors, control logics and laws, the fuel metering device and interfaces with the aircraft computers. As with other critical computers on the aircraft, the FADEC is developed to the highest safety standards. The control functions that relate purely to engine operation, such as controlling the fuel-flow to achieve a thrust target or managing engine acceleration or deceleration, are defined by the engine manufacturer. Some integration functions, such as thrust reverser command and aircraft data selection for the engine, are specified by the Airbus engineering propulsion team. Validation of the system is performed on simulation platforms at the engine manufacturer's facility, before being tested on an integrated aircraft simulation platform and then on the aircraft.



Rigorous process for safety and certification

Propulsion is one of the most critical functions of an aircraft. Engine manufacturers are therefore major contributors to aircraft safety, and they must first certify their engine to obtain a dedicated Engine Type Certificate to meet the safety regulations of CS-E and FAR33.

Once certified, the engines are integrated on the aircraft to form a propulsion system that will also have to comply with dedicated integration certification requirements under the regulations of CS25 and FAR25. This ensures all engines operate as expected when fully integrated with the aircraft structure, systems and avionics throughout the flight envelope, and that relevant safety requirements are met.
It is achieved through a systematic and comprehensive assessment of the propulsion system architecture, design and installation. The assessment covers all potential failures of engines like the loss of thrust, internal fires or uncontained failures that release high-energy debris. It ensures that aircraft integration incorporates sufficient safety margins to sustain these engine failures.

The work does not stop there, however. The propulsion system is tracked throughout an aircraft's life to ensure it remains airworthy and within dedicated safety margins when failures occur. Mitigations are defined and implemented whenever necessary. Both Airbus and the engine manufacturer must follow their own but complementary continued airworthiness obligations to ensure aircraft safety throughout its life.
Over the last two decades, the worldwide rate of engine in-flight shut-down has been divided by 10 (*), showing a continuous joint effort from engine manufacturers and Airbus to improve propulsion system safety.

(*) source CAAM international working group

How to guarantee performance

Airbus specifies a variety of metrics for engine manufacturers to meet, including fuel consumption, in-flight thrust capability, gaseous emissions and noise – all with the aim of optimising operational, environmental and economic efficiency for the end customer. The verification process is executed jointly during the engine development and test phase.

Engine performance follow-up during development is key to anticipate entry-into-service product performance. This is achieved through a joint analysis of the engine manufacturer's ground tests and final flight tests conducted by Airbus. FADEC thrust tables are developed jointly to deliver optimal aircraft performance in different conditions. A hot environment like the Middle East, for example, can require specific thrust capabilities.

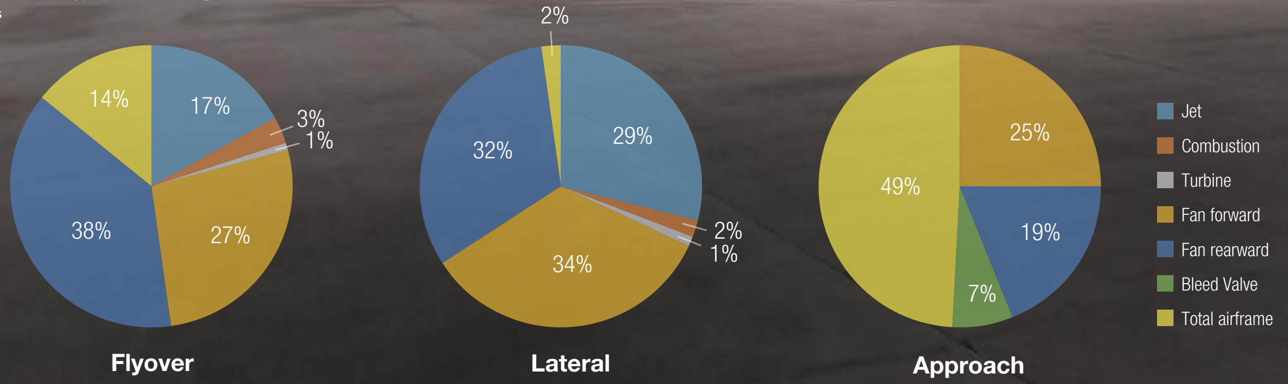
Ensuring system maturity

Reaching optimum aircraft maturity at entry-into-service is essential for all partners. The propulsion system is a major part of regular maintenance procedures. Together with the company's suppliers, Airbus considers the maturity of the propulsion system at every stage of its life cycle. The shared objective is to prevent issues of immaturity affecting a fleet, as well as ensuring fleet management plans are available for known issues and constantly striving for improvements that will enhance reliability.

During pre-development, the maturity of new key technologies is assessed and extensive feedback analyses are conducted to influence design or architecture choices like electrical or hydraulic thrust reversers. Between the preliminary and critical design reviews, much more exhaustive analyses are carried out to assess new equipment suppliers, the robustness of all new technologies and to apply technical lessons learned from previous aircraft programmes. Airbus works with suppliers to ensure an adequate validation and verification strategy on any new components.

Engine Alliance GP7200

Examples of noise from typical, current, large, commercial Airbus aircraft
Source: Airbus



Minimising noise

Propulsion systems are the major contributor to community noise emissions on modern commercial aircraft at take-off. They also generate about half of the noise emission during the final approach phase, in addition to airframe aerodynamic noise sources like landing gears and wing flaps and slats. They contribute significantly to cabin noise, too, particularly during initial climb in the front cabin and most of the cruise in the rear cabin.

The way engines are installed and integrated play an important role in the acoustic performance and quality of an aircraft. Most of the nacelles' inner walls are covered with acoustic absorbing treatment to provide acoustic attenuation to engine noise. The treatments are carefully optimized to match the characteristics of the main turbomachinery noise sources and prevent 50-70% of acoustic energy generated by the engine from being radiated outside. The result is a reduction of between three and five EPNdB (Equivalent Perceived Noise in Decibels) at each control point.

Airbus has developed numerous innovative technologies to minimise noise emissions. One example is the zero-splice (360° seamless) intake treatment, which was an industry-first when introduced on the A380.

Beyond that, Airbus has also developed noise-abatement departure procedures, where the engine thrust and aircraft speed are managed over the initial trajectory. Within their flight mission planning, pilots can then select this function to minimise community noise impact.

Pushing boundaries: future propulsion perspectives

New propulsion systems have been developed for a number of aircraft in recent years, like the A350 XWB, A320neo and A330neo. Nevertheless, the parties involved are continually looking to create improvements. One trend for the future is likely to be a continual increase in bypass ratio (ultra-high bypass ratio, UHBR) to improve propulsion efficiency on turbofan engines.

New architectures are also being explored. High-speed propellers could combine the benefit of improved propulsive efficiency while addressing the challenge of pushing the propeller concept to higher aircraft speed. Placing the engine within the aircraft boundary layer could benefit from the reduced velocity flow environment. And low-power hybrid-electric concepts may offer further potential for turbomachine optimization.

In parallel to the engine architecture, different energy solutions are under study to reduce aviation's environmental footprint. They range from increased use of sustainable aviation fuels beyond today's 50% limit in kerosene blends, to the exploration of more disruptive configurations that could allow for other types of propulsion, requiring completely new aircraft architectures and energies.

The defining moment

Making it easier to choose cabin options

Choosing the right options for a new aircraft cabin can be daunting for airline customers. Airbus aircraft cabins have become far more customisable in recent years, leaving customers facing a huge number of choices, but technological innovations are helping to smooth the process.

Thierry ORILLAC,
A350 XWB Cabin Project Leader explains more:

"People who haven't worked in an airline cabin, don't always realise how complex it is. They can just think it's about seats, toilets and a galley and that's it.

