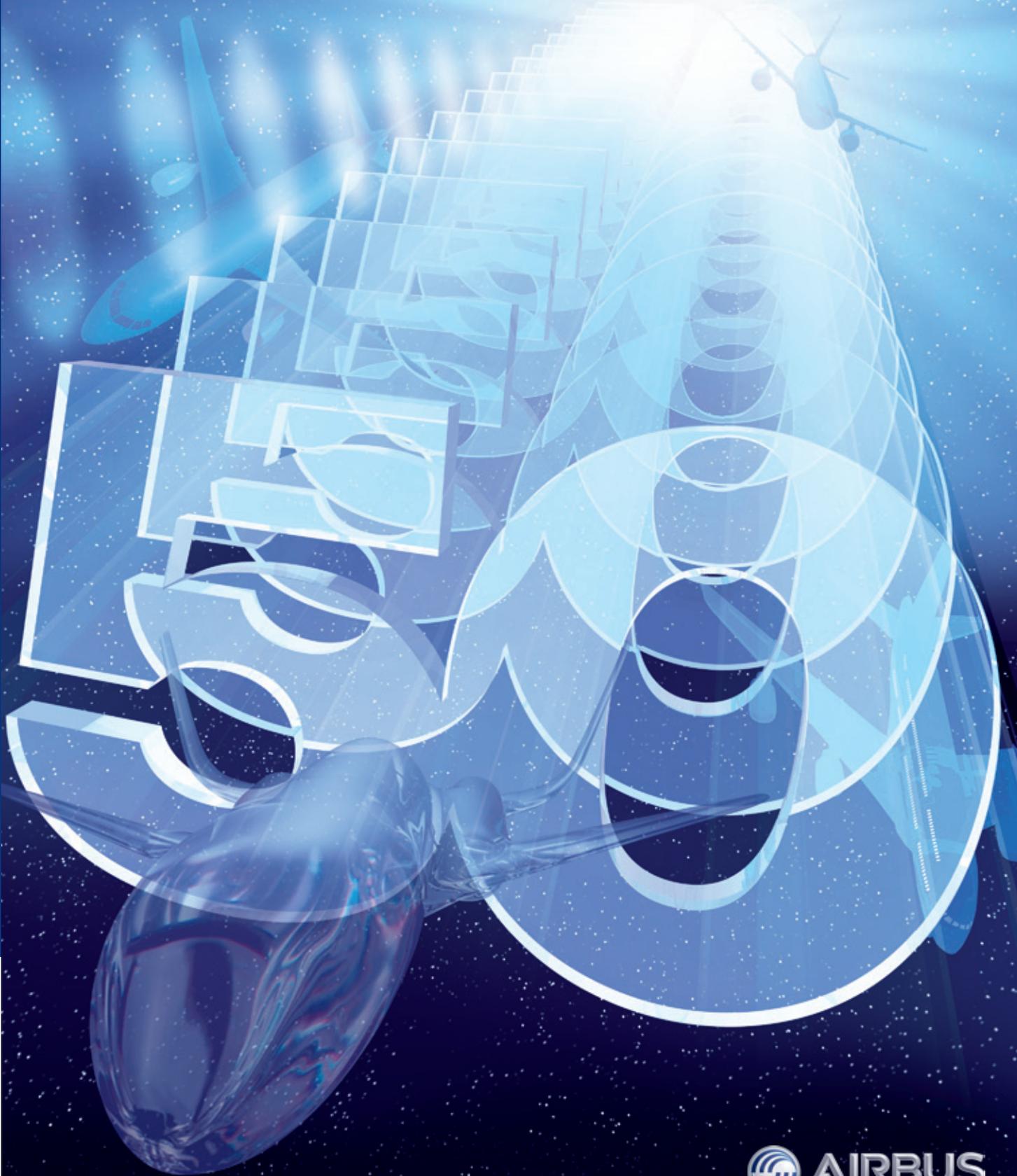


AUGUST 2012
FLIGHT
AIRWORTHINESS
SUPPORT
TECHNOLOGY

FAST⁵⁰

A I R B U S T E C H N I C A L M A G A Z I N E

F A S T 5 0



Dear Airbus friends,

It's not so often that we celebrate symbolic milestones of a magazine dealing with 'serious' subjects such as Flight, Airworthiness, Support and Technology (FAST). So, I thought the 50th edition would be a good opportunity to do so.

The idea for FAST was conceived in 1983 by Arno Stein and Bernard Ziegler - a true Airbus pioneer, at that time respectively Vice President and Senior Vice President of Airbus Customer Support. The editor was Alasdair Reynolds, the Technical Director was Gérard Misraï, and the graphic design was under Knut Marsen assisted by Agnès Massol-Lacombe, who overtook those responsibilities until her own retirement in 2009.

The best way to celebrate this milestone is to thank all of those who made this longevity possible.

Firstly, thanks to the thousands of readers around the world who have encouraged us over the years to continue publishing technical articles on our Airbus aircraft. Secondly, a big part of the merit goes to Airbus colleagues from all different areas of activity: Design offices, flight tests, training, maintenance and engineering support, spares and logistics, upgrade services, to name a few, and also occasionally some airline customers' staff, who have contributed in writing such interesting articles.

Finally, I would like to thank the small team of people on the picture, who directly contributed to the production of this magazine: The successive editors standing from left to right - Denis Dempster, Kenneth Johnson and the actual one, Lucas Blumenfeld - and for the art design, Agnès Massol-Lacombe.

The common point between all the people who made this FAST adventure possible is the same and shared passion for aviation.

Let's continue sharing this passion with you, through many more editions of FAST magazine!



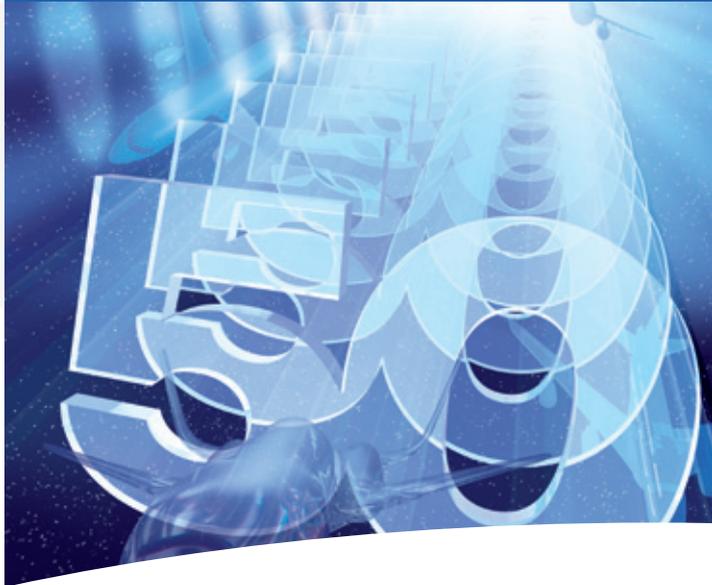
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Fuel and emissions efficiency
Saving fuel and reducing emissions:

A joint undertaking

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This issue of FAST Magazine has been printed on paper produced without using chlorine, to reduce waste and help conserve natural resources.

Every little helps!



Fuel and emissions efficiency

Saving fuel and reducing emissions: A joint undertaking

Airbus has, is and will offer its customers with highly fuel efficient aircraft. Fuel efficiency is also function of how the aircraft is operated and maintained. Airbus supports the airlines seeking to optimize their fuel consumption and we also support airport and Air Traffic Management authorities, helping them to provide ever more fuel-efficient air transport infrastructures. Furthermore, aviation's contribution to our

environment is becoming a matter of increasing concern throughout the world. Today, the most effective way to reduce emissions such as the "greenhouse gas" CO₂ is to reduce fuel consumption.

In this article, separated in two sections, we will demonstrate Airbus' involvement in helping the airlines achieve significant yearly fuel savings, while contributing to a greener planet.



Simon WESELBY
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An ever increasing demand

Projections indicate that from today's baseline, commercial aviation's fuel consumption could double by 2050. Today, for many operators, fuel represents their single largest operating cost (figure 1). Against a background of increasing fuel prices, driven by an ever increasing worldwide demand and continued market speculation, this represents a major risk to the air transport industry development.

The burning of any hydro-carbon based fuel, such as jet aviation fuel, produces a variety of emissions, including CO₂. These emissions are being increasingly scrutinized by the scientific community for their effect on our environment and consequently, by the world's governments as they endeavour to moderate their production.

What has already been done to address these issues? What is being done? What will need to be done in the future?

Airbus and alternative source fuels

The challenges associated with the use and certification of jet aviation fuels derived from "non-traditional" sources have now been overcome. Alternative source fuels that conform to the appropriate specification can now be mixed with fuels derived from traditional sources in a ratio of up to 50%, without any specific operational requirements or constraints.

Fuels derived from gas produce reduced particulate matter when burnt, meaning improved air quality at airports. Also, natural gas reserves exceed those of crude oil and therefore, this technology has a significant economic potential.

Airbus' biofuel development strategy is now focused on making biofuel an economically viable alternative to conventional fuels.

Biofuels can be produced from renewable plant material or even domestic waste.

Biofuels derived from plant matter offer the advantage of being close to "carbon neutral" as roughly the same amount of CO₂ is absorbed by the plants when growing, as is generated when the fuel they produce is burnt.

Airbus only supports sustainable biofuel development that is not in competition with food production, water supply or cause deforestation (read 'Alternative fuels' in FAST magazine 46).



Operators' average operating costs

Figure 1

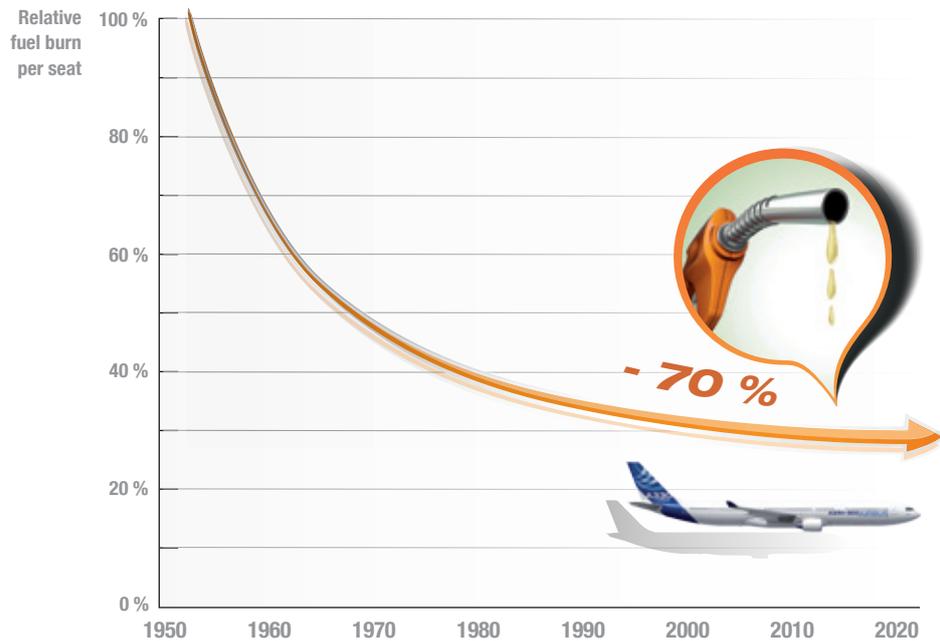
Typical single aisle aircraft



Typical twin aisle aircraft



- Crew
- Nav. & Landing
- Engine Maint.
- Airframe Maint.
- Fuel



Lower fuel consumption for modern aircraft

Figure 2

The fuel efficient aircraft

The overall fuel consumption of commercial passenger jet aircraft has been drastically reduced over the last 50 years (figure 2). Airbus has played its part in this reduction through the introduction of innovative technologies in its highly successful products. Fly-by-wire and the use of composites, initially in secondary and then in primary structure, have many advantages that include improved aircraft performance and economics. The A380's fuel consumption per passenger kilometre makes it the most fuel efficient aircraft in service today. The A320neo (new engine option) will soon deliver outstanding fuel efficiency through the introduction of the latest generation of engines and aerodynamics on an existing platform. The all new A350XWB's (Extra Wide Body) low weight composite structure, ultra efficient engines and advanced aerodynamics, will also deliver class leading levels of performance in the long-range,

twin-aisle sector. The post launch success of both of these products has demonstrated that they are what the airline industry needs.

