

The background of the entire image is a photograph of the interior of an airplane cabin. The perspective is from the back of the cabin, looking forward. Rows of light-colored, upholstered seats are visible, along with overhead luggage bins. The ceiling is white and features recessed lighting. A small red exit sign is visible above one of the overhead bins.

Airbus technical magazine

April 2019

#63

FAST

Flight Airworthiness Support Technology

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#63

FAST

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Deborah BUCKLER
Chief Editor

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The cabin waste mountain

Managing the rising quantities and costs



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For most passengers, when the cabin crew starts going through the aisle collecting the rubbish from seat trays, it's usually a subconscious signal that landing is not too far off, especially on a short-haul flight.

On a long-distance trip, passengers are just happy to fold up their tray.

But what about the waste itself that is generated on a flight? The statistics are incredible. According to IATA 5.2 million tonnes of cabin waste were created in 2016 and that number is expected to double by 2030.

Why is cabin waste on the increase?

There are several factors to explain this rise. First of all, we are consuming more on flights. We may be bringing fewer newspapers on board as we download from tablets and mobile phones, but we drink far more from plastic cups and glasses, especially on short-haul flights. The food that we purchase on board is also more elaborately prepared with fancier wrapping. As more and more airlines charge for food services, passengers are increasingly bringing food on board with them that they purchased at the airport. According to IATA, 25% of meals on long-haul flights are not even eaten and are thrown away, ending up in landfills.

Dealing with waste today

Of course, with air traffic doubling every 15 years and a rapidly growing middle-class taking to the skies, especially in India and Asia, the waste in the cabin will inevitably continue to expand. The growing « airborne waste mountain » will become more and more of a challenge for the airline industry as it has to find new ways of disposing it. Currently, waste is collected but rarely sorted by cabin crew. There is little concrete data on how much waste is currently recycled, but nearly all of it is handed over to airports that then send it to landfills or incinerators.

Overall, the cost of handling cabin waste is estimated at around 500 million US dollars per year according to IATA and that figure could rise substantially in the coming years.

Airports are increasingly charging airlines more to handle airlines' un-recycled waste. Some airlines actually find it cheaper, despite the extra weight, to hold on to their trash for the return flight, then unload it back at their hub where they may have lower unloading fees.

5 million tonnes of waste by 2030

Handling waste tomorrow

Airlines clearly understand the challenges ahead when it comes to handling cabin waste. In recent feedback to Airbus, some airlines rated the issue of recycling as of very high or rather high importance today. However, the same airlines also said that in 5 years' time, the issue will soar amongst their list of priorities.

A combination of higher costs, possible new regulations in the future on recycling and a greater emphasis on aviation's impact on the environment is encouraging the aircraft manufacturers, airlines, suppliers and regulators to find new solutions to better treat waste in the future. The European Union is currently co-financing studies within the industry to tackle the issue.

Jon Godson, assistant director of IATA, specifically addresses the issue of aviation environment and better environmental practices in the cabin. Among the ideas it is promoting, is the reduction of over-ordering by catering companies, since so much food brought on board is not touched. Another idea is to offer vouchers to passengers to eat in the terminal before they board, particularly as regulations allow waste which is collected on the ground in airports to be recycled more easily. IATA also suggests the use of dedicated recycling carts.



Recycling on-board, quickly and easily

One potential solution, the "Retrolley", is already being rolled out and tested with several airlines on both long and short-haul flights in Europe and the Middle East. The Retrolley in its original form was designed by Brazilian aviation students in an Airbus ideas competition*. Airbus worked on maturing the design with Iacobucci Aerospace, an Italian manufacturer with over 40 years of expertise making cabin products including coffee machines, trash compactors and trolleys.

The Retrolley is a totally re-designed trolley to collect trash and separate it in « real-time » as it is collected by the cabin crew. There are several different compartments, which can be customized according to the specific airline needs. One possible configuration is to have one container for cups that can be stacked up, one for liquids, one to hold recyclable paper and plastics and a fourth compartment for trash that cannot be recycled easily. They have been configured for flexibility, as Lucio Iacobucci, CEO, explains: *'The Retrolley is a very simple system because it can be used on different flights. Cabin service for short flights may have more liquids to collect, and so we can configure the Retrolley with between 1 and 3 bins specifically for cups and liquids. However, on longer flights there could be bigger containers for a variety of waste. The bottom line is that there is no standard concept. Each airline has its approach and needs and the Retrolley can adapt to these requirements.'*

Jon Godson from IATA also sees the trolley as a way forward in the campaign against waste because it addresses health inspectors' concerns about the need to clearly separate recyclable rubbish from other waste: *'Retrolley is a great step forward for cabin waste recycling and should provide assurance to regulators that we can keep recyclables free from any bio-security risks.'*

Airbus is convinced that the Retrolley will be welcomed by the industry and will contribute to a more sustainable future because it fulfils key requirements for airlines: this trolley can be integrated into any galley without modifications and with a simple, non-electrical and lightweight design.



Retrolley adapts
to airlines' needs



*Airbus Fly Your Ideas competition behind Retrolley concept

The Retrolley was designed by 5 students from Sao Paolo University. They participated in the *Fly Your Ideas* competition that Airbus runs in partnership with UNESCO to encourage students to come up with new innovations to transform the world of aviation. The students worked alongside Airbus engineers to help turn their idea into a reality. Nicolas Jourdan, an Airbus cabin innovation manager, saw the students' idea and thought: "Wow - this is so clear we should do something with this. We can make it fly, especially as it combines innovation and environmental goals together."

The Retrolley won the 2017 Crystal Cabin Award at the Aircraft Interiors Expo.

www.airbus-fyi.com

There is no standard fit for Retrolley, it can be fitted with between 1 and 3 bins for cups and liquids. However, on longer flights there could be bigger containers for a variety of waste



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CONCLUSION

Cabin waste is on the increase, as are the associated costs of managing it. Challenges include the sheer volume of waste, but also the time and space constraints of the cabin crew and the environmental awareness requiring better recycling of waste.

The Retrolley is one option, expected to be in service by end of 2019. The trolley enables direct sorting by cabin crew as they pass through the cabin. Already, 40 airlines worldwide have expressed interest in acquiring the trolley which is planned to be made available across the whole Airbus fleet. Trials began with a major European carrier in November 2018. The Retrolley is going through the certification process with the European Technical Standard Order (ETSO) under the authority of EASA. Meanwhile, the supplier is working closely with catering companies.

Targeting the perfect fit

Reducing GSE-induced damage to aircraft



Damage to aircraft doors and airframe sections caused by misaligned ground equipment costs the aviation industry billions of dollars every year. There is now a solution which significantly lowers damage risk, developed through a collaborative approach involving airlines, ground equipment manufacturers, ground handlers and service providers.

The proposal links reflective adhesive aircraft markings with camera-guided automated ground equipment to perform accurate docking. It is currently undergoing airline trials with a view to being adopted as an industry standard.

Article by

Diego ALONSO TABARES

Airport operations

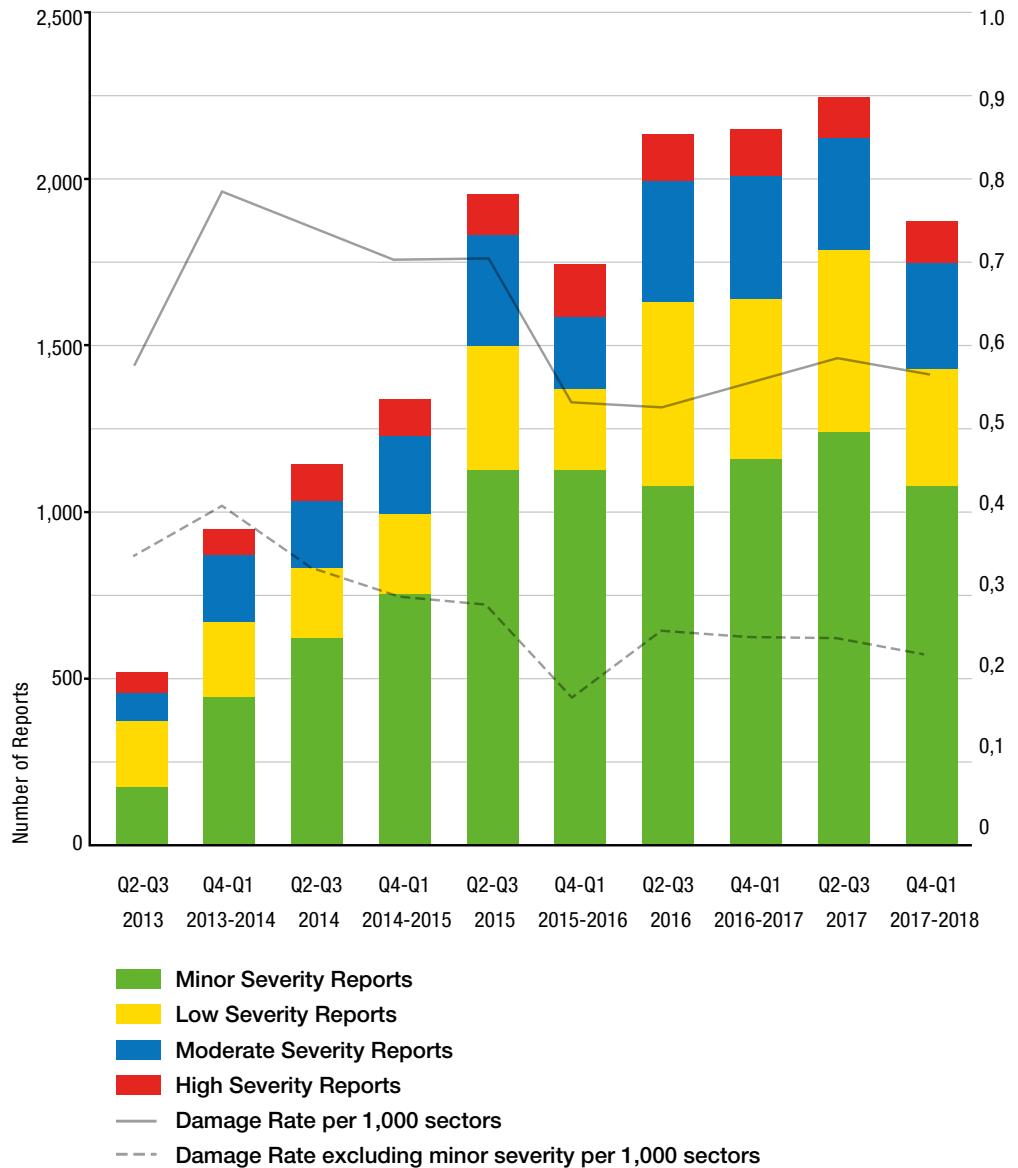
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All commercial aircraft experience ramp damage at some point during their in-service life. Airport equipment misalignment and distance misjudgement are a major issue for airlines, airport operators and ground handlers and are often compounded by time pressure and insufficient manpower on the apron.