But there are also partitions, curtains, storage, lights, air conditioning, cabin communication systems and much more. And there is also a lot of interconnection in the cabin – so there is a domino effect, if you change one option it has knock-on effects elsewhere.

Driving an airline's choices in the cabin are the different objectives of its teams – so cabin definition means balancing the priorities of management, alongside marketing teams and other airline teams such as cabin crew, catering and engineering.

Each cabin definition project is unique and as detailed as the airline wishes. Airlines' aims vary depending on their goal as a carrier – for example, whether they're targeting domestic or international passengers. But they all want to differentiate themselves from the competition. And they are all seeking profitability. If they are investing a lot in the cabin, they also want a quick return on that investment."

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Cabin criteria

“There are several variables for airline customers to consider when defining their cabin.

If it’s a big airline, there can be many stakeholders. While with smaller airlines, we are sometimes in direct contact with the CEO or board members. We have many ways to support the customer and we work to balance the best package for them and help them to take a decision.

Alongside the customer’s requirements, there are also regulatory obligations from the aviation authorities and technical constraints from Airbus – for example, not exceeding weight limits. In addition, there can be mandatory operational requirements from the airline to be considered – for example, having a minimum number of trolleys by the aircraft door, or no seats in front of the lavatory entrance.

After that, airlines are looking at points of differentiation for their cabin, features they want for passengers, requirements for cabin crew to perform effectively, and any additional necessities for pilots or engineering and maintenance personnel.

The requirements of airline and Airbus suppliers also need considering. We work in partnership with them to get the required equipment into the cabin.

The layout of the cabin is the main factor as it provides the basis for the cabin definition. This depends on the needs of the airlines, but we also have to consider integration into the aircraft. We’re creating a unique solution for each airline based on its requirement – considering seat models, lavatories, storage etc.

The cabin layout is modified and updated as the project progresses. Usually it’s about finding a compromise that works for the airlines, for example, there is a maximum number of possible seats and galleys. It’s about adapting the original requirement.”

Definition journey

“The Airbus teams help guide the customer through the definition process. After the kick-off meeting, customers have a product offer demonstration at the CDC, where they see the variety of the cabin offer. Suppliers – such as seat manufacturers - are present as needed to explain their products.
After the demonstration, comes the definition meeting. And then at the end is the Cabin Definition Closure Meeting, where we go step-by-step through the definition document. Then we sign the definition document with the customer and suppliers. Based on that document we build the cabin. Once that is done, the delivery centre and other customer teams take care of the delivery phase.”

Customers can see what their future products will look like – using fully-integrated cabin mock-ups, virtual reality and mixed-reality tools, all under one roof

One-stop shop

In March 2019, Airbus opened its extended Airspace Customer Definition Centre (CDC) in Hamburg for cross-programme cabin customisation including the A320 and A330 Family programmes – alongside the existing A350 XWB Family customisation areas.

Alexander JUERS, Project Manager, Customer Definition Centre (CDC) is responsible for both communication at the CDC and overseeing the customer experience:

“The CDC now fully adopts the Airspace cabin brand, (see insert “What is Airspace?”) which was first launched with the A330neo, and sets new cabin standards of comfort, ambience, service and design for airlines and their passengers.

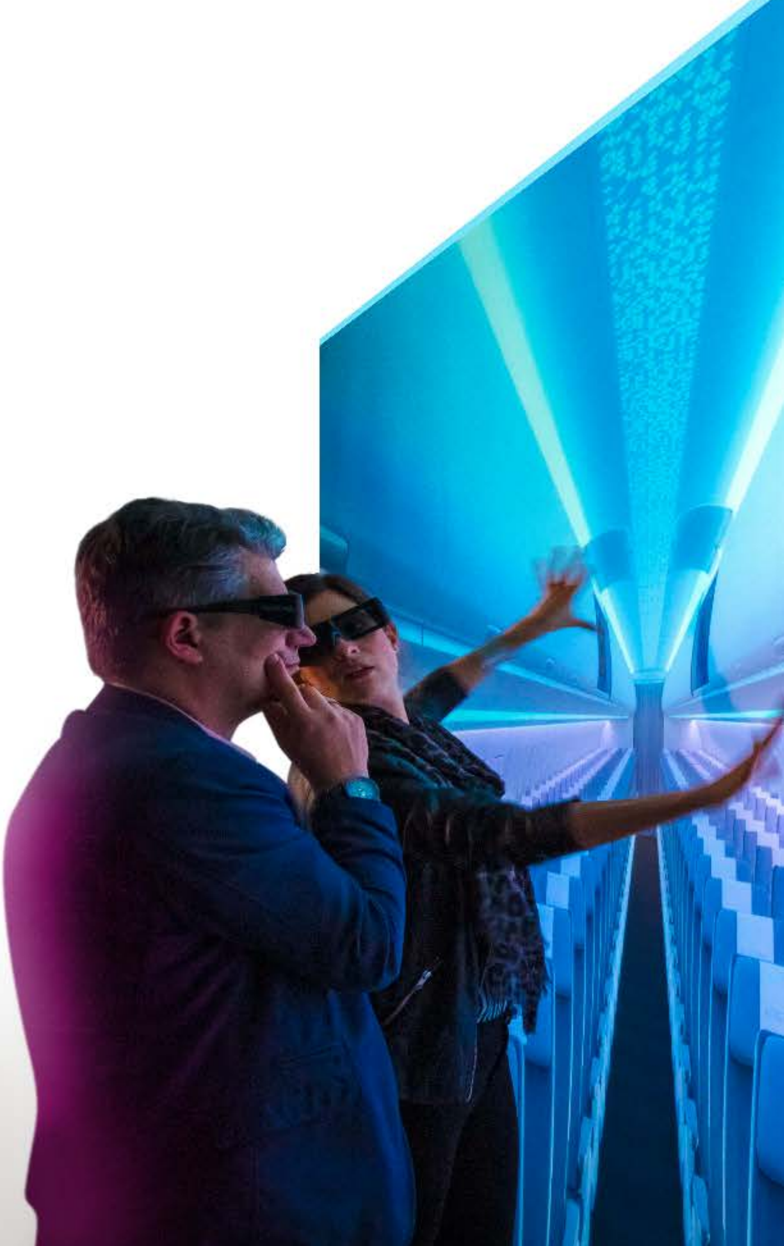
Our teams, tools and state-of-the-art technology at the CDC are there to make it easier and faster for our customers to define their cabins.

A customer visit to the CDC typically lasts two to three days, with most visits dedicated to cabin definition although some are to support customer sales campaigns.

Today, many A350 XWB customers are also A320 or A330 operators, so the enhanced centre is a win-win situation for all stakeholders to streamline cabin definition across their fleet.

The CDC is the one-stop-shop for cabin customisation. Customers no longer need to travel to multiple destinations to see suppliers; they now have the CDC that brings together all the right people from Airbus and the suppliers in one place.

Customers can come to the centre and see what their future product will look like – using fully-integrated cabin mock-ups, virtual reality and mixed-reality tools.”



What is Airspace?

Airspace is Airbus' innovative cabin brand. Launched in 2016, it was created with passengers at heart and airlines in mind, and built around four key pillars: comfort, ambience, services and design. Signature design elements recognisable throughout all Airspace cabins offer more personal space; larger overhead storage bins; spacious, contemporary and more hygienic lavatories. Other features are personalised in-flight entertainment and connectivity options, a unique and customisable welcome area, the latest in LED technology for ambient lighting; plus straight lines, clean shapes and clear surfaces throughout the interior.