Airbus has and will continue to offer its customers the most fuel efficient aircraft possible. However, airlines and infrastructure providers also have a role to play in minimizing fuel consumption.

How can an airline save fuel?

Airlines have many opportunities to save fuel during every single flight. These opportunities are widely known and generally understood. They can be divided into four basic groups:

- Optimized flight profiles: Flying the most efficient routes at the most efficient speeds and altitudes. We discuss this further in the next section ("Fuel efficient routes").
- Operational procedures: Directly reduce fuel consumed with initiatives such as reduced APU (Auxiliary Power Unit) use or single engine taxiing.

Airbus "Getting to Grips" series of documents

Figure 3



- **Maintenance:** Restoring airframe and engine condition to minimize aerodynamic drag and maximize efficiency.
- **Weight reduction:** Every kilogramme of weight carried by the aircraft consumes extra fuel. Weight can be optimized in many areas, for example, cabin service, potable water and even with fuel carried.

These and many other initiatives are discussed in widely available documents. Airbus' contribution to this library can be found in the 'Getting to Grips' series of documents. The two highlighted in figure 3 offer an excellent starting point for anyone interested in the subject of fuel efficiency but the these series also include several titles for those wishing to develop their expertise. All these brochures can be downloaded from the Flight Operations community of the AirbusWorld portal.

Fuel efficient routes

One of the methods for reducing fuel consumption is to optimize the flight profile, including speeds and altitudes.

Usually the most economic routing is the most direct one. It also avoids waiting in line to take-off, in-flight "holding", or waiting for a parking stand on arrival.

The most efficient vertical profile allows the aircraft to climb and accelerate continuously to its optimum altitude and speed. It also allows the aircraft to descend continuously from that optimum altitude to the destination runway. In this way, the time that the aircraft spends in its most efficient configuration - high altitude cruise - is maximized.

However, the realities of the current Air Traffic Management (ATM) system often preclude the execution of optimum flight profiles.

Queues to join runways, holding patterns, airspace restrictions, ILS (Instrument Landing System) approaches, they all have their role to play in the non-optimized flight profile. Noise abatement trajectories can also increase flight distances.

Furthermore, in some regions, notably North America and Europe, the capacity of the current ATM infrastructures are approaching their limits. This leads to delays and other inefficiencies and also represents a significant risk to commercial aviation growth.

Airbus' contribution to addressing these issues is outlined in the Airbus and ATC reform text box.

Implementing a fuel efficient operation

Raising awareness of and dealing with fuel efficiency, across the airline's organisation can also be facilitated through formal training. Here again, Airbus offers a number of courses for both the specialists and non-specialists.

Identifying initiatives that can save fuel is just the start of the story. These initiatives need to be evaluated with all stakeholders to ensure that they do indeed represent an overall cost reduction for the airline. Once this has been confirmed, the initiative will need to be developed so that it can be deployed across the airline's community in a permanent way.

The notion of permanence presents a further question: How can the airline track an initiative's deployment? Again, Airbus has solutions to address these questions. Our Fuel and Flight Efficiency consulting service uses a process that can be adapted to an airline's specific requirements and priorities. It is supported by our fuel efficiency measuring and monitoring software tool, FEMIS (Flight Efficiency Management and Information).

Airbus and the Air Traffic Management reform

Airbus' ProSky organisation offers products and services designed to support the development of the Air Traffic Management (ATM) industry throughout the world. It also enables the deployment of highly efficient operating procedures that airlines can exploit today.

For example, QuoVadis which is part of ProSky's group, has amassed significant experience in the design and deployment of airport approach and departure procedures that deliver considerable savings for the operators using them. The procedures are based on RNP (Required Navigation Performance) technology, which is available for all Airbus aircraft. The development process is done in full collaboration with the local ATM community.

Metron, also part of ProSky's group, offers Air Navigation Service Providers (ANSP), airport authorities and airlines an innovative, cost effective solution to optimize traffic flow and minimize delays. The partnership with ATRiCS provides a tool for airport tower controllers that gives them engine start times for every departing aircraft to allow the most efficient use of runway capacity while minimizing queues.

For further information visit www.AirbusProSky.com

Airbus and emissions

Today's aviation industry produces 2% of all man-made CO₂ emissions, 80% of which are related to passenger flights exceeding 1,500km, for which there is no practical alternative. By comparison, maritime emissions are 50% higher and road transport emissions are even seven times higher than those of the aviation industry. Furthermore, in the last decade the traffic increased more than 50% but the fuel consumption only increased by 3%. The aviation industry is on the right track and Airbus fully

supports the global aviation industry's target of 50% net reduction in carbon emissions, compared to 2005 levels, by 2050. To support this target, Airbus is committed to the European Union's "Flightpath 2050" programme that aims to deliver a 75%* reduction in CO₂ per passenger kilometre.

To fulfil its ambition, Airbus is investing nearly 2 billion euros per annum in research and development. More than 90% of the Research and Technology (R&T) projects have environmental benefits.

* Relative to the capabilities of typical new aircraft in 2000 75% = 65% aircraft related + 10% infrastructure related. "Flightpath 2050" targets also include 90% NOx emissions' reduction and 65% noise reduction.

A collaborative future

Within this article, we have outlined the principle elements of Airbus' support and services package. It is designed to help airlines optimize their fuel consumption. However, recognizing the ever growing importance of this subject, Airbus has launched a customer working group. The objective of the Fuel Efficiency FAIR Working Group is to develop Airbus' support and services' package to better meet the airlines' needs. The working group's priorities for 2012 have been established and developments are underway. Further information on FAIR Working Groups can be found in the adjacent text box.

n

notes

What are Airbus FAIR Working Groups?

FAIR Working groups are dedicated to specific domains that have been selected by the operator community. Their goal is the identification of key issues within the domain, review and development solutions and the preparation of those solutions

for airline use. This established, collaborative process has delivered valuable improvements to support the operational excellence of the Airbus fleet.

The progress and results of the Fuel Efficiency FAIR Working Group (and all the other working groups) can be found on the AirbusWorld portal.

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Conclusion

These days it is common to see airlines citing increasing fuel costs as a reason for lower than expected financial results. It is also common to see airlines showing their "green credentials", either through demonstrations of green technologies or by quoting the emission reductions they have achieved by optimising their operations.

Airbus has, is and will continue to support operators who wish to pursue fuel and emissions efficiency objectives.

Firstly, by continuing to offer the most advanced aircraft, equipped with the most advanced engines and secondly, by providing support and services that help ensure that those aircraft are used in the most efficient way possible.

However Airbus, its engine suppliers and the aircraft operators are not the only stakeholders in the fuel consumption and emissions reduction process. Risks to growth and development are not just limited to ever increasing fuel prices. The ability and willingness of infrastructure providers, such as airports and air navigation service providers, to evolve and government to support (for example in the context of biofuel development or airspace sovereignty) are also key contributors.

These risks can be reduced by continuing to raise overall awareness, such that all stakeholders contribute to the change process and make their respective voices heard.



FOR SPECIFICATIONS REFER TO EURNORM-1

Airbus Fuel and Flight Efficiency Consulting Services

Working together to save on airline costs

Fuel prices fluctuate but its global trend is a long term increase. Fuel and flight efficiency can be a significant source of savings for an aircraft operator. Some have developed strong competences. Some others are just beginning

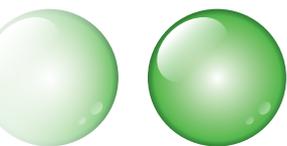
the journey. Almost all now consider that fuel efficiency is a key objective and they are looking how to reach permanent results. Airbus Fuel and Flight Consulting Services help airlines save fuel. In this article, we explain how.



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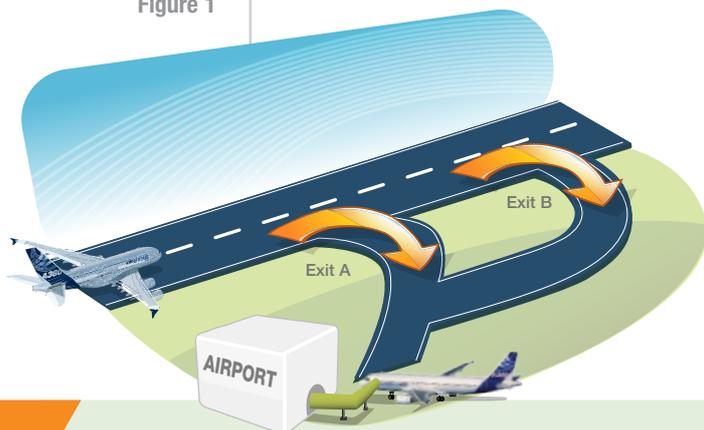
Airbus Consulting Services

Consulting Services is part of a comprehensive portfolio of services, covering the airlines' major activities (maintenance and engineering, flight operations, material and logistics and training) and ranging up to 'capability assistance'.

For more information about Airbus Consulting Services, contact: customerservices.consulting@airbus.com

Which is the best exit?

Figure 1



Choosing the right initiatives

Every operational fuel initiative requires a proper trade-off. Let's consider the simplified example given in figure 1. After landing, this aircraft will be given the choice by the control tower to take exit A or exit B. Which one will lead to the lowest cost for the operator?

The exit A seems the best answer because it has a shorter taxi distance to the airport. But the choice is not so easy!

- Indeed, to reach exit A, the pilot must decrease the landing distance:
 - Either by using more thrust reversers - this meaning an increase of the engine thrust and therefore, increases the fuel consumption.
 - Or by using more the brakes - this leading to premature brake and tyre wear and therefore, increases maintenance costs.
 - Maybe both!

- By reaching exit B, the pilot extends the landing distance leading to:
 - A longer taxi distance to the terminal – leading to a supplement of fuel burnt.
 - The occupation of the runway for a longer time – eventually leading to a congestion of aircraft waiting on the taxiway.
 - Once again, maybe all of the above!

In fact, there is no good answer. It can either be exit A or exit B, depending on the airport infrastructure, the operational conditions, etc. Only a trade-off study considering the relevant parameters will find the good answer for each particular case.

Multi-disciplinary activities

On top of this, a fuel savings' programme faces organisational challenges. Indeed, fuel initiatives usually concern multiple departments such as flight preparations, flight operations, ground operations, maintenance, engineering, etc. A project leader needs to develop an appropriate organisation and communicate the proper arguments to convince all of the involved stakeholders.

FEMIS

FEMIS (Flight Efficiency Management and Information System) is a ground-based software designed for the monitoring of fuel and flight efficiency.



FEMIS automatically processes the aircraft's actual flight data from digital recorders and compares it with the flight plans. On the one hand, users explore this data and identify potential savings. On the other hand, it provides a global overview of savings' initiatives, thanks to relevant reports and indicators.