IATA Ground Damage Database Damage Severity and Rates

Airport ground support equipment that docks to aircraft doors includes passenger boarding bridges; passenger stairs; catering and cleaning trucks; ambulifts; and cargo and belt loaders.



Over the years, attempts to establish a common set of aircraft door markings to accurately align Ground Support Equipment (GSE) have stalled in the absence of an industry consensus. Many airlines have attempted to create their own standards, only to see them incur paint-shop customisation costs then fail to gain recognition from ground service providers outside their home base.

The solution to tackle this problem comprises standardised door markings and automated GSE which can operate under human supervision. The process hinges on a set of aircraft-mounted reflective stickers that are detected by cameras mounted on the GSE, which then guide the equipment to a precise position flush with the aircraft door.

Airbus has qualified the reflective markings. They will be available for line-fit or retro-fit and can be applied to any 100-seat-plus aircraft type.

2D & 3D cameras

GSE is equipped with cameras that read the markings and verify the identification of the door in question, before calculating its position and distance from the aircraft.

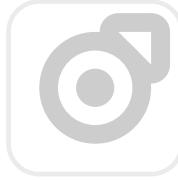


Cameras used for automated docking.

standard distance sensor

Door identification

The markings are based on combinations of 16 different patterns; each combination can be recognised as a specific Passenger, Cargo or Bulk door. (e.g. second passenger door on aircraft starboard)



How the reflective markings proposal works

Aircraft are fitted with two 19x19 cm adhesive markings around each door, as defined by the draft standard SAE AS 6896* ‘aircraft markings for ground support equipment alignment’. The marking pattern identifies the aircraft door and its position relative to the aircraft door. Markings are always at the same relative distance to the door sill and door edges regardless of aircraft type. The markings are highly reflective to ensure detectability and identification from a sufficiently large distance in all weather and operating conditions.

* SAE AS 6896 is a draft aerospace standard being written within the SAE AGE-3 committee (Society of Automotive Engineers, Aircraft Ground Equipment) together with IATA's GSEE group. All GSE stakeholders are involved, from airframers, GSE manufacturers and ground handlers to airports, camera and sensor manufacturers.



GSE is equipped with cameras that read the markings and verify the identification of the door in question, before calculating its position and distance from the aircraft. Once this is complete the GSE establishes the bearing to the door. When docked, the equipment can use the markings to follow any aircraft movements during loading and unloading and to maintain its position relative to the door.

Airbus began work on the solution in 2014 in conjunction with a wide network of partners. Several versions of the markings’ design were required before they were frozen in late 2017. The adhesive stickers are manufactured by Adhetec and the solution is future-proofed thanks to its ability to use several camera technologies including 2D and 3D time-of-flight cameras.

Both types of cameras emit light and receive a reflective feedback. 2D cameras use visible light and receive a 2D view, but can use aircraft door identity. 3D time-of-flight cameras use infrared light to generate a 3D shape of their environment where the ‘reflective stain’ can be located.

Benefits for aircraft operators

The greatest benefit of the standardised markings is the reduced risk of aircraft damage from ground equipment. Besides costly material damage and lengthy insurance settlements, incidents can cause delays and flight operations disruption.

The proposal supports a range of possible solutions from simple guidance to GSE operator to fully automated GSE docking, addressing the commonplace manpower shortages at airports around the world. Automation also leads to more predictable turnaround times, contributing to efficient ground operations that benefit airlines and airports alike. The solution can be retrofitted to existing equipment. A number of GSE manufacturers including Mallaghan, TLD and JBT have already expressed an interest in its standardisation and adoption.

Trials with airlines

The next step is to facilitate the adoption process. Every change in the ground handling environment is lengthy, but on the whole the stakeholders' attitude is positive and the collaborative work of the standardisation groups advocates for a collectively-agreed vision of the future of ground handling. Several airlines are already conducting trials of the adhesive sticker proposal.



Trialling the aircraft reflective markings proposal

easyJet began trialling the GSE marking proposal in partnership with stair manufacturer Mallaghan at Belfast airport in March 2018, using seven of its A319 aircraft and a prototype automated stair. Since its teams familiarised themselves with the markings and the alignment process, the results have been promising, says Dave Cross, until recently easyJet's ground operations quality and safety manager and trial supervisor.

Punctuality is the biggest casualty of GSE damage at easyJet. In 2017 the airline registered door damage on over 75% of its large A320 Family fleet. *"Even the minor damage caused by the majority of incidents requires callout and the input of an engineer,"* Cross says. *"At an outstation that could add two to three hours' unscheduled ground time."*

To reduce the damage risk, easyJet has increased its oversight of GSE maintenance, making sure the parts that interface with the aircraft fuselage are regularly inspected and maintained.

Even better, a standardised approach to door markings and GSE automation would bring big benefits, Cross insists. Yet, as ground operations are not a regulated environment, *"new ideas take a long time to embed."* easyJet's size and influence *"give us a better shot at helping to get the solution adopted"* with the backing of IATA and the SAE, he says. *"Anything that removes the risk of aircraft damage is to be welcomed. Once proven in operation, this solution is something easyJet would consider for line and retrofit,"* Cross concludes.

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British Airways is currently trialling Airbus' adhesive sticker solution for cargo loaders and is interested in its scalability to all GSE aircraft docking.

"Any aircraft that is damaged whilst on the ground almost inevitably results in delays and disruption for customers," says David Anderson, head of ground safety at the airline.

"In addition to the customer impact there is a very long list of associated direct and indirect costs, including the cost of repairs, hotel accommodation, repatriation, EU261 compensation, ferry flights, loss of goodwill and knock-on cancellations."

As technology improves so should British Airways' ability to reduce and then eliminate aircraft damage, Anderson stresses. *"IATA Aircraft Handling Manual Chapter 9 describes in simple terms what is required to be fitted to GSE to provide a minimum level of protection to the aircraft."*



"The standards are not new and there is evidence that some Ground Service Providers are starting to actively procure GSE that complies with these basic requirements," Anderson continues. Yet he says it is "disappointing" that non-modified GSE is still offered for sale by some suppliers.

Anderson notes that IATA has conducted studies to assess the cost of modifying GSE and is very clear that modification costs are "significantly lower" than the cost of damage. However with most of the cost of damage currently borne by the airlines, *"there can be little to incentivise some ground handlers to invest in the modifications that are commercially available to reduce the damage risk."*

And what of Airbus' involvement in standardisation efforts? *"Airbus has actively supported work to identify an interface between GSE and the aircraft and has worked closely with SAE* and IATA to design a target that will work with developing technology,"* Anderson says. *"The development of an SAE standard for target design should give the industry the confidence that any new or retrofit solution will be scalable."*

*Society of Automotive Engineers

Commenting on the GSE markings trial Anderson says: *"As an airline that has conducted some early trials, the chosen design is small enough to be unobtrusive and has the added benefit that it may allow some existing markings to be removed."*

Evidence would suggest that the GSE manufacturers are actively engaged in developing equipment that will interact with the targets. Some manufacturers are already trialling GSE with launch customers, whilst others are openly talking about how they will use the technology.

Due to its simplicity, the targets offer opportunities beyond positioning GSE with other obvious applications being passenger boarding bridge positioning or indeed any other equipment that engages with the aircraft."

CONCLUSION

A straightforward solution for accurate airport ground support equipment docking, developed by a wide network of airline and ground service partners and Airbus, is on track for standardisation and industry-wide adoption after successful operational trials.

Reflecting the collaborative spirit of its development, the proposal is not patented and is publicly available. It has worked its way through several proofs of concept in partnership with other airframers, airlines, ground services providers and camera and ground equipment manufacturers.

The proposal's introduction will significantly reduce the risk of damage at the ramp, lowering the financial exposure stakeholders face, and help address manpower shortages on the ground, thus enabling further automation around the aircraft. ■■■

Pilot training

Meeting the need for competent, qualified pilots



To help address the skills gap, harmonise training quality and meet demand for the estimated 540,000* new pilots needed worldwide over the next 20 years, Airbus has developed the Airbus Flight Training Reference, or AFTR, and is now introducing 'ab-initio' pilot training for beginners.

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*Airbus 2018 Global Services Forecast

An integrated complete programme, from beginner to qualified commercial airline pilot

Civil aviation faces the challenge of continuously improving flight training quality in a market expanding faster than cadets can be recruited. Reinforcing and improving flying skills and building airmanship is paramount for continued safe operation of commercial aircraft.