Delivered on Airbus' A330neo and A350 XWB, and soon to be installed on the A320neo Family, the Airspace passenger experience will be available across the Airbus fleet and benefit travellers on all kinds of routes.

Definition process

Defining a customer's cabin requirements can take anywhere from 6 months to 2 years

- **Based on initial discussions with the customer, Airbus presents its cabin offer, adapting it to the customer's objectives.**
- **The customer works with Airbus on the specificities, progressing step-by-step through each commodity to reach a final decision.**
- **Both parties fix the main concept of the cabin and requirements, reach the Contractual Definition Freeze (CDF) and sign a contract.**
- **Airbus assembles the cabin, bringing all the parts into the aircraft before performing the final physical validation with the airline.**

Zoning in

"In the CDC, the customers are led through specifically designed areas, from the private customer lounge to a hub of meeting rooms, from where they access the centre's different zones.

Huge screens with virtual reality (VR) capabilities represent a 1:1 scale cabin experience. Using VR googles, customers can move around a virtual cabin in 3D where their specification has been applied.

From that room, they can move into different functional zones, view the real equipment, access mixed-reality rooms and mock-up rooms, to clarify specific cabin situations further enriching the Virtual Reality. Today, the customer always asks for a combination of VR and hardware – it's about making the definition as easy as possible for the customer.

Integrated mock-up rooms

When the customer is defining the cabin in 2D and 3D, they typically want to see the real equipment, such as seat options. We have fully-integrated mock-ups for A350, A320 and A330.

Customers can test fully functional seats in a cabin environment, so they can see how they feel in the aircraft. As the CDC is also a partnership platform, suppliers are invited so customers can get their questions answered on the spot.

As they make decisions, the customer's specification is loaded into a file, with selections added to the 3D model so they can view it in VR. Mock-up zones for different areas of the cabin, such as galleys and lavatories, help customers further define the cabin.

Some customers bring their cabin staff to test out the galleys and equipment, and it becomes a 'cooking session' to see how the space and equipment performs.

Over the last few years, cabin lighting options have gained increasing importance alongside material trim and finish. Previously, there were a lot of material trim and finishes - which we still do, but they are more harmonised with lighting as customers take advantage of advanced systems.
We have dedicated mock-ups, where customers can define their lighting scenarios. There are 16.7 million colours in the lighting system on the A350; with the most advanced full LED system, you can enrich atmosphere in an aircraft. Customers can test materials and see how they change the finish of the cabin with different lighting."

Scenario testing

"The speed that customers can access bespoke physical mock-ups at the CDC is one of its strengths. One airline customer was able to experience a specific door zone arrangement, taking advantage of VR and hardware.

They wanted to establish if there was sufficient clearance for cabin crew and passengers during the onboarding procedures. We mocked-up the respective door zone including lavatory and galley, as well as the area in front of it, to test the specific layout arrangement. Management and cabin crew came to test it with the onboard furniture and were able to perform the check within one day and validate the definition."

Configuring the layout

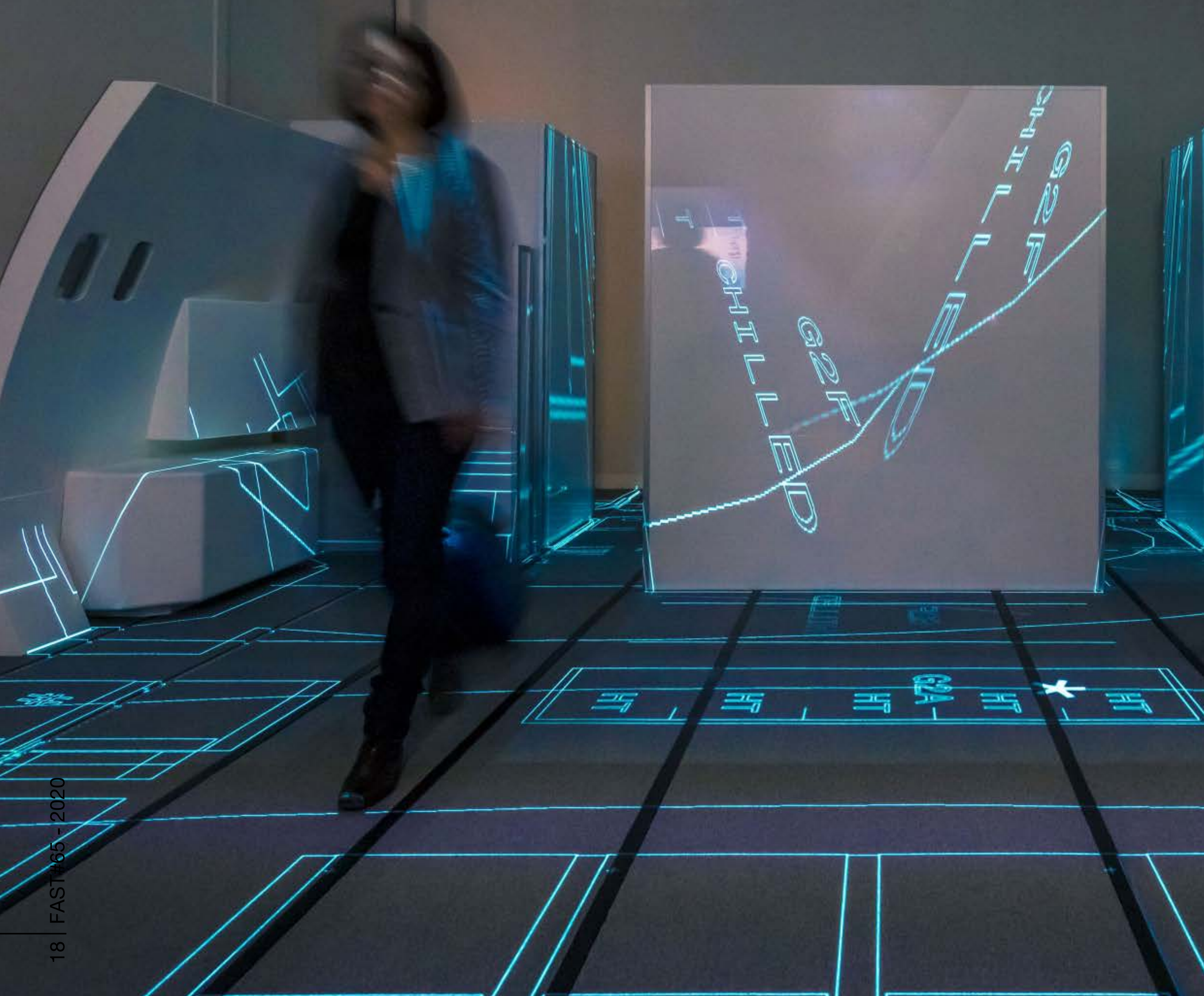
"The Configure Room is where customers get more of a feel for the environment and space. This mixed-reality room has projectors in the ceiling, projecting in one-to-one scale the floor layout on the ground – showing galleys, lavatories, seats etc. Alongside original cabin elements and dimension mock-ups, customers can perform tests of alternative layouts and scenarios.

It allows customers to test the space on a functional level, as well as get a sense of the passenger experience. It helps them reach a balance between function and design. They get the impression of space. For example, they can test if a trolley goes smoothly through the aisle or the galley environment.

Customers can control the layout and change it easily. We can re-arrange room and cabin layout on the spot for them. The room is ideal for a group of people moving around together and reaching decisions.