FEMIS was developed in collaboration with Teledyne for both Airbus and non-Airbus aircraft. Its license can be purchased either on an annual basis, or on a temporarily basis through the "spot-check" service. FEMIS can also be deployed as part of Airbus Consulting Services' missions. For more information, please contact: marketingcontact.FEMIS@airbus.com

To confront this challenge, the project leader should:

- Have an empowered multi-functional team representing all stakeholders,
- Implement a monitoring programme, ensuring the follow-up of the most important indicators.

Last but not least, safety must be a key competence. This sounds basic

for an airline but fuel initiatives can be internally perceived as contradictory. As an example, loading too much fuel reserves increases the aircraft weight, and therefore its fuel consumption. However, loading less fuel reserves can make a pilot uncomfortable because of a potential flight diversion. An initiative must consider safety from the beginning to be successful.

The fuel manager's dilemma



quote

From Air Arabia: A successful consulting mission

“Airbus performed a Fuel & Flight Efficiency project focused on a diagnosis with Air Arabia, covering a fleet of thirty A320. Since Air Arabia was already experienced with its own fuel conservation programme, the objective given by Air Arabia was for the Airbus Consulting team to validate and quantify their current initiatives. The Airbus Consulting team also identified areas of improvements and defined potential savings achievable. The immediate implementation of new initiatives is already bringing benefits for the airline.”



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Conclusion

The objective of Airbus Fuel and Flight Efficiency Consulting Services is not only to help the airlines save on fuel, but to bring a real optimisation in flight preparations, flight operations, maintenance and engineering, while saving on costs at the same time by studying each case individually. Some airlines need full guidance for the identification of potential savings and the implementation of fuel initiatives. Others, which are more advanced in the fuel efficiency management process,

just need a validation of their current initiatives, the identification of new opportunities and the benchmark information. Airbus Fuel and Flight Efficiency Consulting Services investigate airlines' operations through different actions including data processing with Airbus FEMIS software, procedure analysis, face-to-face meetings, etc. At the end of the mission, these various actions result in a tailored answer to match the identified airlines' needs for fuel efficient operations.



The 4D-trajectory management

Flight efficient traffic sequencing based on aircraft predictions

On 10th February 2012, an A320 test aircraft flew from Toulouse (France) to Copenhagen (Denmark) and Stockholm (Sweden), testing the initial step of a highly innovative Air Traffic Management (ATM) concept - the 4D-trajectory management.

This flight which was a world premiere was the culmination of months of collaboration between several partners within the SESAR (Single European Sky ATM Research) programme including avionics and ground equipment manufacturers, Air Navigation Service Providers

such as Eurocontrol MUAC (Maastricht Upper Area Control) centre, NORACON (NORTH European and Austrian CONSortium) and Airbus. This “initial 4D-trajectory management” concept improves the Air Traffic Management (ATM) by using ‘time’ with early traffic sequencing based on the aircraft’s waypoint passage predictions, thus enabling to fly optimal flight profiles. It is planned to be deployed from 2017, paving the way to the “full 4D-trajectory management” concept, covering all flight phases, which should enter-into-service beyond 2020.



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What is a 4D-trajectory?

The full 4D-trajectory management is one of the key pillars of the European ATM target concept for 2020+ that has been defined by the SESAR programme, in order to cope with the worldwide traffic growth and the continuous increasing environmental constraints.

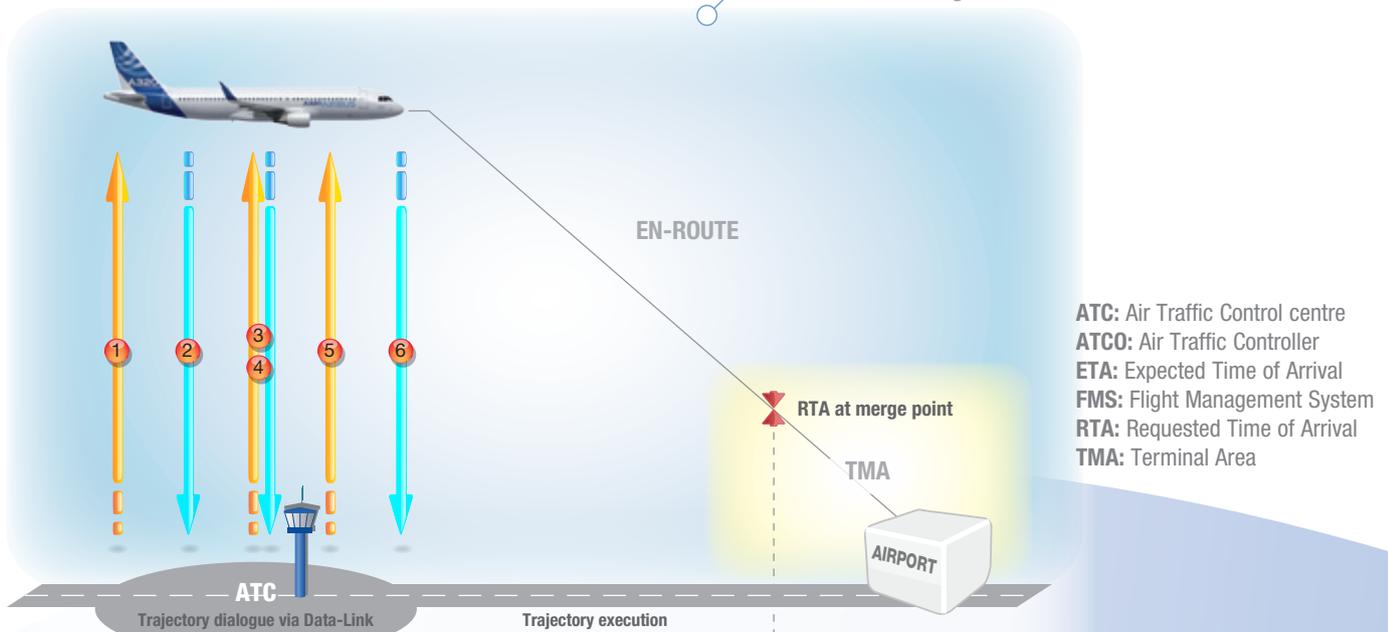
In this concept, the aircraft trajectory is built before the flight, collaboratively between the aircraft operator and the Air Navigation Services Providers (ANSP), considering both the airline's business criteria and the air traffic constraints in the concerned areas. It can be updated during the flight using avionics systems, in order to integrate new constraints such as meteorological constraints not known before flight. This trajectory is defined in four dimensions (4D) which are composed of the three geometrical dimensions (latitude,

longitude and the vertical), plus the time. It means that the Time Of Arrival (TOA) at each waypoint along the trajectory is estimated with an improved accuracy and reliability. These predictions are not aiming at constraining the aircraft along all the waypoints during the flight (with an exception of very few waypoints when it is required for traffic constraints), they are only 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.

This concept is based on the use of 4D-trajectories from take-off 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 airlines operations' control centres.

Initial 4D-trajectory management Data-Link exchanges

Figure 1



- 1 3D route clearance: ATC sends the route to be followed by the aircraft down to the runway via Data-Link
- 2 4D predicted trajectory: The aircraft downlinks the updated airborne trajectory predictions (3D + time) after inserting the route clearance in the FMS
- 3 ETA min/max window request: ATC requests reliable ETA min/max window for merge point
- 4 ETA min/max window: Aircraft downlinks the reliable ETA min/max
- 5 RTA instruction: ATCO chooses a RTA in the ETA min/max window and uplinks this feasible RTA
- 6 4D predicted trajectory: The aircraft downlinks the updated airborne trajectory predictions (3D + time) after insertion of the RTA in the FMS



information

What is SESAR?

The Single European Sky ATM Research programme is the operational and technological answer to the major challenges of European air traffic growth. The aim of this programme is to ensure the modernisation of the European Air Traffic Management system by coordinating and concentrating all relevant research and development efforts in the European Union. Partnerships, sustainability and user-drive are key concepts of the SESAR approach. Founded by the European Commission and by Eurocontrol, 15 companies are members of the SESAR Joint Undertaking programme: AENA, Airbus, Alenia Aeronautica, DFS, DSNA, ENAV, Frequentis, Honeywell, Indra, NATMIG, NATS (En Route) Limited, NORACON, SEAC, SELEX Sistemi Integrati and Thales.



Air Traffic Controllers on the job

As this full step will take time to be deployed and to pave the way to this ambitious concept while getting early benefits, SESAR's partners have defined an intermediate step called the initial 4D-trajectory (i-4D) management, less demanding in terms of improvements for the short/mid-term.

The i-4D management consists in ground systems using time estimates computed by the aircraft, to establish far in advance an optimal arrival sequence of all the aircraft in the traffic converging to a merging point in a congested area. This merging point can be, for instance, the entry point of a dense TMA (Terminal Area - initial approach fix), as it was experienced during the flight test performed earlier this year from Toulouse (France) to the north of Europe. In this type of operation, each aircraft converging to the merging point agrees a 2D route with the Air Traffic Control (ATC) centre before the Top Of Descent (TOD). Then, each aircraft transmits a time window in which it could reach the merging point while still keeping an optimal descent profile. All these air-ground exchanges are made by Data-Link.

In the next step, considering all the traffic converging to the merging point, the ATC centre managing the TMA selects a target time within the time window sent by the aircraft, at which the aircraft should reach its target waypoint to optimize the traffic flow. This target time is sent through the Data-Link system from this ATC centre to the aircraft (via the en-route ATC centre managing the flight before the TOD). The target time received by the aircraft is then loaded and activated in the Flight Management System (FMS), so that the aircraft manages automatically the flight to meet the merging point (figure 2). This ensures that the aircraft flies its optimal flight profile up to the merging point and reaches it

on time, allowing a smooth integration of the aircraft into the optimum arrival sequence.

During the flight test performed this year, the 4D-trajectory management concept has been tested through several i-4D descents, some starting in the Maastricht (Netherlands) airspace and ending in the TMA of Copenhagen (Denmark), and others starting in the Malmö (Sweden) airspace and ending in the TMA of Stockholm (Sweden).

All these i-4D descents were successful and permitted to validate the concept in several different operational conditions.

Once proven and industrialized, i-4D will allow the aircraft to plan and fly an optimized and efficient profile, without any need for the controllers to provide any vectoring instruction. This will offer better predictability of the traffic flow, facilitate fuel-efficient descent operations while reducing emissions, and will contribute to decreasing traffic conflicts upon arrivals into airports. Thus, aircraft flying in a holding pattern will be notably reduced.

The impact on avionics

On the airborne side, the i-4D capability will be available on most Airbus aircraft through software upgrades. It mainly concerns two airborne systems:

- The Flight Management System (FMS), in order to improve the management of the time constraints,
- The Data-Link communication system (Air Traffic Services Unit - ATSU on the A320), in order to be able to exchange new Controller-Pilot Data-Link Communication (CPDLC) messages and send 4D predictions through ADS-C (Automatic Dependent Surveillance – on Contract).

The required upgrade for the i-4D Data-Link capability will be particularly light for all aircraft flying in Europe which have to be FANS-ATN (Future Air Navigation System - Aeronautical Telecommunications Network) Data-Link equipped in the coming years to comply with the Link 2000+ mandate (read FAST 48 magazine - FANS for A320 and A330/A340 families).

I-4D trials in the framework of SESAR

Several actors of the Air Traffic Management sector joined the efforts in the frame of SESAR, to support the full validation of this innovative concept:

- As ground systems' manufacturers: Indra and Thales Air Systems,
- As avionics manufacturers (for the FMS prototypes): Honeywell and Thales Avionics,
- As Air Navigation Service Providers: Eurocontrol MUAC and NORACON Air Traffic Control centres,
- And Airbus, as aircraft manufacturer and avionics integrator, but also as an avionics' manufacturer (for the airborne Data-Link system prototype).