To facilitate the development of competent, operationally-ready flight crew, the Airbus Flight Training Reference (AFTR) provides a standard. It is based on the pillars of quality, safety and competency. Company flight training experts meet frequently with regulators, airworthiness authorities, industry groups and airlines to develop pragmatic operational concepts that enable harmonised, cost-effective and rigorous global standards.

Notably, the AFTR has led to the introduction of specific reinforcement training modules aimed at reinforcing basic skills such as instrument rating or multi-engine aircraft exposure. This allows cadets to start Phase III (JOC/MCC) of their flight training at the same level as their peers and meets the required levels set by the AFTR.

This is an ‘ab-initio’ programme that incorporates the AFTR to apply its high standards from the very beginning

The Airbus Flight Training Reference

The AFTR has four goals:

- To raise quality in flight training worldwide
- To harmonise the huge diversity of training standards amongst worldwide authorities
- To ensure pilot competency
- To contribute to higher safety levels

Now in a further step, Airbus is introducing the Airbus Pilot Cadet Training Programme. This is an ‘ab-initio’ programme incorporating the AFTR to apply its high standards from the very beginning. The programme is operated in partnership with strategically-identified flight schools.

The traditional training path to becoming a pilot comprises different phases (see graphic 1). Airbus is expanding its Competency-Based Training and Assessment (CBTA – see box overleaf) method to cover the entire path, for the first time incorporating CBTA into the screening and selection process.

Phase 1 Initial (Basic) Training	Phase 2 Initial (Basic) Training	Phase 3 Intermediate Training	Phase 4 Advanced Training	Phase 5 Ops Courses
PPL	CPL/IR/ME	JOC/MCC	Type Rating	LIFUS +Ops
Private Pilot Licence	Commercial Pilot Licence/ Instrument Rating/ Multi-Engine	Jet Orientation Course/ Multi Crew Cooperation		

| Graphic 1



Launched in mid-2018, the ab-initio scheme, known as the Airbus Pilot Cadet Training Programme, is based on EASA international regulations, with the initial phase being developed in partnership with ENAC, a leading French aeronautics and aviation university. It was certified by the EASA in December 2018.

Its AFTR-based curriculum is an integrated A320 Family commercial pilot programme that is optimised for airlines. The primary target is naturally focused on ensuring the safe flight of our aircraft via the high training standards we employ. The scheme's stringent entry requirements and assessment levels guarantee an optimised selection level to ensure the selected candidates are considered capable of completing the course and therefore remove cadet 'fallout' and precious 'seats' among the training chain.

The programme prioritises the development and assessment of fundamental pilot competencies to better prepare a smooth transition from the training to the operational environment. This helps students acquire the knowledge, skills and attitude they need to become a skilled pilot.

The programme was launched in conjunction with the Escuela de Aviación Mexico (EAM) flight school, located close to Airbus' training centre in Mexico City. Participating flight schools are selected according to their ability to meet the standards set by the AFTR; the shared vision of the quality of their training; and their capacity to meet the volumes required to support the ab-initio scheme and operators' requirements.

Like EAM, once audited and selected, participating flight schools and their instructors will be standardised to the Airbus Pilot Cadet Training Programme operating under Airbus' supervision. The first batch of cadets began training at EAM in January 2019. A second flight school, located in South-West France (Angoulême), will join the programme in the spring of 2019.

What is Type Rating?

A type rating is a regulatory agency's (EASA or FAA, for example) certification of a pilot to fly a certain aircraft type that requires additional training beyond the scope of the initial license.

Many commercial pilots have multiple type ratings, allowing them to operate several types with minimal transition training. This presents time and cost advantages to airlines.

What is Competency-Based Training & Assessment (CBTA)?

CBTA is a training concept that focuses on the development of the eight core competencies considered necessary to becoming a skilful pilot on commercial aircraft. The training programme is completely adapted to the acquisition of these skills, via continual assessment and competency-based grading throughout the course.



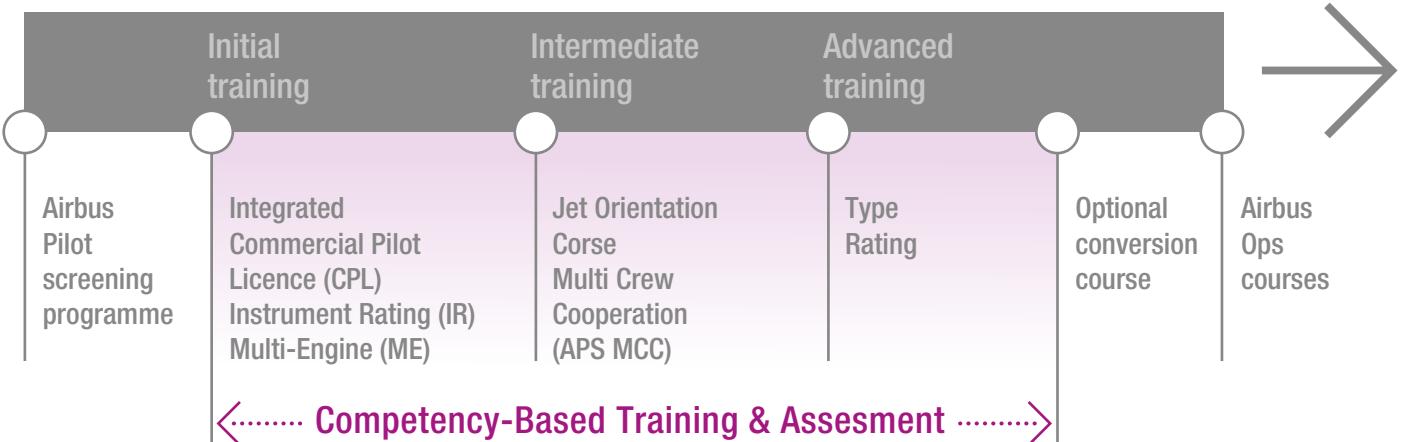
Obtaining an Integrated Airline Transport Pilot Licence

Cadets will receive over 750 hours of theoretical training and 200 hours of practical training during the 20-month ab-initio course. Candidates must be at least 18 years old and in possession of a High School diploma including mathematics, with a proficient level of English.

After clearing the rigorous selection process created by Airbus and jointly reviewed with the flight school, students complete the initial training: an integrated Commercial Pilot Licence, Instrument Rating and Multi-Engine programme (CPL/IR/ME). They then become eligible to train as A320 Family pilots and frozen* Airline Transport Pilot Licence (ATPL) holders at an Airbus Training Centre. This sequenced process presents airlines with the benefit of recruiting operationally-ready pilots trained to harmonised standards.

* A frozen ATPL refers to a Commercial Pilot Licence (CPL) holder who has passed all the ATP theoretical exams. However, they can only pass the ATPL practical exam to unfreeze their ATP licence once they have logged 1500 flight hours on multi pilot aircraft.

Integrated Airline Transport Pilot Licence (ATPL)



Cadets demonstrating an exceptional level of learning and competency, combined with a pre-disposition for teaching and decision-making observed during their Private Pilot Licence (PPL) phase, may be selected for the Airbus High Potential Pilot Cadet training programme. This incorporates pilot, instructor and captaincy training with a view to following an optimised career path.

The Competency-Based Training & Assessment (CBTA) programme ensures successful applicants have the aptitude to acquire the eight ICAO industry-endorsed core piloting competencies:

- Aircraft flight path management – automation
- Aircraft flight path management – manual control
- Application of procedures
- Communication
- Leadership & teamwork
- Problem-solving & decision-making
- Situational awareness
- Workload management

540 000* new pilots needed over the next 20 years



North America
69,000



Europe
94,000



Latin America
53,000



Africa
25,000

*Airbus 2018 Global Services Forecast

Benefits for airlines:

A competent and efficient pilot pool

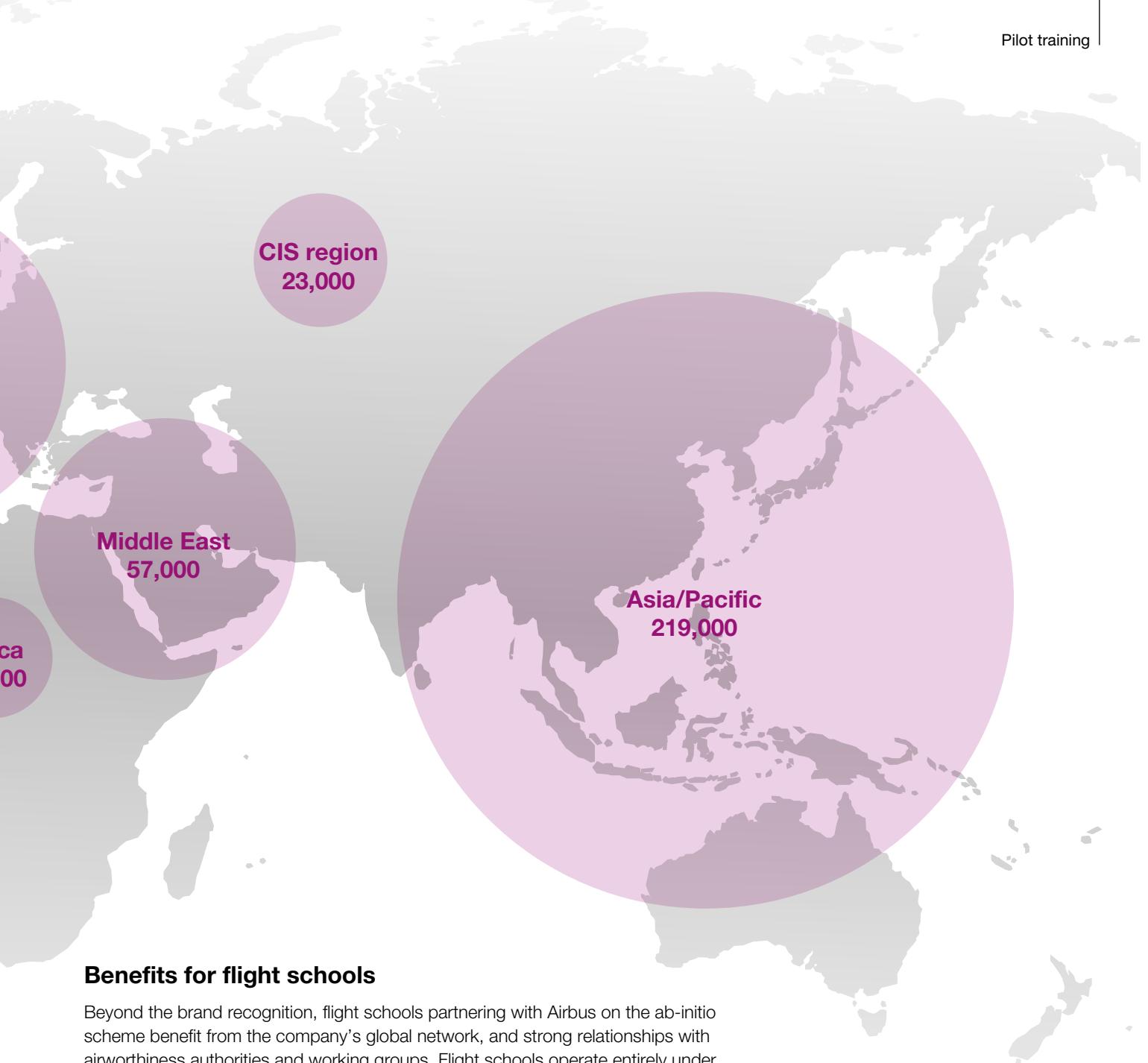
Airlines will see more globally-operational pilots, as students qualifying from the training programme will be able to convert their licence from validity in the country of acquisition to an alternative licence. The programme incorporates the latest safety recommendations and follows the most recent Airbus technical evolutions, thanks to design office and flight test data that is fed back into the course.