The combination of functional playrooms for cabin equipment testing, exhibition areas for typical airline product staging, design studios for material and mood light definitions, virtual and augmented-reality technology complemented by customer-specific mock-up areas, make a unique space for customers.

The experience at the CDC is always customised, it's for the customer to decide how to use it. The centre supports a faster process with full transparency and fosters decision-making. We bring all the people with the right knowledge together, so we can clarify things immediately for customers."



Retro-fitting

"Retro-fitting a cabin has more technical constraints than line-fitting. We have to take into account the current aircraft we're going to refurbish and the current specification it has, so there can be additional limitations.

Most of the airlines want to minimise the cost of refurbishment, so they want to use the most cost-efficient modifications – and we can support them to do that."

Customer experience

Morio Suzuki Manager, Interior Group, Engineering Project Office, JAL Engineering (JALEC)
talks about introducing the A350-900 into Japan Airlines' domestic fleet.

What are some of the most challenging things about choosing a cabin?
"The most challenging thing is making a seat layout to provide satisfaction and a good cabin experience to our customers. We need to pursue a maximized passenger area within a profitable range and certification restrictions. Airbus's configuration tool provides lots of help to seek the viable and certifiable layout as it gives warnings when the selected layout goes against certification rules."

How does the process for cabin definition compare now with how it was 10-20 years ago?
"3D imaging tools and viewers, such as VR, provide advanced experience. Before actual aircraft production, we can feel as if we are actually in the cabin. I remember when I entered the actual A350 cabin, I had a feeling of déjà vu: the actual aircraft was produced as per the image that we saw several months ago in the VR."

What are JAL's priorities when defining a cabin?
"Everything is for our customer. The passenger area is the first priority. The second one is the functionality of the seat (electrical motion, IFE, PC power, WiFi)."

CONCLUSION

Rapid solutions for customers

Cabin definition is a complex process with many deliverables. Despite increasing harmonisation of processes and tools, there are a huge number of deliverables to provide the cabin as expected by the airline. The number of interfaces internally and externally, with the airline and suppliers is also complex.

But advances in digitalisation are helping provide tools such as the virtual and mixed-reality mock-ups in the Customer Definition Centre, that make it easier for customers to define their cabin; it is becoming faster and simpler for them every day.

State-of-the-art cockpit upgrade

The UPS choice for its A300-600 fleet

The fleet of A300-600 aircraft owned by freighter company UPS is benefitting from a major upgrade of integrated cockpit technology. This brings the A300-600 close to the current generation of aircraft, realising its full potential and making it a competitive asset for the company now and into the future.

Article by (left to right)

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The A300-600 cockpit redesign serves to future-proof the UPS fleet for the remainder of its life. A denser set of waypoints and routes in US airspace exceeded the capacity of the current navigation database long ago. The need to operate in busier traffic led the regulator to introduce new operational requirements, either mandates or quasi-mandates such as FANS. Additionally, technology has opened up fresh possibilities, such as new GPS-based approaches, on which more and more airports now rely.

The redesign provides an opportunity for safety enhancements. New functions and upgraded hardware from the updated cockpit remove limitations and coping operational strategies that the customer has to manage to fly the current A300-600.

Current fleet and decision to upgrade

UPS operates 52 A300-600s, and two simulators. From the point of view of counting aircraft flight-cycles, this is a robust, young freighter fleet. The aircraft are flown two to three times per day. Low utilisation combined with a robust design mean their airframes have a long remaining structural life. UPS A300-600s are expected to fly for the next 20 years.

The A300-600 was designed in the 1980s and entered into service in 1983. Airbus ceased production of the aircraft in July 2007. Despite product evolutions brought into this fleet over the years, there is still a significant gap compared to later aircraft designs which have entered into service in recent years.

Until now UPS has been able to adapt in order to operate with these systems, but the most effective way to optimise their current and future operations was to integrate a comprehensive upgrade to the cockpit. UPS operates in the 'next-day-delivery' market so modern cockpit functions bring a distinct advantage and are fundamental to a business model which "sells a speed advantage".

Despite being post-production, when approached by UPS in 2015 Airbus was determined not to leave its customer without support. Stopping production of an aircraft type does not mean the end of the programme. It is just a new phase where Airbus remains engaged with customers, even for ambitious and challenging projects.

A holistic design and installation approach - optimal for the customer

There is now a fully integrated suite of technologies within the new cockpit. The upgrade could have been executed in a piecemeal way, but it would have meant the customer repeatedly immobilising the aircraft to install and integrate the equipment and would create the need to redo pilot training on multiple occasions.

Performing the system redesign and upgrade in one go is a much more efficient approach, with immobilisation happening only once for the customer. In addition, Airbus manages the integration and the design upgrade and delivers the service bulletins and kits to the customer. As the Type Certificate holder, Airbus also provides a warranty and updated documentation with the upgrade. The level of supplier support obligations for the A300-600 cockpit upgrade were aligned with latest Airbus programmes.

What new technology is on board?

Flight Management System

The FMS is a fundamental component of modern avionics. The suite includes a modern FMS which provides sophisticated automation of in-flight tasks, primarily flight plan management and navigation, but also integration of all components of the auto-flight system.

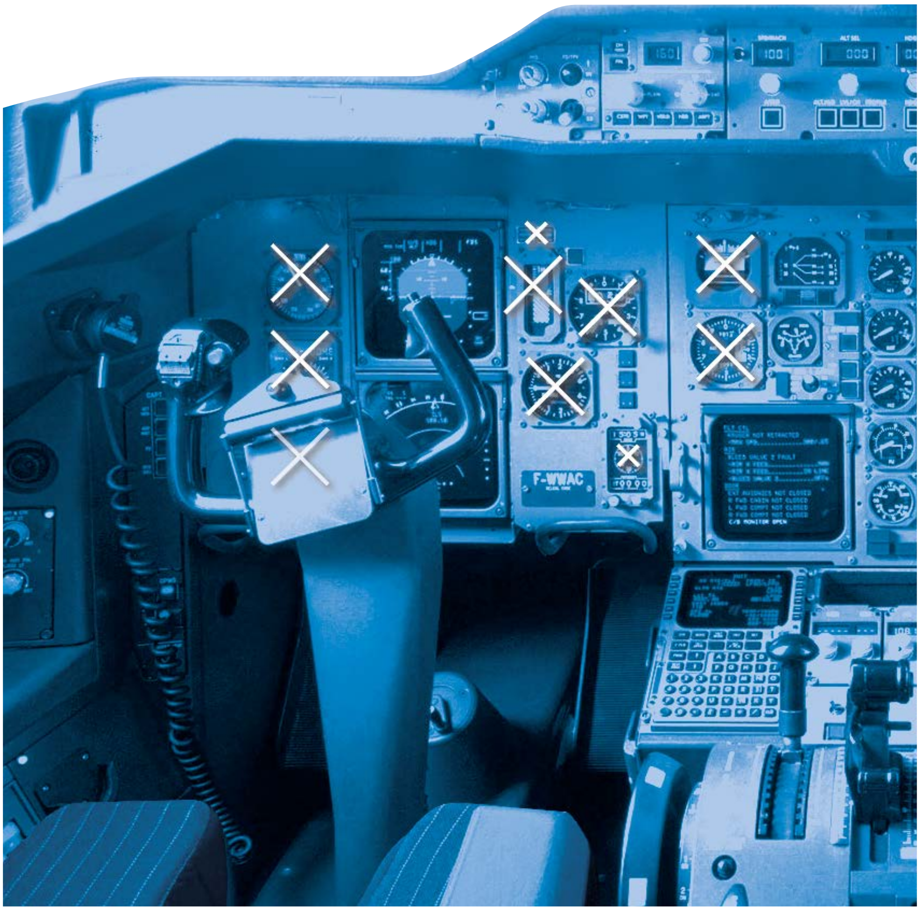
The new database has ample capacity to carry all worldwide data required without being full and is loadable in about ten minutes. In addition, there is space for the 7% growth observed every year, therefore covering the remaining life of the UPS fleet.