The flight test which took place at the beginning of 2012 is one of the main achievements of this partnership, testing in real conditions the ground and airborne system prototypes developed by the industrial partners. However, this flight test is only one part of a complete validation campaign, aiming at validating both technical and operational aspects. Within this campaign, several other trials, not only using flight test aircraft but also simulators, are planned over the next two years.

Target time received by the aircraft then loaded and activated in the FMS

Figure 2





In this framework, the operational benefits of the i-4D operations will be assessed thanks to two different types of exercises:

- **Mixed fleet simulations:** Real time simulations where a full fleet of aircraft is generated with a predetermined percentage of i-4D equipped aircraft and controlled by live controllers from the Air Traffic Control (ATC) centres. It is even possible to connect the Airbus integration simulators to the controller's simulators to integrate real pilots in the loop.

These simulations are mainly focused on the usability of airborne and ATC systems, human factors and operational procedures.

- **Fast time simulations:** Simulations with no human in the loop and which should allow computing the operational benefits in terms of fuel burn, airspace capacity use and traffic optimisation.

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Conclusion

Thanks to the expertise of several partners working in complementary fields, the 4D-trajectory management concept has started to become a reality, reconciling medium to high traffic density with flight efficiency, through better predictability of aircraft trajectories. The concept which is supported by the SESAR (Single European Sky ATM Research) programme is also being considered in other regions of the world with dense traffic, in particular in the United States through the NextGen (Next Generation) programme. As the full step will take time to be deployed,

an intermediate concept called the initial 4D-trajectory management has been defined. This short to mid-term concept has been tested successfully. The main challenge is now to prepare and ensure a synchronized deployment, both on aircraft and in Air Traffic Control centres, in order to get the associated benefits as early as possible.

The deployment cost for airlines should be limited as for most Airbus aircraft, the 'full and initial 4D-trajectory' capabilities will require only software upgrades.



Airbus Technical AOG Centre 24 Hours in AIRTAC

Dedicated teams of highly qualified structures and systems' support engineers are staffing AIRTAC, around the clock and the whole year round. These experienced aeronautical engineers, mostly coming from different areas in Airbus or from an airline maintenance environment, know perfectly well how an Aircraft-On-Ground (AOG) hurts the airline's operation, thus creating the motivation to deal with the airlines' queries to get them solved as quickly as possible. In addition to its support activities, AIRTAC has expanded its scope of activities and is now proposing

a new service called AiRTHM (Airbus Real Time Health Monitoring). The objective of this new activity - actually in service and will be proposed as an extension of the Flight Hour Services (FHS) offer - is to health monitor the Airbus A380 fleet in real time and thanks to its modern technology, to anticipate, solve AOG issues, or reduce work stoppage situations.

In this article, we invite you to share 24 hours in AIRTAC's very closed and confined environment, but open to the world, while we assist Airbus customers by providing state-of-the-art support.



Ronie GNECCO
AIRTAC Structures Engineer
Airbus Engineering



Damien CUSSAC
AIRTAC Systems Engineer
Airbus Engineering



AIRTAC is a 365-day, 24-hour centre where specialist engineers are always available to help Airbus customers' aircraft get back in operation. To carry out these technological enhancements, a challenging Information System (IS) programme was set up to centralize and better control real-time business information, with an integrated control tower concept providing all the critical information to manage each customer's issues.



notes

The term AOG should not be used if the aircraft is on a maintenance planning. The term AOG is used for aircraft in operation and is meant to keep the aircraft in service with a temporary repair and approval. On the other hand, during the aircraft maintenance, we can have a so called "work stoppage", in which case the maintenance facility is awaiting Airbus' technical repair approval.

History of AIRTAC

The idea to move from the old on-call out-of-hours support to a full 24/7 dedicated support centre had existed for a long time, but it really started to take shape in the early 2000's with the Airbus fleet growth. This, combined with the market considering more and more this type of support as state-of-the-art, led to the opening of the Airbus Technical AOG Centre, AIRTAC, on 7th February 2003.

Airbus inaugurated today's set up of AIRTAC's modern facilities in Blagnac (France), in December 2005. The new facilities are fitted with the most innovative technology and leading-edge solutions. These enhancements represent a multi-million Euro investment that enables Airbus to provide its worldwide customers with improved technical support, and an even wider range of engineering services.

The aim of AIRTAC's team is to minimize on-the-ground time for aircraft for troubleshooting and repairs.

In 2007, the staff was increased to keep up the pace with the growing workload. AIRTAC has been involved as of the

Entry-Into-Service (EIS) of the A340-500/600, the A318 and the A380. And of course, AIRTAC is starting to look ahead to be ready for the EIS of the A350.

The first year, AIRTAC had answered a bit less than 4,000 queries from Airbus customers, of which around 75% of the issues were solved directly by AIRTAC. Each following years, more than 13,000 queries have been treated.

Based on its ever growing experience, AIRTAC's service has been recognized and appreciated by Airbus customers, and their inputs are carefully studied in order to ensure that the service provided stays in line with Airbus customers' expectations.

AIRTAC OBJECTIVE:

To provide structural repair and engineering advice to address technical AOGs and work stoppages.

AIRTAC ORGANISATION:

A complete staff of 44 people composed of:

- Eight teams available 24/7
 - each team being composed of two structures, two systems' engineers and one AiRTHM engineer,

- Three Maintenance Innovation Team (MIT) engineers on standard hours,
- The head of the AIRTAC department who manages the teams.

AIRTAC MISSION:

AIRTAC structures, systems and AiRTHM engineers all ensure that the customers' Airbus aircraft are flying safely and with the best Operational Reliability (OR).

AIRTAC engineers meet all the customers' demands and ensure a proactive support in any high-stress situation, around the world and around the clock.

AIRTAC is Airbus' front line with the customers and is the entry point for any AOG, but also for accidents and major incidents.

AIRTAC development



AIRTAC TODAY

24 hours in AIRTAC

“Ladies and Gentlemen. Welcome on-board the Airbus Technical AOG Centre. We wish you a pleasant reading while following some issues dealt in AIRTAC during 24 hours. Please remain seated at all times and remember that only AOG and work stoppage situations are permitted during your reading.”



information

All messages delivered to AIRTAC's mailbox are limited to five mega-bytes, causing some technical messages including damage reports and/or pictures

to be blocked. Therefore, try to resize or divide the messages and contact AIRTAC's front desk in order to check that your message was correctly received.

AIRTAC FEBRUARY 2003



24 HOURS WITH AIRTAC

0 H

6 H

12

STRUCTURE



Response Time: 3 h

A320 AOG

Aircraft found with a previous permanent repair disbonded from the RH INBD Flap Leading Edge between Rib 4 and Rib 5. The customer doesn't have the manpower to perform a permanent repair.

Airline question:

Airline proposes to apply high speed tape on the disbonded area to cover the rear closure of the T/E for 1,000FC, and to perform a DVI at the affected locations every 100FC.

AIRTAC answer:

AIRTAC informs the customer that the repair proposal is not acceptable due to the extent of damage and provides the repair instructions to be performed as per the SRM.

SYSTEMS



Response Time: 5 h

A330 work stoppage

A part needs to be replaced on a manifold.

Airline question:

Airline needs to have confirmation that the valve P/N D31AB4453 is included within the manifold P/N D31AB4415.

AIRTAC answer:

AIRTAC advises that as per CMM 32-31-31 of the manifold, the valve gear selector P/N D31AB4453 is a sub-assembly part of the manifold P/N D31AB4415.



RT: 1 h

AiRTHM
AIRBUS REAL TIME
HEALTH MONITORING



RT: 1 h

A380 In-Flight

"BRAKES RELEASED" warning fault was triggered associated with "MONITORING UNIT-WLG, RH WHEEL 4(58GG2)".

Fault confirmed thanks to an uplink made from the AiRTHM front desk.

AIRTAC action:

AiRTHM team advises the airline to pass the TSM task "Tachometer continuity fault on the RH WLG" associated to this fault code.

AFT: Aft - AOG: Aircraft-On-Ground - CMM: Component Maintenance Manual - DVI: Detail Visual Inspection - ESPM: Electrical Standard Practices Manual
FC: Flight Cycles - F/CTL: Flight Control - Fig: Figure - FR: Frame - INBD: Inboard - NVM: Non-Volatile Memory - MCE: Motor Control Electronic
MEL: Minimum Equipment List - P/N: Part Number - O/B: Out Board - RAS: Repair design Approval Sheet - RH: Right Hand - RT: Response Time
SFCC: Slat Flap Control Computer - SIL: Service Information Letter - SRM: Structure Repair Manual - T/E: Trailing Edge - TSM: Trouble-Shooting Manual
WLG: Wing Landing Gear

A380 work stoppage

During cargo loading, damage was located on the AFT Cargo Door frame web at FR81.

Airline question:

Airline requests approval to dispatch the aircraft with the damage as is for 100FC.

AIRTAC answer:

A temporary repair analysis is done by AIRTAC and the quality check of the damage report is performed. Airbus Design Office is contacted in order to have repair/approval comments. The customer is allowed to operate the aircraft with this damage "as is" for the next 100FC, performing a DVI on the affected framework area to ensure a crack free condition.



RT: 2 h

Airline comments:

"Thank you very much for this efficient recovery. It has been a great relieve for our customer management to receive a RAS for 100FC. Our flight will be slightly delayed, but it will be operated by our same A380, and no passenger will be left on ground".

18 H

A330 work stoppage

During the aircraft painting, the RH wing is damaged by the lift technician creating an impact on the O/B T/E.

Airline question:

According to the SRM 57-55-00 Fig 108, the damage falls under zone 5 & 6 and Airbus is to be contacted for assistance.

AIRTAC answer:

AIRTAC advises the customer that due to the extent of damage, the flap needs to be sent to an approved Repair Station and Airbus AOG Spares needs to be contacted in order to provide the part availability, lead time and price.



Response Time: 4 h

24 H

A340 work stoppage

Feeder cable P/N 2456-5325 needs to be replaced with a hydraulic crimp tool and a crimp head.

Airline question:

Airline requests if there are any alternative tools for a cable replacement.

AIRTAC answer:

Referring to the ESPM 20-48-12, AIRTAC advises the operator that no alternative tool has been identified and suggests contacting Airbus AOG Spares to check the availability of the tool needed.



RT: 2 h

A310 work stoppage

Passenger oxygen generators P/N 117042-02 and 117019-02 are about to expire and customer's stock balance is only sufficient for the replacement of the effected generators with P/N 117016-03.

Airline question:

AIRTAC is contacted to provide comments/acceptance to use P/N 117016-03 instead of P/N 117042-02 and P/N 117019-02.

AIRTAC answer:

AIRTAC advises the customer that in accordance with SIL 35-007, the P/N 117028-02 can be replaced by P/N 117019-02 or P/N 117042-02.



RT: 1 h

A380 one hour after take-off

"F/CTL SLAT SYS 1" fault triggered combined with "Electric Drive Fault, Slats".

This item is NO GO, a deviation of the MEL is not possible and no Electric Motor spare is available in outstation

Fault confirmed thanks to an uplink made from the AiRTHM front desk.

AIRTAC action:

AiRTHM front desk confirms the fault and advises the airline to reset both NVM (SFCC1 & SFCC2) and perform several times an operational test of the slat and droop nose system. The airline afterwards sends an electric drive motor from main base to outstation and installs it in the aircraft. The aircraft is serviceable and is operated with no delay.

These are only a few examples of situations that AIRTAC need to deal with on a daily bases. Of course, some days are busier than others and we kindly remind our customers that AIRTAC must only be contacted for AOGs and work stoppage situations. Airbus Field Representatives and your Customer Support Directors remain your initial focal point.