The scheme purposefully involves the selected flying schools from the very start to ensure the fundamentals of safe flight are instilled and maintained from end to end. Ultimately, competent and efficient pilots contribute to increased safety levels and indirectly to reduced airline operational costs.

Benefits for students

Strict selection means that students accepted for the ab-initio training are likely to make it through to qualification and a return on their investment. The ab-initio programme can be followed in any location within Airbus' worldwide training network once in place, subject to visa regimes and local approval. Aircraft approved for use as part of the scheme include modern, classic and glass-cockpit fleets.

The aim of the AFTR has been to create a standard of quality in flight training that is a worldwide reference. The ultimate goals of Airbus are that this reference is recognised and recommended by authorities such as EASA or the FAA, but more practically, that pilots are trained with the Airbus Training Reference to reach the same flight training level of competencies and proficiency. This standard is now Airbus' reference for working with any training organisation – and is paving the way for delivering a worldwide high quality training programme leading to the continued safe operation of Airbus aircraft.



Benefits for flight schools

Beyond the brand recognition, flight schools partnering with Airbus on the ab-initio scheme benefit from the company's global network, and strong relationships with airworthiness authorities and working groups. Flight schools operate entirely under the Airbus Approved Training Organisation's responsibility, whereby Airbus provides all training manuals, documentation and training programmes, operations processes, and instructor and flight school standardisation. This provides significant cost savings for the flight schools who no longer have to carry out course development in particular. Through Airbus, the course is kept up to date in line with the latest fleet, safety and industry standards.

CONCLUSION

Airlines and future pilots alike will benefit from the Airbus Flight Training Reference and ab-initio cadet training programme, which emphasise and reinforce the safety culture. Quickly establishing an operationally-ready pool of pilots qualified to the latest, harmonised highest standards is an important step towards addressing the pilot shortage and reinforcing basic skills. ■



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Flying the A220

Design features and airline feedback



Following the partnership between Airbus and Bombardier and subsequent arrival of the A220 into the Airbus family, FAST takes a look at the design, innovations and operational strengths that are the hallmarks of the A220-100 and -300 aircraft and speaks to two operators about their experience.



Interview with

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Aligning to a specific market segment

The decision to design and build what became the C Series and then the A220 Family started with a reflection on what potential customers seemed to need. Nobody was offering a new aircraft with between 100 and 150 seats. Airbus and Boeing focused on larger aircraft while Bombardier and their closest rivals targeted the “below 100-seat” segment. It was clear that many airlines would be keen to operate a state-of-the-art, comfortable, fuel-efficient aircraft dedicated to the passenger range between these two segments.

In fact, the predicted market for new aircraft aimed specifically at the 100-150 seat segment is currently estimated to be around 7,000 aircraft over the next two decades, half as replacements for ageing fleets and half to keep pace with growth.

Determination to manufacture an aircraft which would meet the particular needs of operators’ routes and passenger numbers informed every stage of the design process.

Comfort counts

Another key goal was to design aircraft suitable for a travelling public that is growing in stature as well as in number. The fact that people are larger than before and growing was taken into account. Rob Dewar, responsible for the development of the A220 Family, explained: *“Aircraft designers have always set out to reduce drag and weight and so on but we added passenger comfort to that list at the earliest stages”*.

Addressing the fact that the average person is around 12 kilos heavier than 25 years ago had a direct impact on the width of the fuselage and the consequent ability to offer the widest economy seats.

With the wider cabin comes larger luggage bins. Again, these are ideal for today’s travellers who prefer to take their belongings into the cabin on short-haul flights.

‘Cabin-only’ luggage also facilitates the fast turnarounds that are of great importance to airlines operating on tight schedules and fine margins.

There is even a bonus feature of the wider cabin that is primarily about the ‘feel’ rather than specific measurements. The overall impression of space that is created by increased shoulder and head-room, and the wider seats, creates the perception that there is also increased pitch compared to competitors. *“Airlines tell us that their customers often comment on the extra legroom even though the pitch actually remains standard,”* says Dewar. *“That tells us something about the psychological effect of an overall feeling of comfort and a seat that fits your proportions.”*

Delivering on costs

Much of the technological innovation in the A220 targets the operating costs.

The aircraft’s fuel burn figures are a particular strength, amounting to 20% per seat compared to previous generations in the segment.

Around one third of these fuel burn gains come from the lightweight structures and advanced systems. Extensive use was made of advanced aluminium for the main fuselage with Carbon Fibre Reinforced Plastic (CFRP), selected for construction of the wing, nacelle and aft fuselage. Developed alongside pilot, the cockpit includes sidesticks for intuitive flying, LCD displays, integrated flight management systems, an electronic checklist and head-up displays.

The Pratt & Whitney geared turbofan engines account for approximately two thirds of the overall fuel-burn reduction. They share a lot of common architecture with the A320neo Family engines but have a smaller, 73-inch fan. *“As is usually the case there was work to be done on the maturity of a brand new, highly advanced powerplant but they’re now in service and performance and reliability are both good,”* says Dewar.

The cockpit was developed alongside pilots. It includes sidesticks for intuitive flying, LCD displays, integrated flight management systems, an electronic checklist and head-up displays.

Designed for short and long-haul – and a challenging airport

Choosing to concentrate on one airport in particular might seem unusual, but knowing that launch operator SWISS was planning to fly out of London City offered the designers a challenge that became a strength. *"It's a difficult airport because the runway is short and the surrounding environment means that a steep approach and take-off are required,"* Dewar explains. *"SWISS had been restricted to 100-seat aircraft because of this but the A220 has allowed it to increase its capacity while using the same slots at the same airport."* The same advanced technology means that 99% of the world's airports are accessible to the A220 Family.

SWISS is using its A220s on short routes that involve completing seven or eight legs every day. The A220-100 deals with short fields and steep approaches while the A220-300 offers additional seats and further cost per seat reductions.

In a contrasting approach airBaltic is capitalising on the A220's ability to go long-haul – up to 3,200 nautical miles. The Latvian carrier is using A220-300s on six to seven hour flights, including a new route from Riga to Abu Dhabi. The aircraft is at the centre of its growth strategy and was re-ordered only a year after its first -300 entered commercial service.





Head-Up Display



A220: the airlines' view

Peter KOCH SWISS' A220 Fleet Chief, explains the airline's experience of operating the A220:

→ **Have you had feedback on comfort levels from passengers? Are there any features of the cabin that seem particularly popular?**

The feedback from our passengers is very positive. They mostly appreciate the welcoming, bright cabin, the comfortable seats and the large windows as well as the fact that there is more space in the overhead bins and ample legroom.

Also our cabin crews are pleased with the A220s. For example, they appreciate the spacious overhead bins and the ergonomic galleys. Last but not least, they benefit from the positive perception of the customers and their appreciation of the state-of-the-art aircraft.

→ **How do your pilots find the cockpit and systems?**

They have a lot of praise for the new aircraft. They are particularly impressed with how intuitive it is to fly and the perfect situational awareness provided by the large displays and the head-up displays.

→ **How do you use your A220s? Are they particularly suited to these routes and airports; if so, why?**

They offer a high degree of flexibility when it comes to our flight operations. With this aircraft, we're able to operate on longer routes, such as Moscow, Cairo or Hurghada, as well as at operationally challenging airports with short and narrow runways and complex approaches, such as London City and Florence. At the same time, the A220 is an all-rounder that can be used for all our other short- and medium-haul destinations. From and to London City, the A220 allows us to transport more passengers than with any other aircraft. The A220-100 is currently the biggest aircraft flying into LCY which means we can offer more seats on this important route with the same amount of flights.