This is a key enhancement as the original database in the A300-600 was from the 1980s and was then adequate to contain all options and routes within its 1GB of Random Access Memory (RAM). Compare this to the RAM of a modern smartphone, which typically has 4GB of RAM! But database growth over the years means that even North America airspace information alone vastly exceeds this memory size. UPS therefore carves it up onto separate regional databases with every database change taking about 40 to 50 minutes per computer. This is not compatible with the UPS business need for efficiency and compromises competitive advantage. This problem is now fully resolved with the database embedded in the new FMS.

There is also a new colour Multifunction Control and Display Unit (MCDU). The MCDU is a combination of a keyboard and a high-performance Liquid-Crystal Display (LCD) that allows pilots to input and modify flight plans.

New cockpit displays

There are four new LCD displays at 6 x 8 inches each (as compared to the previous 5 x 5 inch screens). These organise information in the primary field of view. Terrain can be displayed, and a vertical display can be added in the increased screen size. The new primary flight display (PFD) also shows a horizontal situation indicator (HSI) which can provide navigational information. All of these features further enhance safety and are efficient tools to assist the flight crews in their operations.



LPV (Localiser Performance with Vertical Guidance)

The LPV is a Global Positioning System (GPS)-based instrument approach procedure. It is an Instrument Landing System (ILS) look-alike, using GPS positioning corrected by a Satellite-Based Augmentation System (SBAS).

The modern LPV capability creates a more versatile A300-600, from which the customer can expect a higher rate of mission completion because the upgraded aircraft can fly to non-ILS equipped outposts and make double-hop routes.

As a reminder, Instrument Landing System (ILS) is the instrumentation on the runway that defines the path that the aircraft can follow. Beacons send a signal which aircraft receive and decode. The LPV provides the same feature, but with satellite information. Airport ILS systems are being decommissioned more and more in the US, and some smaller airports simply do not have them. Having an LPV function avoids reliance on an ILS. LPV avoids reliance on ILS, making the destination airport less dependent on the weather as aircraft can land in poorer conditions. The minimum altitude at which the pilot can make a decision about landing is reduced. This ability to make landing decisions at relatively low altitude avoids some diversions or go-arounds. This is conducive to UPS's speed mission.

FANS A & B (Future Air Navigation System)

In recent years, a need has arisen to exchange routine information in flight in a flexible, reliable and secure manner, and in all operational contexts. The ICAO (International Civil Aviation Organisation) recommended the selection of FANS (Future Air Navigation System) to address these needs. FANS is a set of applications for Air Traffic Control based on modern technologies such as datalink communication and satellite navigation. The main FANS application is the CPDLC (Controller-Pilot Data-Link Communication) that allows the pilots to communicate directly with controllers on ground, using datalink with a set of predefined text messages.

The UPS A300-600s' new avionics suite includes FANS A and FANS B.

FANS A & B cover different geographical territories. FANS A was designed to cover oceanic and remote areas where no radar coverage exists. Since then it has been deployed in other areas, including domestic North American airspaces. It is mandatory for airlines flying North Atlantic routes. FANS B was designed for domestic flights within Europe where radar coverage was already present. It is mandatory for airlines operating in this area. Even where these systems are not mandatory, they are valuable. UPS have localised fleets so it is practical for them to have either the A or B systems installed on their aircraft.

Recent figures show that air traffic management related delays are growing as the global fleet increases, so anything that can ease that situation will be of benefit to airlines. This is especially the case for those relying on fast, on-time turnarounds as part of their operating strategy. With enhanced flight departure clearances, automation tools and improved ATC communication, FANS technology gives the UPS A300-600 fleet a business advantage. Most crucially for UPS, FANS- equipped aircraft get priority from air traffic control.

New Weather Radar

The current weather radar has been replaced by state-of-the-art Primus EPIC®-integrated IntuVue™ Weather Radar RDR-4000 from Honeywell*. This system automatically scans the sky at 17 tilt angles, the most in the industry, and continuously delivers a 3D view of the weather through an intuitive vertical navigation display.

The new radar offers many functions which combine to further enhance safety and more effectively avoid weather hazards. These include predictive wind shear, and predictive hail and lightning.

The intuitive system also makes training pilots quicker and easier, resulting in lower costs. Better avoiding weather hazards should bring a reduction in lightning strikes and the costly inspections they require. Pilot fatigue is reduced because the radar gives great visibility, giving pilots more information and confidence.

**Honeywell Primus EPIC is a range of Electronic Flight Instrument System (EFIS) cockpits and integrated Avionics manufactured by Honeywell Aerospace. Each system is composed of multiple display units used as primary flight display and multi-function display.*

Additional Features

There are many more features included in the new cockpit, including RNP-AR (Required Navigation Performance - authorisation required) with RF (radius-to-fix) legs, which enables fuel savings and noise-reducing approaches on selected airports; TAWS (Terrain Awareness and Warning System); and RTA (Required Time of Arrival) which is an aid to ATM (Air Traffic Management).

On the maintenance side, it is of note that the new cockpit's centralised maintenance function provides diagnostics capability and easier dataloading. This will help customer maintenance and configuration checks and ensure the aircraft is ready for future growth in maintenance analytics.

Overcoming technical challenges

It will be no surprise that a complex and ambitious project such as this raised some challenges. It requires a multi-functional team - including experts in upgrades, engineering, testing, procurement, supply chain, production, quality, and support - to collaborate and find solutions to suit the customer's needs.

Although the A300-600 was originally designed by older tools, the team used modern 3D techniques to conceive and check the installation of the new systems into the existing fuselage nose.

As there were no A300-600 test aircraft at Airbus' disposal, UPS and Airbus agreed to lease one of UPS' aircraft for flight testing.

Customer motivation: Why upgrade the cockpit?

Kevin O'HARA, Director of Project Engineering/Aircraft Acquisitions for UPS Airlines, told FAST that the primary reason to upgrade the A300-600 cockpit was the navigation database capacity in the flight management system.

“ The navigation data required to fly in current national air systems has grown significantly over the last five years. UPS estimates that it will continue to grow in the future at a rate of approximately 7% per year as the United States manages increased air traffic and congestion in the national airspace and terminal areas.

Navigational database growth can be attributed to the move from fixed navigation aids such as a very high-frequency (VHF) omnidirectional range (VOR) system to coordinates in space to support required navigational performance (RNP).

The new technology will significantly reduce the requirement to upload new navigation data from once per aircraft per day to the typical monthly update.

The time required for multiple data loads are a significant burden on the UPS operation resulting in aircraft routing constraints, and the potential for dispatch delays and interrupted service to our customers.

The associated benefits to UPS from the new suite of integrated cockpit technology includes reduced maintenance cost, a substantial improvement in systems/component reliability, and safety improvements. There is also the ability to operate efficiently in both highly congested airspace as well as smaller airports during poor weather operations.

This cockpit upgrade was required to enable UPS to operate the aircraft efficiently into the future. The A300-600 was first introduced to UPS in 2000. The average fleet age today is 16 years. The cockpit upgrade extends that life expectancy by a further 20 years.

Continued use of our fleet would certainly not be realistic if the technology didn't support the demands of our business operation, government regulations, part obsolescence, and the service levels required for our customers. ”

What is it like to fly?