AIRTAC, the Airbus AOG centre runs around the world, around the clock and the whole year round.

The AIRTAC-MCC action plan is based on four steps:

- 1] Identify the fault message which can cause a potential delay (alerting function),
- 2] Uplink to the aircraft to collect further data,
- 3] Analyze the results,
- 4] Advise the customer.

An alerting system is deployed on the AIRTAC's screen wall.

Amongst the hundreds of aircraft messages and based on the list of operational data transmitted which has been mutually agreed with the customer, the messages potentially leading to a delay or an Operational Interruption (OI) are filtered and displayed for further investigation.

For the analysis, each system engineer has access to a set of tools and engineering expertise.

This allows her/him to:

- View the sequence and details of the aircraft data,
- Choose parameters and request their values to the aircraft in return,
- Analyze the collected data versus previous similar cases.

Based on the gathered information, the AIRTAC-MCC engineer is able to quickly provide a tuned technical advice. This enables the operator to ease its aircraft dispatch.

The AiRTHM service solution is currently available and is used to ease each A380 Entry-Into-Service (EIS). This service will then be extended to the Flight Hour Services (FHS) customers. The next step will also be to prepare the A350's EIS and contribute to an even higher level of smooth operations.



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Conclusion

AIRTAC (AIRbus Technical AOG Centre), with its qualified structures and systems' support engineers is a state-of-the-art support service available 24/7 handling both, AOG or work stoppage situations for Airbus aircraft.

AIRTAC has set its mission to provide an answer to the customers' queries within a four hours time frame for the AOG situations and 12 hours for work stoppages, that is a challenge by itself considering the continuous growth of Airbus' fleet.

The newly created AiRTHM (Airbus Real Time Health Monitoring) service has been set up to provide, as its name clearly stands for, 'real time health monitoring' for Airbus aircraft. This innovative service helps Airbus' customers improve their

Operational Reliability and maintenance scheduling, whilst reducing the associated costs.

The involvement of the Airbus' Field Representatives and the Customer Support Directors remain the customers' focal point, providing they can immediately support and assist the customers to dispatch the routine technical queries to the relevant Airbus Customer Support or Engineering department.

AIRTAC is participating to develop the future of aviation with pro-active maintenance and a personalized customer support.

For AIRTAC's team, 'Today is Already Tomorrow' to cover your 'Turn Around Time'.





Cabin air quality: The key to a comfortable flight

How to make an aircraft breathe

On aircraft, cabin air quality contributes significantly to the comfort and well being of passengers and crews alike. But what is actually cabin air quality, what is the importance attributed to cabin air quality in aircraft design and operation,

and what is Airbus doing to preserve good air quality in the aircraft cabin? Let's take a journey into the technical depths of the rather abstract term of "cabin air quality".



Dr. Andreas BEZOLD
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Aircraft operating environment

Civil aviation occupies a position of particular importance among modes of public transportation, due to its environmental and operating conditions. Commercial aircraft operate primarily in the troposphere and lower stratosphere, depending on their geographic position. This is an environment that is hostile to life. The outside temperature can drop to below -50C, the ambient pressure can decrease to less than 200hPa (hectopascal), which is one fifth the ambient pressure on the surface of the earth and high ozone concentrations may occur. The aircraft cabin becomes increasingly part of our normal habitat and is therefore subject to high expectations. Besides the ergonomic design and the amenities, there are also other factors with an impact on passenger and crew well-being that we have to take into consideration.

Air quality, temperature and pressure are important parameters which are directly controlled by the environmental control system.

Definition of cabin air quality and its relation to smell

As indicated in figure 1, cabin air quality is defined by the content of gaseous, particulate and biological contaminants in the air. Besides this, other factors like temperature, humidity, or even aircraft movement can have an influence on our perception of air quality. Such influences and real air contamination issues are difficult to disentangle, and physiological perceptions cannot always be attributed to airborne contaminations.



definition

Troposphere: The lowest region of the atmosphere between the earth's surface and the tropopause, characterized by decreasing temperature with increasing altitude.

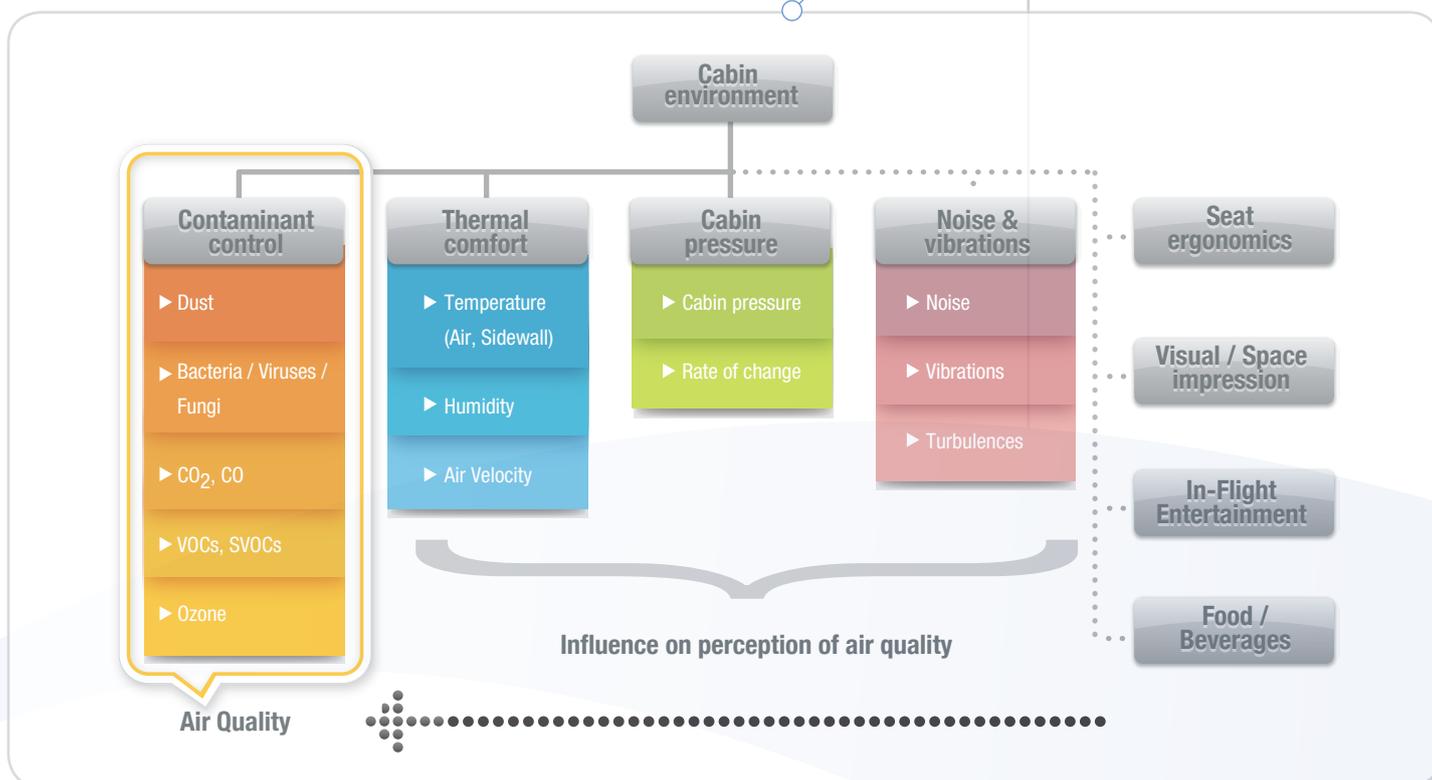
Tropopause

The boundary layer between the troposphere and stratosphere. It is defined as the lowest level at which the temperature lapse rate decreases by 2°C km⁻¹ or less, to reach an average of -56°C.

Stratosphere: The region of the atmosphere above the troposphere and below the mesosphere.

The cabin environment and its influencing factors

Figure 1



Cabin air quality in the aircraft environmental control design

The main and most powerful approach to removing contaminants on state-of-the-art aircraft is by air exchange. Outside air which is usually very clean, particularly during flight, is conveyed into the pressurized fuselage and approximately the same amount is discarded overboard by the environmental control system. The entire cabin air is exchanged with outside air every three minutes. As a prerequisite to maintain excellent air quality aboard aircraft, it is necessary to assure cleanness of the air delivered to the cabin. Consequently, it is important to know where the air is coming from and which way it moves from the outside environment into the cabin. An aircraft environmental control system performs three main tasks:

- 1] It supplies fresh air and, in connection with this, removes air pollutants from the cabin replacing used air,
- 2] It pressurizes the aircraft fuselage and,
- 3] It controls the temperature in the cabin and cools technical equipment.

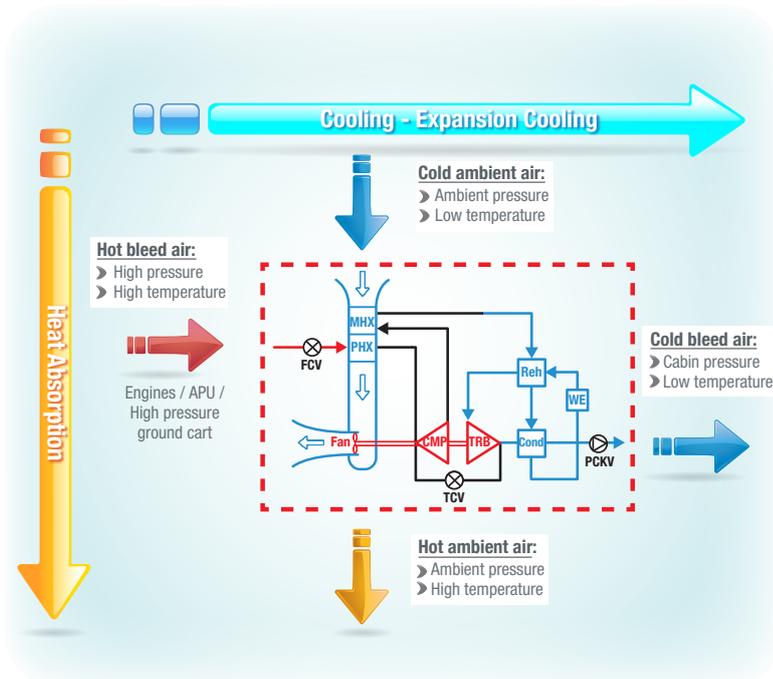
During flight, pressurized outside air is taken from the compressor stage of the engines (bleed air) upstream the combustion chamber, where temperatures up to 400°C can be reached, passed through a pre-cooler unit and conveyed to the “air conditioning pack” at a temperature of approximately 200°C. Alternative bleed air supply sources during ground, or near ground operations, supplying the air conditioning pack with pressurized and consequently hot bleed air, are the Auxiliary Power Units (APU) and High Pressure Ground Carts (HPGC).

The air conditioning pack (figure 2) cools the air to the required temperature using outside air (ram air) as the cooling medium and air cycle machines for compression and expansion cooling. This basic architecture is still the best proven technology for aircraft air conditioning systems with regards to efficiency, flexibility, reliability, installation space and maintenance costs.

A mixer unit, installed below the cabin floor in front of the centre wing box, mixes outside air with cabin air. The cabin air is taken from the under-floor area and drawn through recirculation filters by recirculation fans (figure 3). The quantity of re-circulated cabin air mixed with the outside air varies from 40% to 60% and improves efficient removal of heat loads at a moderate temperature gradient, and increases the humidity by making use of the cabin air. The latter contains humidity contributed by the passengers whilst outside air, being very cold, is almost completely dry.