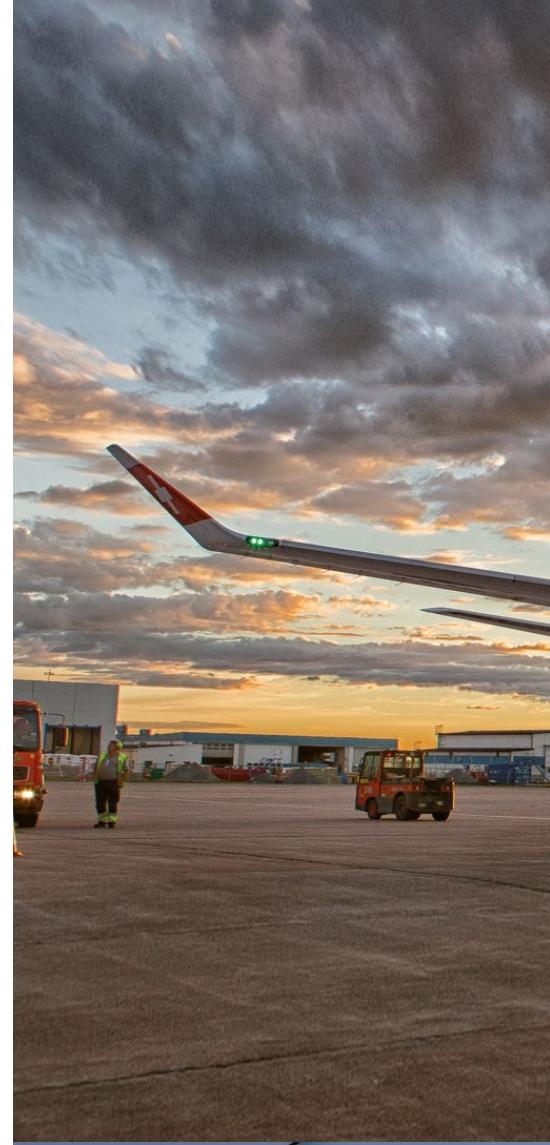
→ **Are your aircraft delivering on performance and operating cost promises?**

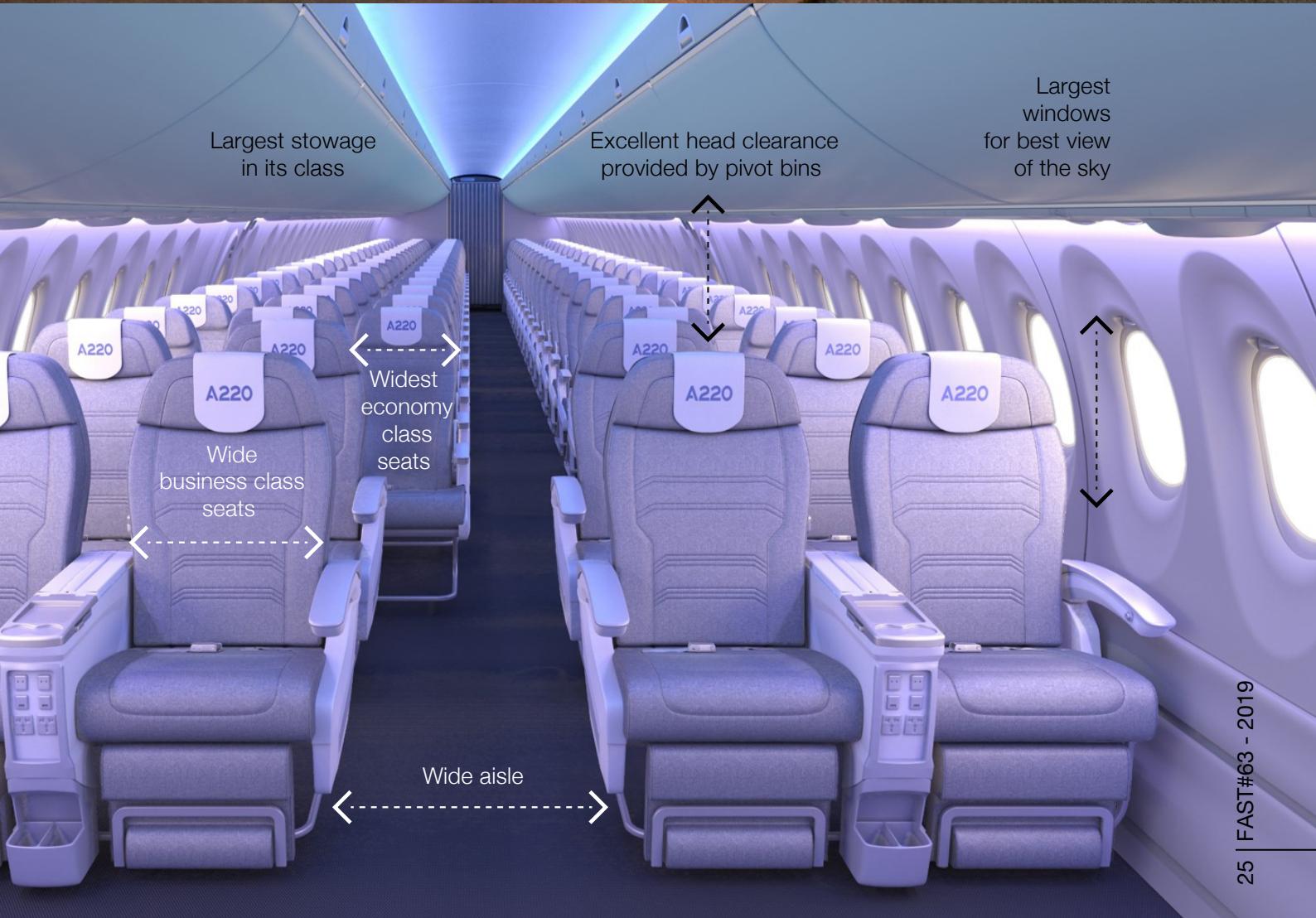
The technical reliability lies in the nineties, which is a good value for a newly designed aircraft. Swiss and Airbus A220 teams continue to work together to continuously mature the aircraft in order to reach a comparable value with the other aircraft in the SWISS fleet.

Overall, the new aircraft helped to decrease our unit costs. Thanks to the A220, costs can be reduced by 25% per seat in comparison with the Avro RJ100 through lower maintenance costs and more fuel-efficient engines. We are pleased to report that certain performance parameters such as fuel consumption and range have proven substantially better than agreed. The fuel consumption is 20-25% lower compared with the Avro RJ100. It is also quieter than comparable aircraft types which is very important for densely populated areas.

→ **Overall, how would you describe your experience of operating A220s so far?**

All in all, SWISS is satisfied with the performance of the A220. With the state-of-the-art technologies that it incorporates, and with its engines, systems and construction materials, the A220 sets new benchmarks in terms of both its operating economics and its environmental credentials.







Right sized for 100-150 seats

Latest generation engines

State-of-the-art aerodynamics



20%

lower fuel burn & CO₂ emissions

18*

EPNdB margin to chapter 4

NOx emissions

50%

below CAEP/6

airBaltic's SVP Technical Operations, Andris VAIVODS also shared his view on how their new aircraft have started working life:

→ **How have your crew found working in the A220 cabin?**

The Airbus A220-300 is the most modern aircraft of its size. Our crew are satisfied about being able to fly on the aircraft on a daily basis. Its new features make the duties more convenient and a true pleasure.

→ **How do your pilots find the cockpit and systems?**

Feedback from the pilots has been very good – they feel that the cockpit has been designed 'by pilots for pilots' as their wishes and needs have been met. The latest avionics and other technologies on the Airbus A220-300 ease the daily duties of airBaltic teams significantly.

→ **How do you use your A220s? Are they particularly suited to these routes and airports; if so, why?**

The Airbus A220-300 provides both greater capacity and longer range than our current fleet. Because of that, the aircraft operates on such popular routes as Amsterdam, Barcelona, Budapest, Rome, Moscow, Nice, London, Paris, Vienna, Athens, Madrid and many others. Notably, the longer range of the aircraft has enabled airBaltic to launch direct flights to destinations such as Abu Dhabi, Almaty, Malaga and Lisbon.

→ **Are your aircraft delivering on performance and operating cost promises?**

The aircraft has performed beyond our expectations, delivering better overall performance, fuel efficiency and convenience for both staff and the passengers. The fuel economy has reached 22% and in 2018, the regularity of Airbus A220-300 flights reached 99.76%. Notably, Airbus A220-300 provides very high utilisation rates. Our aircraft have flown up to 18 block hours per day.

→ **Have you had feedback on comfort levels from passengers? Are there any features of the cabin that seem particularly popular?**

Already, every third airBaltic passenger enjoys the higher comfort level provided by the Airbus A220-300 fleet. It offers an excellent flying experience with benefits such as wider seats, larger windows, more hand luggage space, and improved lavatories. The feedback we receive from passengers is overwhelmingly positive. If we look at revenue data, we see that advanced seat reservation is especially popular on the Airbus A220-300. With the larger windows, window seats are the most popular selection among passengers.

Over the summer we also launched an improved cabin with new, comfortable seats on our Airbus A220-300 aircraft. Passengers now benefit from such additional improvements as more legroom, new pockets behind the seats for magazines, as well as hangers next to the seat for jackets.

→ **Are the health monitoring/predictive maintenance systems proving useful?**

The most notable benefits we've seen from proactive maintenance are reduced maintenance costs, increased reliability, decreased number of flight delays and airplane downtime for troubleshooting, as well as continued improvement of our punctuality and regularity rates.

To prepare for the proactive maintenance capabilities, airBaltic maintenance staff took an Aircraft Health Monitoring System course. In addition, duties for some positions within our company were adjusted to monitor maintenance data coming from the fleet and the company IT system was set up to route and store the relevant data.