Airbus test pilot, **Captain Michel BONNIFET**, commented after his first flight in the new cockpit:

“ I really know this aircraft well and the upgrade felt like a generational change. It is now like flying a modern airliner ”

Next for the upgraded A300-600

The UPS A300-600 cockpit upgrade is currently in the lab and flight-test phase. It is scheduled for approval and certification by the European Union Aviation Safety Agency (EASA) and the Federal Aviation Administration (FAA).

UPS will select MRO (maintenance, repair and overhaul) providers for the remaining aircraft.

The project includes detailed delivery planning, covering the services bulletins as well as the aircraft modification kits. Airbus will also support UPS and their MRO for the implementation, starting with an on-site support for the first embodiment.

CONCLUSION

The cockpit technology upgrade gives UPS a go-anywhere fleet of A300-600 aircraft, with high-tech, flexibility and reliability supporting their mission to deliver speed to their customers.

It provides UPS with an original equipment manufacturer (OEM) solution, and an easier way to operate in an ever more demanding business world.

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FAST
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Protecting precious assets

Parking and storing aircraft

From a purely operational point of view, all aircraft would be working round the clock and generating revenue throughout their life. In the real world some need to be parked or stored for short, or even long, periods of time.

Special COVID-19 update

Customer Services teams are working hard to adapt maintenance recommendations and support customers who have fleets partially or wholly grounded during this period. The situation calls for exceptional measures and reactivity to provide pragmatic support to operators during this difficult period, while keeping the highest levels of safety.

In addition to increasing its support teams and giving recommendations to customers, Airbus is providing technical justifications and solutions for maintenance burden reduction. This includes extending calendar intervals for scheduled maintenance tasks and reducing the frequency of periodic ground checks from every week to every two weeks.

Airbus has published technical data via Operators Information Transmissions (OITs). Technical queries about these should be addressed to Airbus Customer Services through the TechRequest tool on AirbusWorld, selecting the Scheduled Maintenance domain and the Parking & Storage topic.

"Never in the history of aviation have airlines had to ground so many aircraft, so quickly. They need help to reduce the huge and sudden maintenance workload, and to ensure a quick return to service when required," explains Gilles de CEVENS, Head of Maintenance Programmes and Services.

Parking and storage - what's the difference?

'Parking' usually means the aircraft is taken out of operation for up to six months. Sometimes longer spells of parking mean coming out of a flight-ready condition, but it is more usual to carry out the regular light maintenance needed to preserve a 'ready to go' state which allows a rapid return to service. Every week over 100 aircraft are parked for periods which exceed 14 days.

'Storage' generally applies when a rapid or unexpected return to service is unlikely and the planned period out of service is up to two years. In these cases airworthiness can be maintained but more preferable is a reduced maintenance schedule combined with preservation activities, such as sealing and greasing.

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Why store an aircraft that could be earning?

Aircraft are sometimes referred to as 'revenue generators'. It is common for them to enter commercial service within days of delivery to operators and a key aim of fleet planning is to safely maximise the time each aircraft spends in the air carrying passengers or freight. Parking or storing an aircraft is an expensive option but there are sometimes compelling reasons to do so.

Time away from operations, such as when waiting for maintenance activities, isn't unusual and some operators have business models which include being less busy at particular times of year. Offering holiday-related travel to regions where a seasonal climate is part of the destinations' appeal might mean anticipating a regular 'down-season'. Reducing flight frequency or closing some routes and then parking or storing part of the fleet makes better financial sense than flying aircraft with too many empty seats. Aircraft are also sometimes taken out of service while awaiting return to the leasing company that owns them. Getting all the relevant dates and activities involved to coincide perfectly can be difficult so a short period of parking can be a practical solution.

However, unplanned events can also create a need for parking or storage, usually in circumstances where the operator has little choice but still needs to protect their asset. These can range from technical issues which can't be resolved quickly to an aircraft being grounded by the authorities while a long way from its base. Financial issues can also create a need for storage, such as bankruptcy, outstanding fuel bills, lack of ground and cabin staff or pilots, and abandonment of aircraft owned by lessors.

Regional or global crises can lead to a complete or partial collapse in the usual infrastructure needed to support aviation. Humanitarian disasters, widespread health or sanitary problems, extreme economic or political events; whatever the reason, parking or storage might be the only viable option available to aircraft operators caught in the middle of such events.

Why protection is key

Once an aircraft is out of service the likelihood of issues caused by the wear and tear of routine flying is reduced. Nevertheless, without proper protection a host of new threats to the condition of the aircraft can emerge depending on the climate and conditions the aircraft is stored in. Weather can cause problems. If rain, snow, salty air, dust or sand enter air ducts, they can degrade or contaminate the mechanical parts they come into contact with. Extremely high winds can also cause damage to an aircraft that might be considered safe and stable in normal circumstances. High humidity, lightning strikes and volcanic ash also require special consideration.

Protection against unwelcome 'passengers' is also vital. It only takes weeks for rodents, birds and insects to cause serious damage to a previously pristine cabin with seats, carpets and wiring all vulnerable particularly if a nest is established. Returning to service without an expensive and time-consuming deep-clean and repair operation is unthinkable. In extreme cases, infestation can also lead to blocked ducts, some of which could have safety repercussions – again thorough checks and remedial actions take time so avoiding the problem is the best solution.

Help! - Requests from around the world

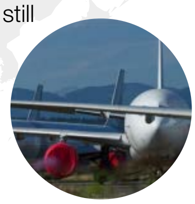
A wide variety of natural phenomena can threaten stored or parked aircraft. Customer Services teams are often asked for advice on dealing with potential issues, some of which have a distinct regional flavour.

Siberia: In winter, temperatures can reach below 40°C. In 'deep freeze' cold of this nature, some plastic and rubber derived parts can become brittle so care is needed.

Asia and Northern Europe: Heavy rain and high humidity can cause mildew inside the aircraft. Without careful sealing, extreme water levels can even cause cabin flooding leading to litres of water pouring out at the end of the storage period. However, sealing must be done correctly to ensure that evaporation is still possible, thus preventing mould.

Caribbean: Salty and humid conditions require extra protection.

Middle East: With up to 80 million locusts in the central area of a swarm the need for extra caution is clear. Moving aircraft into hangars and sealing ducts and potential entry points is crucial.



Japan: AMM (Aircraft Maintenance Manual) procedures cover mooring of aircraft in winds up to 75 knots. Severe typhoons have winds of at least 80 knots while super typhoons are defined by winds of at least 100 knots. Advice varies according to specific circumstances but it can include moving aircraft into hangars - or out of them if the buildings themselves are at risk. Filling fuel tanks can add extra weight to the aircraft while removing plastic sheeting prevents it from catching the wind and becoming a 'sail' which drags the aircraft.

Overall it is fair to say that, depending on location and on seasonal and operational conditions, the exact procedures for storage or parking vary. However, protecting the aircraft against contamination, mechanical degradation or damage is always essential.

Aircraft should be parked or stored in clean and serviceable condition. Measures should be taken to clean the cabin, galleys and cargo, service all the systems, protect the exposed areas, and carry out the periodical checks. Anticipation is also vital. Use experience and knowledge of the environment as a guide, to take appropriate actions for cold weather, ventilation, mooring, and ensuring that sufficient fuel is in the tanks for water draining or APU (auxiliary power unit) operation and engine runs.

AMM or Maintenance Procedure tasks exist to prepare an aircraft for parking/storage and return it to service and these should always be followed.