Basic principle of an aircraft air conditioning pack

Figure 2



FCV: Flow Control Valve; PHX: Primary Heat Exchanger; MHX: Main Heat Exchanger; CMP: Compressor; TRB: Turbine; TCV: Temperature Control Valve; Cond: Condenser; WE: Water Extractor; Reh: Reheater; PCKV: Pressure Check Valve

After leaving the mixer unit, the air is distributed to different cabin zones. For each cabin zone, a different temperature can be selected. Trim air valves regulate the cabin outlet temperature by injecting small amounts of hot bleed air from the pre-cooler outlet (trim air).

Air cleaning technologies

Besides the air exchange with the outside air for efficient contaminant removal, additional technologies are necessary to avoid exposure to ozone from the operational environment and to exclude distribution of biological pathogens in the cabin with the re-circulated air.

During cruise at high altitudes, in particular on polar routes, the outside air may contain significant concentrations of ozone. To ensure a sufficiently low ozone concentration in the cabin, long haul service aircraft and even most of the short haul service aircraft, are equipped with catalytic ozone converters (see figure 4 on the following page). The ozone converters are installed in the bleed air ducting upstream to the air conditioning pack to ensure sufficient temperature levels for the catalytic process. Modern ozone converters, as introduced by Airbus in 2004, combine the ozone conversion with the ability to partially deplete kerosene vapours which might occur during ground operations to improve the olfactory perception.

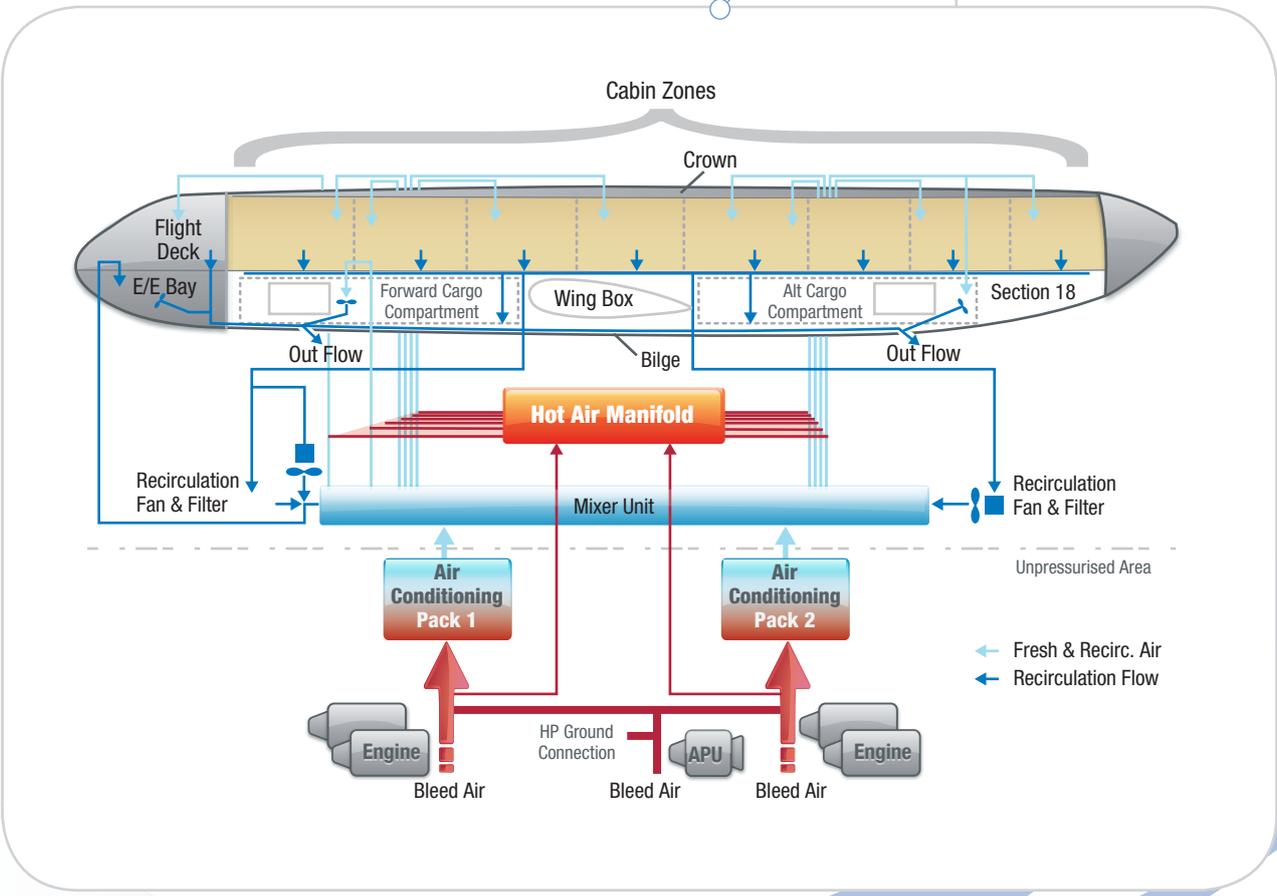
d definition

Olfactory: Relating to, or contributing to the sense of smell.

Olfactory perception: The sensation that results when olfactory receptors in the nose are stimulated by particular airborne chemicals.

Aircraft air generation and distribution system (here for an A340-600)

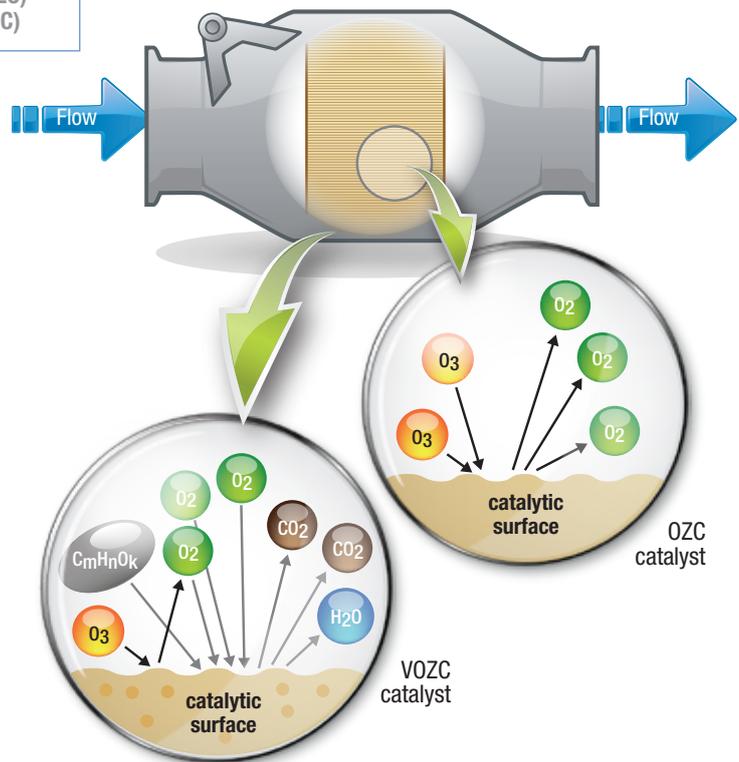
Figure 3



Simplified scheme of Ozone Conversion (OZC) and combined Ozone/VOC Conversion (VOZC)

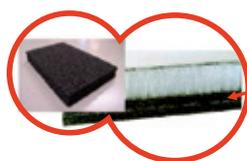
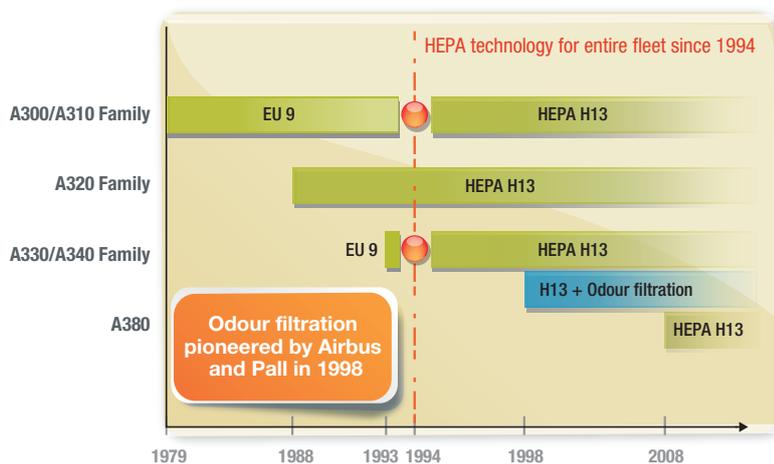
Figure 4

OZC: Ozone Converter
VOC: Volatile Organic Compound
VOZC: VOC/Ozone Converter
O₂: Oxygen
O₃: Ozone
CO₂: Carbon dioxide
H₂O: Water
C_mH_nO_x: Simplified molecular formula for organic compounds consisting of Carbon (C), Hydrogen (H) and Oxygen (O) atoms



Filtration technology installed on Airbus aircraft for re-circulated cabin air

Figure 5



Optional activated carbon layer in recirc filter as gaseous filter, developed by Airbus and Pall for long range aircraft in 1998.

Pall is one of the major filter suppliers for Airbus aircraft.

HEPA: High Efficiency Particle Arrestor
H13: HEPA classification (> 99.95% removal) according to European Norm EN1822
EU9: Filter classification (> 95% removal) according to European Norm EN779

Since 1988 on Airbus single aisle aircraft and since 1994 for the entire fleet (see figure 5), Airbus installs HEPA (High Efficiency Particle Air) H13 filters for the re-circulated air providing more than 99.95% filtration efficiency (for 0.3 micrometer particles as most penetrating particle size). Bacteria and viruses are effectively removed by these filters and hence, cannot be distributed by the ventilation system.

Sustainment of cabin air quality

Within the aircraft, air supply system areas with high temperatures are most critical with regards to air quality because high temperatures lead to evaporation and possibly to the breakdown of organic substances, in case these find their way into the high temperature areas.

Consequently, special care needs to be taken to avoid any contamination with materials susceptible to evaporation or deterioration in this area during design, manufacturing and operation of the aircraft.

A top priority is clean air supply, starting with the sources of pressurized air for the aircraft ventilation, engines, APUs and air conditioning systems. Since the 1990's, Airbus has defined additional requirements for bleed air cleanness on top of the requirements used for the certification of engines and APUs by the authorities. Airbus is promoting and supporting international research projects and working groups, to acquire independent external expertise and scientific knowledge by promoting best standards for an ideal cabin environment and its verification. Airbus is also involved during the validation of the verification strategy with APU and engine manufacturers, while supporting with its own measurements. Currently, a number of air quality measurements are conducted on the A380 flying test bed for the new A350XWB (Extra Wide Body) Trent engine.

These analytical capabilities were also used to tackle problems that could occur during production flights, which are conducted for each aircraft prior to delivery by Airbus. Any contamination introduced during manufacturing will become apparent when the aircraft air supply system is operated as a whole, and some parts of the bleed air system are subjected to the highest operational temperatures for the first time.

Recently a sophisticated measurement system was planned and installed on several A330/A340 Family aircraft, consisting of a unique online mass spectrometer (Ionicon PTR TOF-MS 8000) and a multifunctional sampling system (Fraunhofer IBP) to elucidate the origin of a particular smell that occurred during production flights only. The online mass spectrometer used is a unique combination of a Proton Transfer Reaction (PTR) ionisation method with a Time Of Flight-Mass Spectrometer (TOF-MS) as detailed in figure 6.