Once the aircraft lands, all the maintenance data is automatically off-loaded to company servers. To find the desired report, you only need to access the server. Manual download is also possible by writing the maintenance report to a USB stick or printing out smaller reports on a cockpit printer. The data is analysed by our reliability engineers who keep a close eye on it.

All of the engineers have access to the data. After analysis it is discussed during periodic engineering meetings where decisions on preventive actions are made. Most critical data affecting airplane dispatchability is delivered to maintenance and engineering staff while the aircraft is in flight, before it has landed. So, once the airplane reaches the gate, the maintenance team has everything in place to rectify any sudden problem. This results in minimum effect on flight schedules.

→ **Overall, how would you describe your experience of operating A220s so far?**

The introduction of Airbus A220-300 has been very successful and provided the additional efficiency any airline is seeking in the highly competitive aviation market. Thanks to the good overall performance, airBaltic took a decision to introduce a single type fleet that will consist of up to 80 Airbus A220-300 aircraft.

A220 Family - the story so far

In-service status

- 90,000+ revenue flights, 120,000+ flight hours
- 170+ routes (130+ destinations)
- 7,000,000+ passengers (estimation assuming 80% load factor)
- 18+ hours daily utilisation, up to 13 legs per day

Orders and deliveries

- 536 orders from 19 customers
- 60 deliveries to 5 operators (SWISS, airBaltic, Korean Air, Delta Air Lines, Air Tanzania)
- 476 in backlog as of February 2019



Family commonality and differences

Commonality is very high between the A220-100 and the A220-300, above 99 %. This allows a common spare inventory which reduces investment and maintenance costs as well as training costs for mechanics and crew.

Nevertheless, the aircraft are neither stretches nor shrinks of each other and there are some important technical differences between the siblings:

- The nose landing gear is common for both the -100 and -300, and the main landing gear for the -300 has been slightly reinforced due to the aircraft's higher weight.
- The -300 brake stack assembly has one additional pair of stator/rotator assemblies compared to the -100's three.
- The wing and the centre wing box have been structurally reinforced to carry the load increase.
- The centre fuselage for the -300 is 3.4 m longer and was also structurally reinforced to carry the higher loads.
- Environmental control systems are identical except for an additional bleed leak detection sensing element to accommodate fuselage length differences.

Designed together for the highest commonality



**>99% LRU
Commonality**



Common Spares



Common Structures
& Systems



System optimization
for A220-300



	A220-100	A220-300
Range	5,460 km	5,920 km
Typical seating	116	141
Overall length	35.0 m	38.7 m

Future developments

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The A220-300 has achieved 180-minute ETOPS (extended range, twin-engined operation) approval, from the Canadian authorities with FAA and EASA to follow, which makes it unique in its class. Although the approval is actually based on the distance from a diversion airport, over land or sea, when one engine fails, ETOPS allows the aircraft to cross large expanses of ocean so routes such as New York to London and Seoul to Darwin are now possible.

Also now certified is the addition of Category 3B auto-landing which provides for safe landing in zero-visibility conditions as long as the airport is also equipped to the required standard. *"These developments are both extremely useful to many existing and potential customers but they are just part of an on-going strategy of constant improvement and innovation,"* says Dewar. *"We're also looking at adding more seats, improving the flight deck, and further performance enhancements."*

CONCLUSION

Although the A220 Family has many of the advanced technologies that are associated with larger aircraft, they were incorporated with the customers and passengers of the 100-150 seat segment firmly in mind. This methodical 'designing-in' played a key role in the creation of two aircraft that complement the wider Airbus Family. ■■■

Data management

What big data is doing for aviation

The rise of 'big data' and data analytics has been acknowledged throughout the business world for some time. With its Skywise data-sharing platform, Airbus is working with customers and suppliers to use the aviation industry's data more effectively than ever before. It is a collaborative approach designed to benefit everyone involved.



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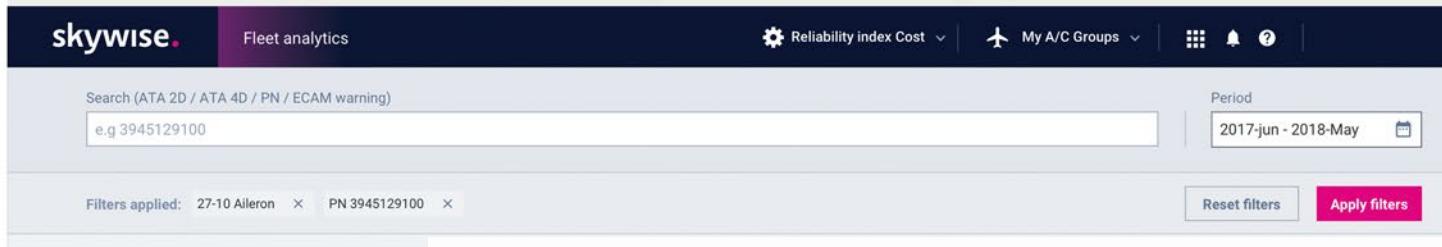
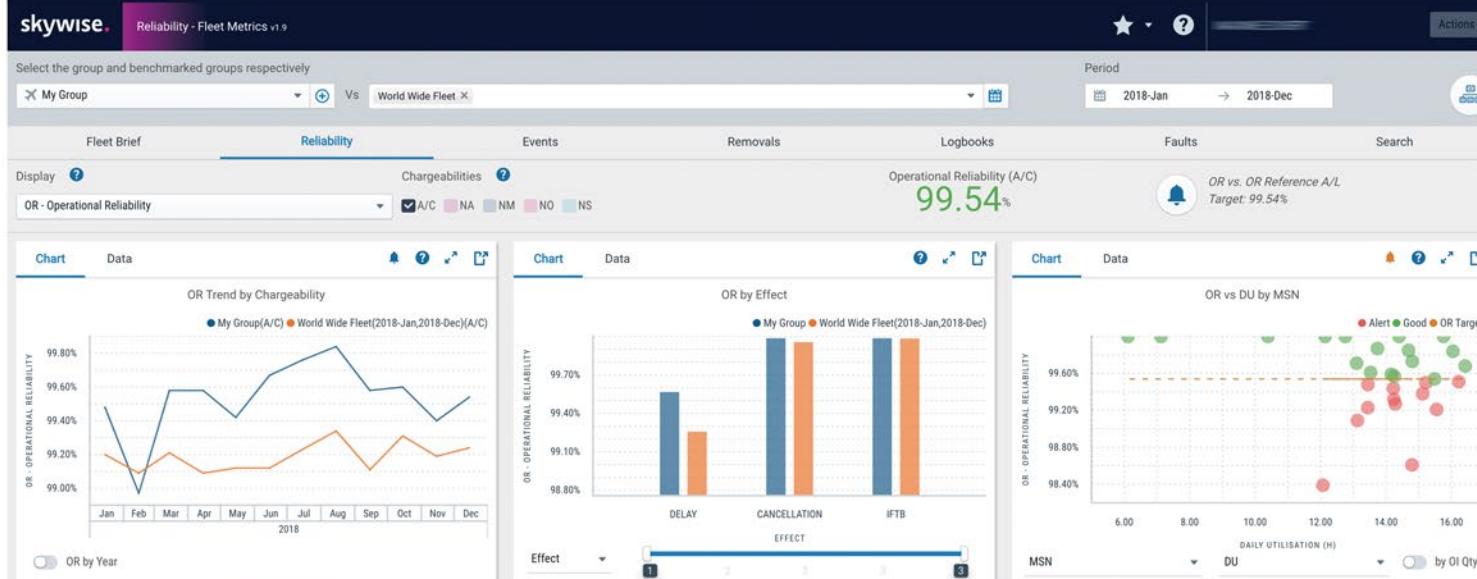
The birth of big data – and the challenge for aviation

The analysis of big data did not originate in the aviation industry. It grew out of the rapid boom in on-line, consumer-oriented businesses and social media platforms. The companies involved realised that, thanks to the billions of interactions taking place, algorithms could be used to analyse and predict patterns of behaviour.

Airbus, like all aircraft manufacturers, has always recorded data meticulously for safety reasons and made use of it to refine its products. A single A320 can generate up to 24,000 parameters of data, adding up to ten gigabytes, every flight hour. However, data around the aircraft was traditionally recorded using a variety of means ranging from binary coding through numerical systems to photographs and video footage. Also, the number of aircraft and flights in the global fleet is far smaller than the billions of internet users worldwide so the total volume of data available is not on the scale available to leading consumer and social media brands. That makes reliable analysis through algorithms alone much more difficult.

A further complication in making data work for aviation lies in the unique nature of every aircraft. As well as having cabin and engineering differences according to the requirements of customers, every aircraft builds a specific history over time with lengths of trips, number of legs in a day, weather and passenger numbers varying according to how, where and when it is operated. Without expert understanding, much of this data can prove to be irrelevant or, worse still, misleading.





Collecting and securing data with Skywise

The first key requirement for Skywise to be successful is an extensive data pool that is harmonised to make it accessible to analytics which run across all of the inputs. To build that, Airbus worked with well-established partners to make a secure system that includes operating data from participating airlines, flight test campaigns, fleet data, and the original design processes and in-service updates. To make data taken from so many different sources into a homogenous whole which can be analysed, a standardisation process takes place. This doesn't mean that any data is deleted or altered, it is simply transferred into a standardised format so comparisons can be made and patterns spotted.

As well as its previously exclusive access to flight test and design data, Airbus also adds its expertise in aeronautical engineering. It uses a team of over 20,000 highly qualified aviation professionals to ensure that when analysis takes place it is based on the data that matters most and that the results are properly understood before anyone draws conclusions.

Who owns the Skywise data?

Attitudes to data ownership vary around the world with some cultures embracing data-sharing as being central to innovation that will benefit all, while others see data as something to guard and protect.