Protect
Waste tank cleaning
Inspection after impact
Hydraulic fluid contamination
Drain lines cleaning
Check

Asking the right questions

When deciding whether to park or store an aircraft, you should check requirements carefully. An out-of-operation aircraft can be maintained with an approved maintenance programme. Consult the AMM to find procedures and check which are mandatory.

Seven frequently asked questions:

1) **ISI 10.00.00003 Guidelines for appropriate actions**

Is it necessary to park or store an aircraft before a scheduled maintenance check, working party or cabin refurbishing?

Check the guidelines regarding your specific circumstances.

2) **ISI 10.00.00004 Parking or Storage extension**

What can I do when the parking or storage period has expired?

Normally after two years an aircraft must return to operation before going back into storage. This should become a deviation in the future and there will be no need to re-fly if the aircraft is not required by the operator.

3) **ISI 10.00.00005 Aircraft system integrity**

Is it possible to remove parts from an aircraft that is parked or stored?

Parked aircraft should be flight ready – batteries can be removed to preserve them as they can be quickly reinstalled. Other items can be removed in specific conditions, for example some of the fire extinguishers in the cabin aren't necessary for a flight without passengers. However, removing parts for parking is highly restricted.

In stored aircraft, it is more common for major components to be removed. Engines, APUs, flaps and computers all have high value and can be transferred to in-service aircraft.
The best solutions often depend on the planned storage time. Operators have some flexibility and should check with Airbus if in doubt. It can become a costly process if an aircraft needs to return to service when major parts have been removed, so operators should be clear about the storage mode and duration before making decisions.

4) **ISI 10.00.00006 Scheduled maintenance control**

What is the starting date to be used to calculate future ground checks?

All dates must be calculated based on the last flight date. This rule applies even if an aircraft is initially parked then moves to storage, or if it needs two months of maintenance then is parked.

5) **ISI 10.00.00007 Tasks calendar**

How does a parking or storage period influence the scheduled maintenance?

Scheduled or planned maintenance must still be done, but may be postponed until the end of a parking/storage period if operators have agreement from their local authority.
If an aircraft is in short-term parking mode, it is advisable to do scheduled maintenance when due, to avoid delays on return-to-service.

6) **ISI 10.00.00008 Engines & APU on wing**

Who shall I ask questions to related to engines and APU?

Operators need to refer directly to the engine and APU manufacturers in line with legal requirements.

7) **ISI 10.00.00009 Assistance and ISI 10.00.00010 cover deviations**

How can Airbus support me regarding aircraft parking and storage?

Operators can log a request in the Airbus TechRequest too, for advice, deviation options, and overdue maintenance where aircraft needs to be flown to a specific maintenance base or to new owner.

Operators who supply full and accurate information to Airbus can be supported with documents confirming that procedures have been followed – these can be a requirement for airworthiness authorities.

Support and responsibilities

Airbus deals with several requests for support every day and offers advice as well services. It can evaluate specific situations to help ensure the safety and serviceability required for an easy return-to-service. Operators are responsible for ensuring correct and complete information for Airbus when preparing validation from their authorities.

As for any maintenance actions, parking and storage have to be approached like a planned maintenance check. All the regulations and standard practices apply. Preparation, traceability and proper execution of the maintenance tasks are essential for a safe and uncomplicated release back into service.

Keeping the AMM current

By reporting back to Airbus, operators can help keep the AMM up-to-date in the light of experience and evolving techniques. This happened, for example, when operators explained that the aluminium covers being used to prevent fabric fading inside the cabin were actually causing paint discoloration around the windows. A new technique was then developed to resolve this issue.

Scheduled Maintenance seminars

These include some information on critical situations for parking and storing, aircraft waiting for dismantling, or needing leasing company acceptance for flight, aircraft on standby and more

- sched-maint.seminar@airbus.com

Back to service

To return an aircraft to service all the required maintenance must be carried out. This includes all scheduled maintenance, daily and weekly servicing when needed, and the restoration of any defects which may have arisen during the period of storage or parking. Everything required to bring the aircraft back to operational standards and ensure safe use is essential. Calendar items as well as mandatory items, Airworthiness Directives, All Operator Telex, shelf-life equipment, and inspections due must be included. Upon release into service the aircraft must be fully airworthy in every respect.

CONCLUSION

Whatever the circumstances, when parking or storage is the right solution for an aircraft it is wise to prepare in advance and strongly advisable to refer to the latest recommendations and guidelines in the AMM, in-service information and technical follow-up documents.

Making full use of Airbus support as early as possible to evaluate specific needs, avoid unplanned deviations and anticipate costs will also help. Keeping delays and costs down means thinking through storage rental but also planning maintenance to avoid overdue work causing a backlog which ultimately delays return-to-service.

The most crucial piece of advice is to get in touch early. This helps all parties and allows the best possible experience of a potentially complicated situation. Poorly planned and handled storage or parking can lead to aircraft being prevented from returning to operation when required and the consequences for revenues can be serious.

FASTFORWARD

Airbus is powered by innovation to redefine and shape the future of flight

Introducing the blended wing body aircraft of the future

What if the aircraft of the future looked like a giant wing? This is the concept behind MAVERIC, Airbus' small-scale, remote-controlled aircraft demonstrator unveiled at Singapore Air Show 2020. The innovative design - known as a "blended wing body" - has the potential to generate up to 20% fuel savings thanks to a wide cabin layout that completely breaks the mould of conventional single-aisle aircraft architecture. The spacious configuration also opens up the design space, enabling the possible integration of various other types of propulsion systems. If commercialised, a MAVERIC-inspired aircraft could significantly improve the passenger experience: the exceptionally comfortable cabin layout would enable passengers to benefit from additional legroom and larger aisles for more personal comfort. The development of demonstrators like MAVERIC enables Airbus to accelerate understanding of new aircraft configurations and to mature the technology necessary to fly such a radically different aircraft.

Birds of a feather flock together

When a flock of geese takes to the skies, it usually adopts a V-shape. But why? The answer lies in a flight technique known as "wake-energy retrieval." When a bird flaps its wings, air flows over the wings and swirls upwards behind the wingtips.

This flow creates a wake through which air gets pushed upward. When another bird enters this upwash, it immediately benefits from free lift. Just like birds, every aircraft creates a wake while flying. Flying together could thus help aircraft to retrieve the lost kinetic energy by positioning a follower aircraft in the air upwash of one of the lead aircraft's wakes.

Today, Airbus is exploring the benefits of wake-energy retrieval for commercial aircraft through the flight demonstrator project fello'fly. If the technology behind fello'fly proves viable, this collaborative activity could produce fuel savings of between 5-10% per trip. *"It's a great opportunity for our industry to demonstrate a joint commitment to reducing our use of fossil fuels,"* said Nick Macdonald, fello'fly Demonstrator Leader, Airbus.

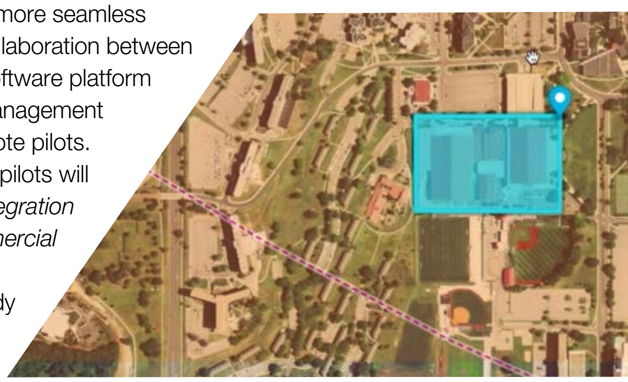
Airbus aims to involve manufacturers, airlines, air navigation service providers, regulators and authorities to help the aviation industry to reduce fuel consumption and CO_2 emissions. The next flight tests are expected to take place in 2020.