Simplified scheme of the proton transfer reaction and longitudinal section through the Ionicon PTR TOF-Mass Spectrometer

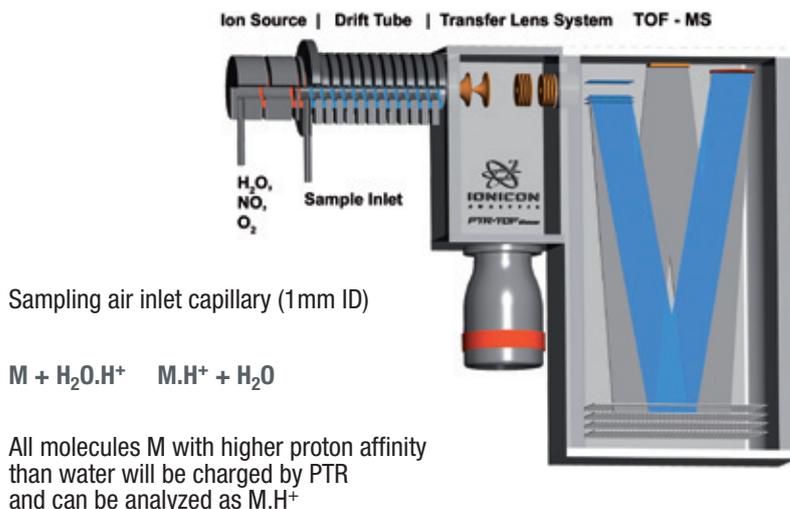


Figure 6

- H₂O: Water
- H⁺: Protonated Hydrogen.
- ID: Inner Diameter
- M: Molecule of interest
- NO: Nitrogen Oxide
- O₂: Oxygen
- PTR: Proton Transfer Reaction
- TOF-MS: Time Of Flight-Mass Spectrometer

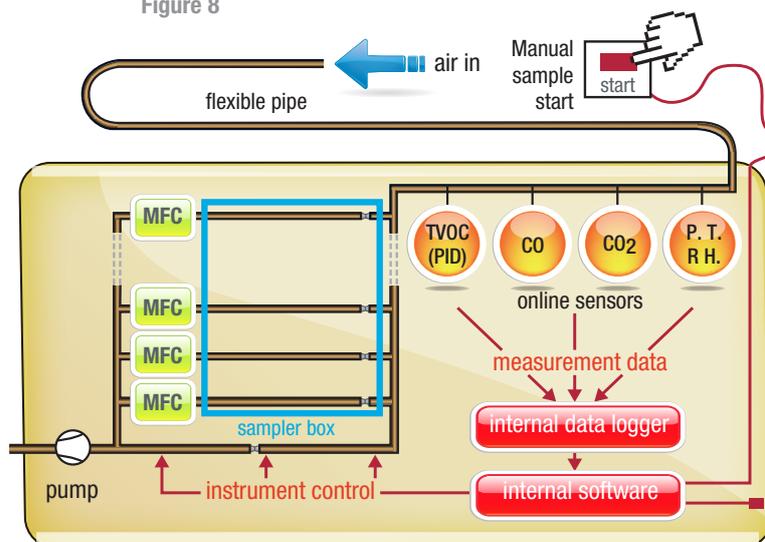
Installation of the PTR TOF-MS 8000 mass spectrometer on an A330 aircraft. The instrument weight is 200kg and the dimensions are comparable to a middle-sized refrigerator.

Figure 7



Scheme of sampling trolley with sensors and sampling tubes connected to a vacuum system. The flow through the sampling tubes is controlled by mass flow controllers and initiated by pressing a push button located in the cockpit.

Figure 8



The automated and self sustaining sampling system developed by Fraunhofer Institute for Building Physics (Fraunhofer IBP) consists of two trolleys and can be installed in galley compartments (see figures 7, 8 and 9). The trolleys contain up to 36 sampling tubes tailored for different compound classes and several sensors (e.g. for carbon monoxide and carbon dioxide).

MFC: Mass Flow Controller - **TVOC:** Total Volatile Organic Compounds
CO: Carbon monoxide - **CO₂:** Carbon dioxide - **P:** Pressure
T: Temperature - **R H:** Relative Humidity

Interface for data transmission

With this analytical system, a marker substance and finally the root cause for the smell could be identified unambiguously, based on the results of air quality measurements on the aircraft during flight (figure 10). Knowing the precise root cause and having clear evidence at hand, corrective actions could be implemented at the supplier which is manufacturing the component responsible for the smell, and will be further followed-up.

Installation of dedicated sampling trolleys in the A330/A340 Family aircraft galley area. The sampling hose is rooted to the cockpit and positioned at the fourth occupant seat.

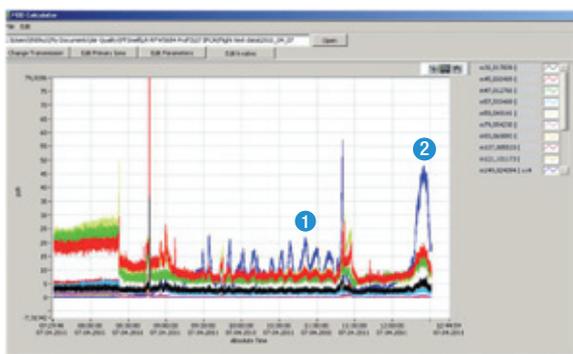


Figure 9

- Trolley with cartridges
- Trolley with pumps and sensors
- Sampling hose



Concentration of a marker substance indicating a particular smell in comparison with concentrations of a usual VOC spectrum



- 1 Pronounced component significantly higher concentrated than VOC background
- 2 Smell event

Figure 10

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Conclusion

Analytical methods will be further improved and new sophisticated analytical tools are continuously scrutinized to simplify measurements with the long-term objective to perform a complete analysis of the cabin air at the push of a button. Yet this objective of having a Star Trek-like device is still out of reach for years, if not decades. However, it is a tempting idea to combine sophisticated measurement technologies with established databases of contaminant patterns, in order to revolutionize troubleshooting and aircraft system monitoring. Airbus continuously reviews whether any air filtration or cleaning technology could add any value to the passengers, crews and aircraft operations. However, since the air provided

to the cabin during flight is very clean under normal operating conditions, and since the technical and environmental repercussions, as well as safety implications of installing such system into a highly optimized aircraft environment may be severe, the introduction of such technologies needs to be thoroughly justified. The impact on safety, crew and passenger comfort, and on side-effects on the environment, need to be carefully weighed to evaluate whether an added value for our society can be created. Rational decisions in design and operation of aircraft are key to safe air travel. Considering that civil aviation is still the safest mode of public transportation, this basic principle seems to work well so far. Let's take a fresh deep breath!





Space-Flex An innovative cabin option for the A320 Family

Every airline is concerned in providing comfort and the best level of service to its passengers, while generating more revenue seats.

Airbus has launched an innovative cabin option for the A320 Family fleet, named Space-Flex. This option, with first deliveries due in 2013, frees space for more revenue-generating seats by reconfiguring the rear of the aircraft, and by

making more efficient use of the volume at the rear of the cabin with a lavatory accessible to Persons with Reduced Mobility (PRM).

The PRM-friendly lavatory is facilitated via a simple conversion process.

In this article, you will find some of its features and you will already have an idea on how it will benefit Airbus operators.



Stefanie von LINSTOW
Aircraft Interiors Marketing Manager
Airbus Operations

Increase your cabin comfort and increase revenue

Market feedback from Airbus customers on the Space-Flex concept revealed in 2011 during cabin interior exhibitions has been very positive, not only due to the unique revenue and comfort benefits, but also by optimizing the cabin layout.

Airbus has therefore decided to launch Space-Flex as an option on the A320 Family aircraft.

By making more efficient use of the volume at the rear of the cabin, two lavatories plus a galley can now be efficiently accommodated in this space, providing the following advantages:

- Freeing-up space for, typically, three to six more revenue-generating passenger seats and/or an improvement in the seat pitch throughout the cabin,
- Offering two lavatories, each of comparable size to the existing A320's (i.e.: Larger than the competitors' lavatories),
- Providing one of the lavatories with a full access for 'Persons with Reduced Mobility' (PRM) where a wheelchair can conveniently be manoeuvred, for the first time in a single-aisle aircraft.

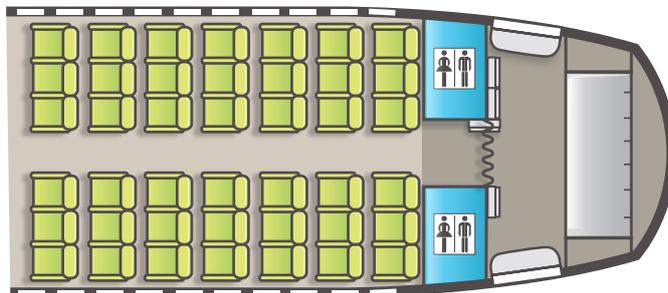


information

With an order from TAM Airlines, Airbus has officially launched the Space-Flex PRM (Persons with Reduced Mobility) lavatory as an option for A320 Family operators.

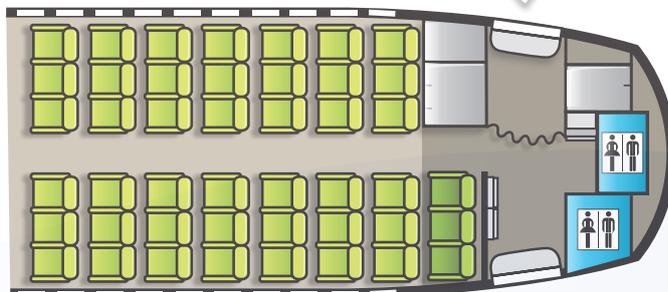
TAM Airlines will become the first Airbus customer to benefit from Space-Flex, creating more comfort for its passengers. TAM Airline's newly equipped aircraft with Space-Flex will be delivered as from the fourth quarter of 2013.

Current A320 rear configuration

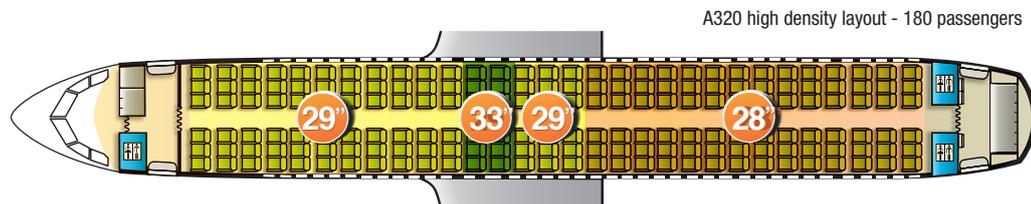
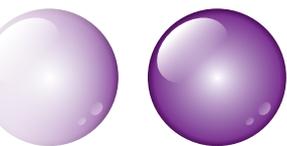


Current A320 rear configuration versus the Space-Flex option

Space-Flex option



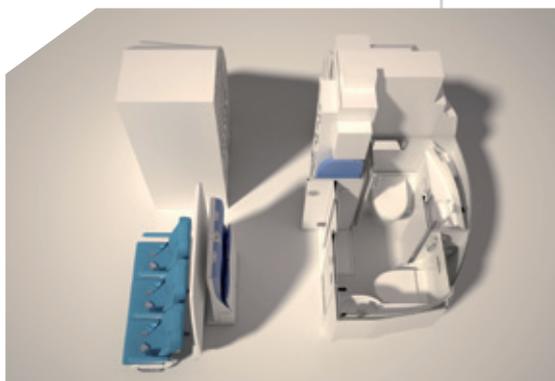
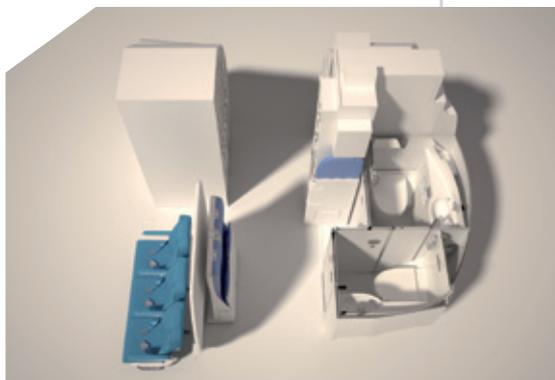
- › Gain of three seats
- › Use currently unused cabin space
- › PRM lavatory
- › Increased cabin comfort



A320 high density layout - 180 passengers

Identical forward cabin

Space-Flex PRM lavatory conversion process



The two different Space-Flex variants include a:

- Lavatory only configuration: Comprises a lateral and a centre lavatory separated by a rigid wall which can be deployed at your convenience, as well as a corresponding Space-Flex galley.
- Lavatory with a urinal configuration: With a lateral lavatory and a centre urinal, separated by a moveable rigid wall. The corresponding Space-Flex galley option offers a higher capacity than the first variant, and the urinal can bring advantages for a better hygiene and the passengers' satisfaction.