The Skywise approach is designed to suit both views. It starts from the premise that data only has real value once it can be used effectively, therefore sharing will be of greater benefit as participation widens. Nevertheless, all data remains under the control of the entities that join Skywise and in the 'big picture' that they can see and analyse, everything except their own data is anonymous to them. It is also possible to leave Skywise and withdraw own data although the trend is for users to appreciate the benefits and actually add more data over time.

Put simply, the original contributor of any data put into Skywise maintains control over that data.

What are the practical benefits of Skywise?

For airlines...

After the pooling and harmonisation of data, airlines can monitor the performance and health of their aircraft much more accurately. This allows much more effective planning of routine maintenance and a more rapid response to any issues which do occur. One of the 60 airlines using the core version of Skywise which is available to all Airbus customers reported a 50% drop in maintenance-related delays. There are also proven fuel burn savings and other efficiency benefits while almost any data-heavy task is made far easier. For example, a typical Reliability Report used to take around three weeks to complete but Skywise users are now compiling them in a matter of minutes with a single click. With the data-gathering side of the task already taken care of, airlines can move straight to analysis and action.

Other benefits have varied according to the focus of individual airlines but a few practical examples confirm that using Skywise core makes real operational differences.

- LATAM reduced the fraction of mechanical issues leading to delays from 24% to 15% by identifying repeated issues, anticipating occurrences, and taking preventive action.
- Bangkok Airways reported that joining Skywise core resulted in on-time performance increasing significantly in 2018.
- Japan Airlines said that the time spent on collecting data decreased dramatically, saving hundreds of hours while giving more time to engineers to perform analysis. This led to higher aircraft reliability.
- At AirAsia Group, users leveraged Skywise to create dynamic CG (centre of gravity) targets that consider all fuel-impacting parameters leading to reduced fuel penalties and significant financial savings.

Ten of the 60 participating airlines are also using the paid-for predictive maintenance service which is working towards the target of zero aircraft on ground. The plateau devoted to this is staffed by a mixture of data scientists and engineers, a combination that is leading to some creative solutions.



Air Arabia started using Skywise Predictive Maintenance on its fleet of 60 A320 Family aircraft in early December of 2018. FAST asked Allan FULLILOVE, the airline's Head of Engineering, how things were going so far.

“Skywise Predictive Maintenance is simple to use and projects data in an easily digestible manner. The display graphs allow swift interpretation of data and that allows quick, easy decision-making.

Integration was easy to us as we assembled a group of engineering specialists who had previously undertaken investigation-based tasks. They have started looking at historical data to assess reliability and they're now applying forward-looking analytics which means predictive data with Skywise Predictive Maintenance.

We work differently now by adapting our processes from the traditional reactive approach to a more strategic approach based on planning to create a better operational protection envelope.

We are more forward looking and, as we accumulate experience moving from reacting to defects, which tends to mean unscheduled maintenance, we're moving to a more scheduled workload.

We have had a few good results on Skywise Predictive Maintenance that have prevented delays, and as the product matures we expect to see more.

As a low-cost operator, we wish to achieve the highest operational use of the aircraft. Changing unscheduled reactions to a positive scheduled planning will create the necessary benefits to maintain this. Skywise Predictive Maintenance is therefore considered another vital tool to achieve this goal.

The ability to look at an aircraft's technical performance at component or system level performance and to then plan and execute corrective actions at scheduled opportunities can only bring greater value and savings. And this is all done from an engineering desk away from the aircraft.

Over the last 30 years maintenance activities have seen little change with each operator sharing more or less the same focus on reaction-based solutions. Now, much needed change is fast becoming a reality through projects such as Skywise Predictive Maintenance. The use of big data to effect this is now very real. For us, this is a very positive step in the right direction.

”

For Airbus...

One simple benefit is that Skywise helps Airbus to build better products. The larger volume of data, including operating data from airlines, means that the monitoring and analysis of fleet performance are more accurate than ever before, thus enabling preventive and corrective measures.

The best example of this is the entry into service of the A350 XWB which rapidly achieved high levels of maturity at the same time as the programme was engaged in a steep ramp-up. Once the first delivery was made, information gathered from the flight test campaign and design office was joined by a continuous flow of in-service data from early customers. This allowed root cause analysis of issues, and potential issues, which were then addressed rapidly meaning that subsequent aircraft benefited more quickly than ever before.

Another crucial benefit for Airbus is the ability to respond to customer requests for bespoke solutions much more quickly than before. The old response cycle involved launching development if customers expressed an interest in a particular area. By the time development and certification were complete 18 months had usually passed, which meant that the solution might no longer be needed or the need had become less urgent. There is now a library of previously developed and certified 'blocks' of digital services and these can be combined into a solution that directly and quickly addresses the customer's need.

Skywise now usually offers digital solutions within a few weeks of customer requests. That is a far better fit with the aspirations of a customer focused company and with its customers' expectations.

For suppliers...

Skywise for Suppliers is in the early adopters phase which is dedicated to defining, developing and testing the platform functionalities that will serve to make a step change between Airbus and its partners and suppliers. There are already 15 early adopter suppliers in the platform.

Skywise aims to serve as a single access point for Airbus and suppliers to share relevant diverse data, to perform powerful data analytics, and to allow more informed decisions. This should bring significant improvements in aircraft performance and operational excellence.

The overall goal is to implement the concept of the extended enterprise, enhancing cooperation between Airbus and its suppliers.

In the area of industrial performance, for example, some participating suppliers have moved from taking a few days to a few minutes when identifying candidates to swap sections in the production line. This has enabled them to keep to delivery dates. In other cases, finding and sharing the root causes of quality problems has been improved from taking weeks to taking just days.

In the area of in-service, Skywise is in the experimentation phase and striving to define a way to speed up the root cause analysis of in-service issues in cooperation with suppliers. Thanks to data sharing and analysis through Skywise, real progress looks possible in areas such as Aircraft on Ground, Major In-Service Problems, No Fault Found, and more. Preliminary results are promising, with a double-digit percentage reduction in time. Data governance, data anonymisation, data ontology and setting up a scalable solution are some of the most important activities in this area.

CONCLUSION

Although there is still plenty of room for Skywise to grow, it is already proving its value in practice for operators and for Airbus and suppliers. They will soon be joined by additional suppliers and other aviation industry stakeholders. As momentum gathers, the volume of data will increase and further possibilities will open up. The mutual benefits generated by sharing data are becoming increasingly apparent. ■



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FANS C

Latest technology for air traffic management

FANS C is the latest datalink technology for communication between air traffic control and aircraft, developed by Airbus. It brings major benefits both for air traffic management at a time when delays are growing, and for airlines thanks to its 4D trajectory (see box) management potential. It is now being used in a major in-service demonstration with airlines to confirm how beneficial it could be.



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What is FANS?

The Future Air Navigation System (FANS) concept originated from ICAO. Its aim was to provide a data link between aircraft and the air traffic control services that organise the flow of aircraft to and from airports.

In all areas, FANS replaces voice contact between ATM and pilots with a text-based system which is similar to sending and receiving SMS messages. This proves particularly useful in circumstances where voice signals could be unclear by avoiding any confusion and the need to repeat instructions and requests. The use of digital communication also opens the door to advanced system automation, both in the cockpit and ground systems, which permits significant workload reduction for flight crew and controllers.

There are currently two technologies, FANS 1/A and ATN B1, which are already widespread, and even mandatory in many geographical areas. B2 is the new emerging technology that will support introduction of new ATM techniques and gradually replace other technologies.

FANS 1/A technology was designed to cover oceanic and remote areas where no radar coverage exists. It is mandatory for airlines flying North Atlantic routes. Since then, it has also been deployed in other areas, including domestic North American airspaces. In these areas, Airbus has been offering its **FANS A+** (originally FANS A) solution.

ATN B1 technology was designed for domestic flights within Europe where radar coverage was already present. Again, it is mandatory for airlines operating in this area and Airbus has been offering its **FANS B+** solution.

B2 technology was designed to cover all existing operations, including FANS 1/A and ATN B1, and to address emerging operations being explored as part of ATM renovation programmes, such as SESAR in Europe or NextGen in US.

FANS C, the latest Airbus datalink version, introduces B2 for the very first time on any airframe, while combining all of the features of FANS A+ and FANS B+ in a single, harmonised product. FANS C provides the airlines with continued worldwide datalink operations and opens up the possibility of 4D trajectory planning that includes time as an extra dimension.

What is a 4D trajectory?

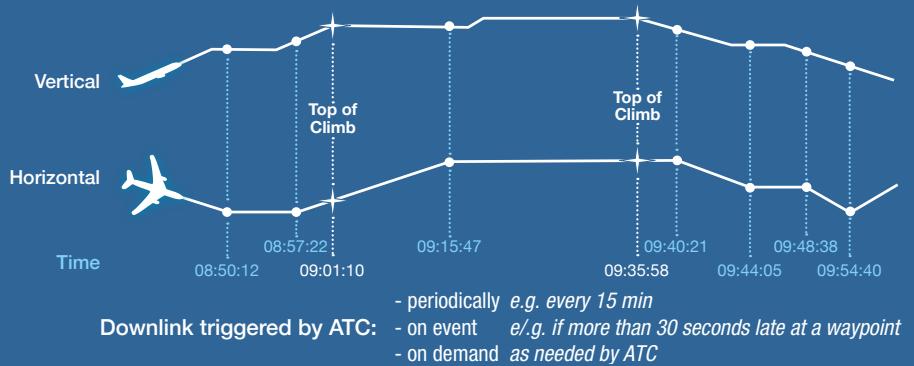
The full 4D trajectory management is one of the key pillars of the European ATM target concept for 2020+ as defined by the SESAR (Single European Sky ATM Research) programme which aims to manage worldwide air traffic growth and increasing environmental constraints.