Connecting Chinese airlines to the Skywise data platform

Airbus is teaming up with Alibaba Cloud, the data intelligence backbone of Alibaba Group, to co-develop a Skywise Data Centre in China. By partnering with Alibaba Cloud and utilising the local data centre, Skywise will provide customised services for Chinese domestic airlines, as well as features and tools for data compliance required for Chinese airlines to join the platform. Since the beginning of 2019, Airbus has rolled out advanced analytics services to Chinese domestic airlines through Skywise. To date, Spring Airlines, Yunnan Hongtu Airlines and Zhejiang Loong Airlines have connected to Skywise. Approximately 1,800 Airbus aircraft are operated by Chinese airlines today.

Paving the way for safe integration of drones into airspace

Commercial drone remote pilots will soon be able to benefit from a safer, faster and more seamless experience when planning, reviewing and conducting their flights thanks to a new collaboration between Airbus UTM (Unmanned Traffic Management) and DroneDeploy, the largest drone software platform in the US. Airbus UTM has integrated its UTM software into DroneDeploy's drone management platform to offer airspace authorisation and flight briefings for commercial drone remote pilots. One of the key benefits of the integration is the speed at which DroneDeploy remote pilots will be able to secure digital flight authorisation and a guaranteed level of safety. *"Our integration with DroneDeploy streamlines the flight authorisation process for DroneDeploy commercial pilots, while laying the foundation for new services and safe cooperation of drones in airspace,"* said Joe Polastre, Head of UTM Products, Airbus. The integration is already being tested in private beta with DroneDeploy's enterprise customers, and a full release is expected to arrive in 2020.



easyJet & Airbus take important next step to help decarbonise the aviation industry

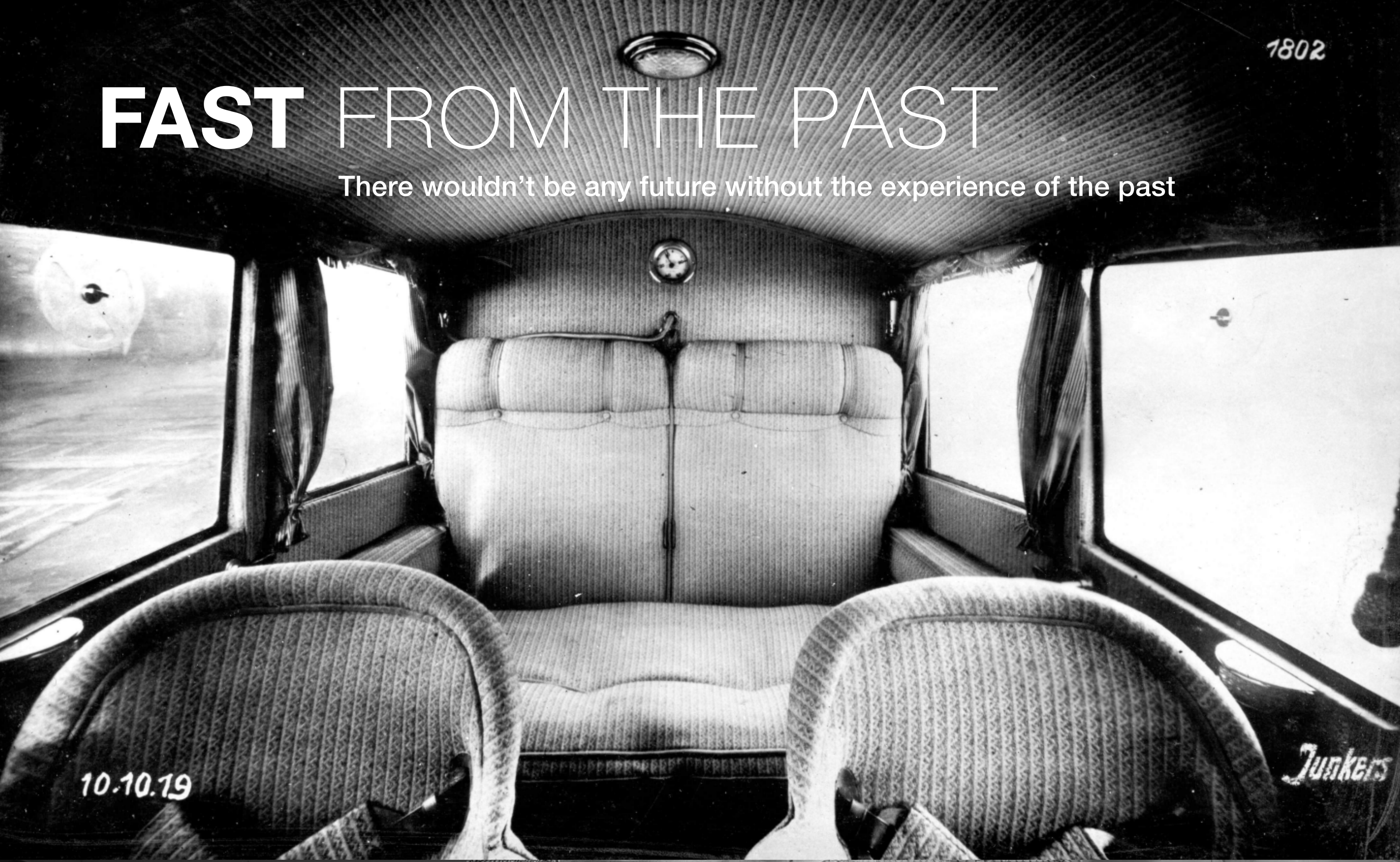
What are the requirements necessary for the large-scale introduction of hybrid-electric aircraft? What infrastructure will be required? How will day-to-day commercial aircraft operations be impacted? These questions are at the heart of a joint research project signed by easyJet and Airbus. According to Johan Lundgren, easyJet CEO: *"I'm delighted to be working with Airbus on a new hybrid-electric plane research partnership. The project will aim to identify the detailed technical challenges and requirements for electric and hybrid-electric planes when deployed for short-haul flying around Europe so that we can help shape the technology and airline networks of the future. We hope this will be an important step towards making hybrid-electric planes a reality."* The announcement comes several months after Airbus signed a similar agreement with SAS Scandinavian Airlines to study infrastructure development and commercial operations needs for hybrid-electric aircraft.

The end of an era: Vahana takes its final test flight

The flagship programme that launched the urban air mobility initiative at Airbus has now come to a close. In November 2019, the final page of the Vahana story was written at the Pendleton UAS range in Oregon, USA. Here, Vahana took its final test flight to the cheers of all those who have closely contributed to the electric vertical take-off and landing vehicle (eVTOL)'s development over the last four years. The Vahana programme was launched in 2016 at Acubed, the company's innovation centre in Silicon Valley. Says Zach Lovering, VP of UAM Systems, Airbus: *"Learnings from Vahana will be used to advance our relationship with regulators and to understand key technologies."* Now that the Vahana programme has been completed, the project team is looking forward to applying the lessons learned to the future urban air vehicle at Airbus.

FAST FROM THE PAST

There wouldn't be any future without the experience of the past



Rugs and exotic hardwood furniture may be seen as luxuries of the past... but cabins have come a long way over the years, offering more comfort for passengers. And with the huge array of choices available to airlines, technology has also evolved to help facilitate the process (see article page 14 *"The defining moment"*).

Photo courtesy of Airbus Corporate Heritage

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