Basic and optional lavatory equipment remain the same as on the existing A320 Family lavatories.

Additional galleys with different capacities, on the right hand side before the aft door, can be selected. In this particular case, an airline would gain three additional revenue-generating passenger seats. However, without any galley installed before 'Door 4', the seat gain could even be of at least six additional seats. The total seat count, of course, must always remain within the existing exit limit.

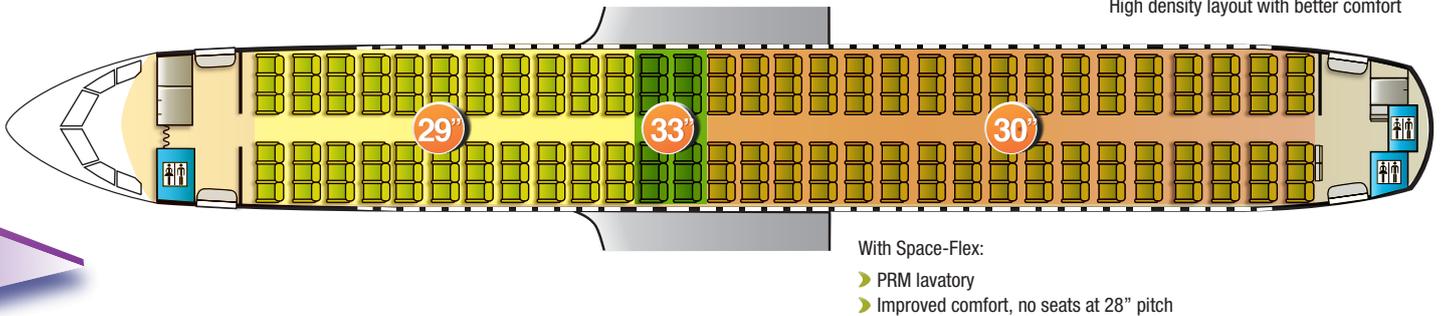
The 'PRM-friendly' lavatory is facilitated via a simple conversion process: Two single Space-Flex lavatories (or the one lavatory and urinal configuration) are convertible into one Space-Flex PRM enclosure in a similar manner to those delivered on the Airbus wide-body aircraft. During the concept development, Airbus conducted tests with European and North American experts, inviting wheelchair users to make sure that the lavatory was designed to reach the needs of the PRM users. Thanks to this and after having reviewed several criteria, some un-adapted elements have been detected and immediately improved. The resulting design is available today with Space-Flex. Airlines choosing the Space-Flex option will be in line with the U.S. PRM lavatory recommendation, and any PRM lavatory regulation that will be mandated in the future.

The entry-into-service is foreseen in autumn 2013.

The retrofit aspect of any innovation has to be taken into consideration to maximize the aircraft operators' benefits. Space-Flex will also be available for retrofit.

Space-Flex improves
the passengers' comfort

High density layout with better comfort



Operators will then be able to harmonize their A320 Family fleets and get the maximum benefits of Space-Flex. Whether the customers want to install additional revenue seats, add legroom by improving the seat pitch in their cabin, or simply comply with the PRM recommendations, Space-Flex is the answer.

Today, more than 3,700 A320 Family aircraft could be retrofitted with this solution. The concept has obtained a tremendous success with the majority of Airbus customers during the different exhibitions,

and Airbus Upgrade Services is already working with several major customers who envisage the retrofit of Space-Flex in their A320 Family fleets.

The Service Bulletin (SB) and the kits to embody the solution will be available two to three months after the Space-Flex introduction on the first production aircraft.

The Airbus Upgrade Key Account Managers will be able to give you more information regarding the integration of Space-Flex in your current in service fleet.

CONTACT DETAILS

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Conclusion

Space-Flex is an innovative A320 Family option maximizing the cabin revenue space, and is equipped with lavatories accessible to Persons with Reduced Mobility (PRM). The entry-into-service will occur during the 4th quarter of 2013 and will be proposed as a retrofit for the A320 Family aircraft.

This convenient concept, shown in several aircraft cabin interior exhibitions, has already found the interest of many operators which either, desire to add more revenue-generating passenger seats, wish to improve the seat pitch layout and want to offer the PRM-friendly lavatory for their passengers' satisfaction.



- "Hello everyone, this is your Captain speaking. We welcome you on-board this Fw 200 Condor flight to New York City! We wish you a pleasant flight and don't hesitate to ask our attendant if you would like refreshments, newspapers, the latest FAST magazine, or an ashtray.
- Ashtray? Did he say an ashtray?!!!"

Although they valued the cozy cabins in the past, they all would appreciate that most of the worldwide passenger commercial flights nowadays are non-smokers.

Airbus has even taken a step forward in cabin air quality for the comfort of the operators' passengers,

and you can read all the details in this FAST magazine at page 22.

Take a fresh deep breath and enjoy your flight on Airbus aircraft!

Courtesy of EADS Corporate Heritage



The Focke-Wulf Fw 200 Condor was a German aircraft equipped with four engines that entered service as a commercial aircraft. It was capable of carrying 25 passengers, separated in two cabins. It first flew in July 1937 after just less than one year of development. The Fw 200 Condor was the first airplane to fly non-stop between Berlin and New York City. The production ended in 1944 with a total of 276 aircraft produced.

Customer Services events

Just happened

A successful A330/A340 Family symposium

This symposium took place in Bangkok (Thailand) last June. During the three days, the symposium mainly focused on the fleet's performance optimisation with 34 Airbus specialists who have provided presentations on actual in-service issues affecting the A330/A340 Family fleet, as well as some subjects of more general interest.

This year's symposium gathered not less than 54 airlines, 20 vendors and six MROs (Maintenance Repair and Overhaul) organisations, representing a total of 174 participants.

Technical Data Support & Services symposium

This symposium will be held in Istanbul (Turkey) from 20th to 22nd November 2012. It will be focused on technical data related to maintenance & repair, spares & suppliers, Service Bulletins (SB) and flight operations. The targeted population is all tech data users from engineering and maintenance departments from airlines, MROs and a panel of suppliers which are also invited.

This event provides a comprehensive view on the current status of Airbus Technical Data, including planned improvements and future developments for all Airbus aircraft families.

For more information, please contact: miguel.coto@airbus.com.

Coming soon

Airbus Lessors Conference

This next conference will be held in Santa Monica, California (U.S.A.) from the 9th through 11th October 2012.

The agenda will focus on many important technical and future development subjects for Airbus aircraft. If you haven't received the invitations and agenda, please contact your Customer Support Director.

Material Matters - Airbus Material, Logistics, Suppliers and Warranty symposium

The invitations have been sent out for this symposium to be held in Bangkok (Thailand) from the 22nd to 24th October 2012. Airbus will share with their worldwide customers and major suppliers the latest developments and initiatives taken on lifetime support and first-class innovative services.

For registration, please use the link provided in the invitation you have received.

A380 symposium in Dubai

More than 150 participants are expected to participate to the upcoming A380 symposium which will be held in Dubai (United Arab Emirates) from 3rd to 6th December 2012.

The symposium will focus on fleet-wide A380 subjects, operational reliability, maintenance and flight operations. The invitations have been sent out in July to all the A380 customers.

Announcing the 11th Airbus Training symposium

Two years after the previous successful symposium which gathered over 375 delegates from more than 100 operators, Airbus Training organizes the 11th Training symposium in Dubai (United Arab Emirates) from 10th to 13th December 2012.

If you haven't received the 'Save the Date' notification sent out in July, please contact your Customer Support Director.



All the FAST magazines

are available free-of-access on: WWW.AIRBUS.COM/SUPPORT/PUBLICATIONS

Have fun and test your knowledge by answering this small quiz!

For AirbusWorld users, log-on to *AirbusWorld/What's new/News, events and publications* and answer the quiz online to try to win one of the 50 Airbus giveaways!

FAST magazine quiz

10 questions - 1 possible answer

The answers will be provided in the next FAST magazine edition.

1) When was the first FAST magazine published?

(clue in FAST 1)

- A. 1979
- B. 1983
- C. 1989
- D. 1995

2) What is the wing span of an A310? (clue in FAST 5)

- A. 41.5 m
- B. 42.1 m
- C. 43.9 m
- D. 44.6 m

3) What is the advantage of the Airbus Fly-By-Wire system? (clue in FAST 9)

- A. It saves weight
- B. It reduces complexity
- C. It increases the aircraft reliability
- D. All of the above answers are correct

4) I am an engineering tool used to design, integrate, optimize and validate vital aircraft systems such as the Electrical Generation, Hydraulic Generation, Flight Control System, Auto-Flight System, Warning System (ECAM) and the Centralized Fault and Maintenance System. What am I? (clue in FAST 24)

- A. The Test Bed
- B. The Iron Bird
- C. The Flying Prototype
- D. The Virtual Fly Test

5) Airbus received acceptance of the A380 Maintenance Review Board Report (MRBR) from the European Aviation Safety Agency (EASA) on which date?

(clue in FAST 38)

- A. 23 December 2005
- B. 17 September 2006
- C. 12 November 2007
- D. 4 July 2008

6) Which system on Airbus aircraft provides protection against fuel tank fire and explosion? (clue in FAST 44)

- A. Fuel Tank Extinguishing System (FTES)
- B. Fire and Explosion Prevention System (FEPS)
- C. Fuel Tank Inerting System (FTIS)
- D. Fuel Valve Bypass System (FVBS)

7) What happened on 1 February, 2008? (clue in FAST 46)

- A. Airbus completed a flight non-stop around the world with an A380
- B. Airbus completed the world's first ever flight by a commercial jet (A380) using synthetic liquid jet-fuel made from natural gas (GTL)
- C. Airbus launched its new A350XWB programme
- D. Airbus sold its 5,000th A320 Family aircraft

8) What is the name of the tool especially developed by the Airbus Structures Test Domain for the A320 impact calibration campaign, which is now used for the impact threat evaluation for the A350XWB composite fuselage?

(clue in FAST 48)

- A. MICKEY
- B. RATATOUILLE
- C. YOGI
- D. GUISMOT

9) The radio altimeter is used to provide an accurate height above ground level when the aircraft is between?

(clue in FAST 49)

- A. 0 and 1,000 feet
- B. 0 and 2,000 feet
- C. 0 and 2,500 feet
- D. 0 and 3,000 feet

10) What is called the innovative cabin option for the A320 Family aircraft? (clue in FAST 50)

- A. Space-Flex
- B. Spice-Flex
- C. Space-Flux
- D. Spice-Flux

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Please don't hesitate to contact us with your comments at fast.magazine@airbus.com



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