The aircraft trajectory is collaboratively designed by the aircraft operator and the ANSPs before the flight. It takes into account the airline's business criteria and the air traffic constraints in the concerned areas. During flight it can be updated through avionics systems, in order to integrate new constraints such as meteorological changes. The trajectory is defined in four dimensions (4D) which are composed of the three geometrical dimensions (latitude, longitude and altitude), plus the time. The Time Of Arrival (TOA) at each waypoint along the trajectory is estimated with improved accuracy and reliability compared to previous approaches.

These predictions are not aiming at constraining the aircraft along all the waypoints during the flight, unless this is required by traffic constraints; they are being used to get a more accurate picture of the traffic flow evolution far in advance, and then to adjust it efficiently with the offered airspace capacity.

The approach uses 4D trajectories from takeoff to landing (even for airport surface operations in the ultimate steps), and requires significant improvements and upgrades in ground Air Traffic Management systems and procedures, as well as in the airline operation's control centres.

4D Trajectory predicted by the Flight Management System



What are the key benefits of FANS C?

The first and most obvious benefit is that an aircraft can now be equipped with a single system. This responds to requests from Airbus customers who wanted to move away from choosing between FANS A and B.

The second key advantage is the introduction of 4D trajectory planning possibilities into the field of ATM. Aircraft can share their active flight plan - including anticipated times, speeds and altitudes - with equipped Air Navigation Service Providers (ANSPs) and this is expected to reduce the increasing number of ATM-related delays at busy destinations.

With FANS C aircraft, ground ANSP will have a better and more accurate predictability of traffic flows. 4D trajectory aircraft data will be able to feed a wide variety of automation tools used today by controllers to monitor, organise and sequence traffic in a given airspace sector and even beyond. With more predictable traffic data and additional automation tools, the controller workload could be reduced and additional air traffic control capacity can be envisaged. To close the air-ground synchronisation loop, FANS C aircraft can automatically update the onboard FMS flight plan based on uplinked route instructions, once the flight crew have reviewed and accepted them. Such automation, reducing the flight crew workload, is also a crucial enabler to allow smooth introduction of complex route clearance uplinks into the datalink Air Traffic Control exchanges. FANS C will contribute to the improvement of capacity in ATM congested areas in Europe but also in other parts of the world.

What's in it for airlines?

Recent figures (as for instance highlighted by Central Office for Delay Analysis (CODA) from Eurocontrol) show that ATM-related delays are growing as the global fleet increases. Improved capacity in air traffic management will help reduce delays for airlines, particularly those relying on fast, on-time turnarounds as part of their operations.

Other benefits will be confirmed during the large-scale demonstration in Europe which is being organised as part of SESAR*. 4D trajectory planning may well lead to optimised descents being possible more often and this would reduce fuel burn. FANS C includes the technology to enable this but exactly how it will work for ANSPs remains to be seen. For now, ATM systems will continue to place constraints on individual aircraft for a variety of reasons so optimised trajectories will not always be available although their frequency should increase.

Operators may also find an increase in residual value of their aircraft. The installation of FANS C will "future-proof" their assets if the technology becomes mandatory in more areas of the world while the optimised route planning will always be of value in its own right. Furthermore, any FANS C aircraft will be able to fly anywhere so the possible need to re-equip it for a new operator would be avoided.

Assessing FANS C in Europe and China

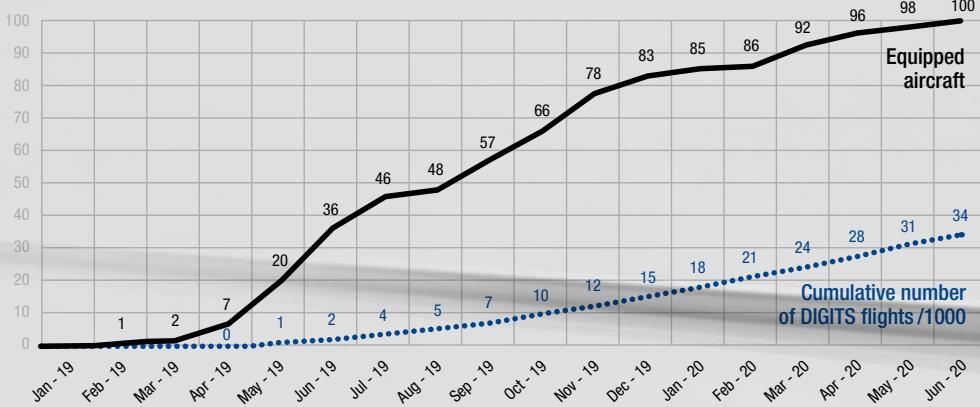
A large-scale demonstration of FANS C is underway and 100 in-service A320 Family aircraft will be equipped with the new certified technology by the middle of 2020. The demonstration is known as DIGITS (Demonstration of Air Traffic Management Improvements Generated by Initial Trajectory Sharing) and is part of the Single European Sky ATM Research (SESAR) initiative.

The focus on the A320 Family is to allow the assessment of the maximum number of flight cycles as they are very commonly used on short-haul flights within Europe.

Seven European airlines (Air France, British Airways, EasyJet, Iberia, Novair, Thomas Cook and Wizzair), are participating and data will be collected from over 20,000 flights. They will be working alongside Airbus, suppliers and the ANSPs for Germany, the UK, Benelux and Italy to ascertain the exact benefits of FANS C in practice.

Aircraft from the participating airlines will generate 'extended projected profiles' (the four-dimensional flight path) data via downlink messages triggered by air traffic control. Analysis of this 'big data' will be enriched with feedback captured from controllers and pilots so that operational experience will be built up to support the general deployment.

Airborne deployment of FAN C / ATN B2 (SESAR Demonstration)



An additional demonstration is taking place in China with a single flight involving an airline-equipped aircraft still under Airbus ownership. This is a technology trial rather than a data-gathering demonstration but of interest to the Chinese authorities (CAAC) to discover more about the potential of FANS C.

“

Air France supports FANS C / 4D and decided to be actively involved in the SESAR DIGITS demo by retrofitting 25 aircraft because, in the short term, this should highly improve the flight predictability from an ATC and network management perspective. As a consequence, we could expect a more optimised use of the available en-route capacity as well as flight efficiency improvement for the arrival flows towards the major European hubs.

In the longer term, FANS C / ATN B2 will be the cornerstone for the trajectory-based operations and ATC automation.

”

Laurent Renou

Air France Flight Operations engineering,
Head of ATM/CNS/SESAR



EasyJet decided to support the FANS C / 4D demo because we understood the significance of live flight trials to verify this important enabler for the future European airspace.

Captain Dan Wood

Flight Operations Technical Manager, EasyJet.



* What is SESAR?

Launched in 2004 by the European Union, SESAR (Single European Sky ATM Research) is a public-private partnership whose objective is to increase ATM performance and build a more intelligent air transport system. Today, the SESAR Joint Undertaking, founded in 2007 to manage this partnership, features over 100 companies and 3,000 experts working in Europe and beyond.

According to SESAR, in 2012 there were 9.5 million European flights carrying 700 million passengers. In 2035 those projections call for 14.4 million flights and 1.4 billion passengers. This increased volume of aircraft can only be sustained if new ATM processes are developed and deployed to replace today's ageing system.

A key component of facilitating more traffic is 4D trajectory technology. The idea is to share the airborne intended trajectory with air traffic control (ATC) and take advantage of avionics functions to improve air traffic management processes. By upgrading the existing airborne and ground systems with 4D software, both the ATC and the flight crew can proactively know and agree on the trajectory to be flown and share the most accurate time predictions all along the route.

4D technology was first demonstrated on an A320 flight in 2012. Since then, dozens of A320 Family ferry flights between Hamburg and Toulouse have been used to help mature the technology. In 2014, the technology took another step forward with a wide-scale demonstration flight in real-world conditions. On a flight from Toulouse to Stockholm in Sweden via Copenhagen in Denmark, local ATCs provided six 'controlled time of arrival (CTA)' points. At each CTA point, the aircraft was within plus/minus 10 seconds and the flight crew reported no disruption in their activities.

The technology is now certified on Airbus A320 Family aircraft and being demonstrated on a large scale through the DIGITS project.



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GLOSSARY

ANSP Air Navigation Service Providers

ATM Air Traffic Management

DIGITS Demonstration of air traffic management Improvements Generated by Initial Trajectory Sharing

NextGen

NextGen is the Federal Aviation Administration (FAA) programme to modernise the air transportation system for the United States of America. This comprehensive initiative relies on satellite navigation and advanced digital communications, to help improve and evolve the National Airspace System.

CONCLUSION

Many of the possible benefits of FANS C will be confirmed once the data generated by the DIGITS is analysed. However, the immediate benefits of a single, harmonised product converging FANS A and B while adding new capabilities are clear now.

While reconciling the datalink technologies of the past, FANS C is above all a breakthrough innovation that leads the way towards the 4D trajectory based operations, commonly recognised as the cornerstone of ATM optimisation and efficiency. ■■■

FAST FROM THE PAST

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



These 1930 photos of Dornier aircraft show that cabin comfort - especially at mealtime - is nothing new.



Today's Airbus aircraft also offer high standards in cabin comfort, as well as in safety. And in addition, with environmental awareness, airlines may soon be using meal trolleys that help cabin crew sort recyclable cabin waste.

See **cabin waste** article page 4



The Armagnac SE-2010, built by the SNCASE (Société Nationale de Construction Aéronautique du Sud Est) at Toulouse flew for the first time in April 1949.



It was designated as a long-range aircraft capable of carrying 100 passengers.

See **pilot training** article page 14

The illustration shows the full-sized cockpit mock-up used for studying the instrument layout and for crew training. Note that the controls for the four engines are suspended from just above the windshield.

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