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April 2017

#59

FAST

Flight Airworthiness Support Technology

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The ground handling challenge

04

Saving time and money

N-Tracking for flights

10

Smarter tracking for decision-making and analysis

Transferring aircraft between operators

16

Key factors for successful handovers

Staying on line

24

Eliminating unwanted offset from the steering system

FAST from the past

30

Around the clock, around the world

31

Field representatives

The ground handling challenge

Saving time and money

Over the last 20 years, turnaround time has become a strategic challenge in operations due to increasing competition between airlines and due to airport congestion; less time on the ground means more time generating income, and subsequently greater profitability of the airlines.

Ensuring training and best practices of ground handling staff can help eliminate many issues, in particular those relating to service and cargo doors, thus avoiding unnecessary time and costs of aircraft on the ground.

Article by
Serge KIYMAZ
Structure Engineer
AIRBUS
serge.kiyaz@airbus.com



The risk in the race to reduce turnaround time is that corners may be cut, correct procedures not respected, and consequences may actually be time-consuming and expensive to fix.

The most spectacular examples are collisions with Ground Support Equipment (GSE) such as stairs, catering trucks and cargo loaders.

Damage caused by collision with Ground Support Equipment



However, thanks to new generation GSE and ground personnel training, these major occurrences are decreasing. Despite this, statistics show that an increasing number of less obvious incidents concerning the access/service doors and cargo doors are starting to emerge, with incorrect ground handling practices being the cause.

Isolated minor mishandling procedures do not appear particularly serious, and yet when repeated cycle after cycle, they create fatigue and eventually damage the aircraft.

A better knowledge of the precise areas most commonly damaged by non-respected ground handling procedures will help to alleviate these costly repairs.

Damage to a fuel panel following incomplete latch engagement



Access/service doors

Access/service doors are used for various purposes such as refuelling, hydraulic fluid servicing, potable water/toilet/waste servicing and cabin air conditioning. They are mainly located under the belly of the aircraft and therefore highly exposed to ground personnel, carts and GSE traffic.

Without being specific to any type of aircraft family, there are 2 main types of damage:

- **Damage to latches due to the use of sharp tools.**

Using sharp tools such as screwdrivers to open latches is a commonly 'accepted' practice for ground handling personnel. However, this practice gradually damages the latch which, if it eventually breaks, renders the door inoperative and often leads to delays until it can be replaced.



- **Incomplete closure of access/service doors.**

Incomplete latch engagement due to dirt accumulation/latch damage/human error may lead to the door opening in flight and potential damage/loss of the door.



Airbus maintenance data shows that each aircraft family has specific areas that suffer from irregular ground handling practices:

A320 Family

- Waste service panel 172AL is experiencing latch corrosion and failure.

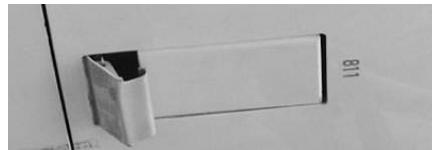


This is caused by improper cleaning after servicing. The corrosive deposits/spillage left during waste servicing slowly attack the latch/hinge material and potentially lead to their failure.

Airbus recommends rinsing the whole waste servicing area with water to remove all contamination.

A330/A340 Family

- Avionics door flap is found deformed, which may disable the locking system; in turn, this may trigger an ECAM* open flap warning which could potentially lead to an in-flight turn back.

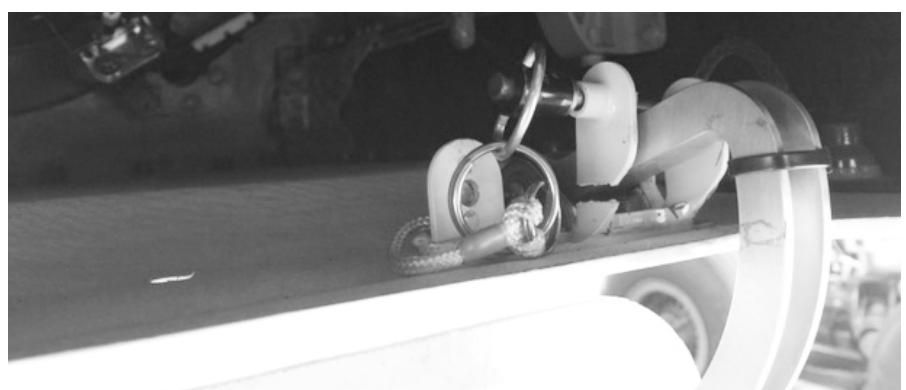


Airbus recommends operating the handle as shown in the Aircraft Maintenance Manual (AMM) to avoid damage.

*ECAM - Electronic centralised aircraft monitor

A350

- Belly fairing access panels with a 'hold open' device are being damaged on the internal hold open bracket. Investigations have shown that the locking pin is not removed prior to door closure and that the bracket's lugs are sheared off.



Airbus recommends removing the locking pin before door closure, as shown in the AMM.

Cargo doors

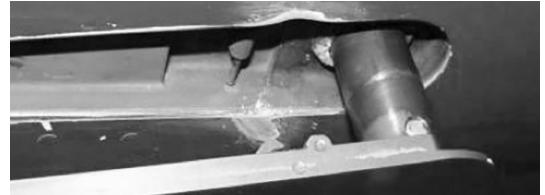
Cargo doors (including the bulk cargo door) and their surroundings are recognised as frequently damaged areas by cargo loader collisions during turnaround time.

In some cases, however, mishandling by ground personnel can damage specific areas on the following aircraft:

A320 Family

- The bulk cargo door handle housing sustains chaffing damage when the handle is rotated and stowed at the same time. This mishandling could be caused by the access platform being too small.

If this action is repeated and not repaired, then the door skin may be damaged and the handle housing could puncture, leading to cabin pressure leaks.



- Cargo door proximity sensor is displaced.

During loading the cargo loader bumper may touch the proximity sensor and its bracket, bending it slightly and/or unseating the wiring connector from the sensor.



This may generate 'cargo door open' warnings during taxi/climb and subsequent delays/in flight turnback.

A330/A340 Family

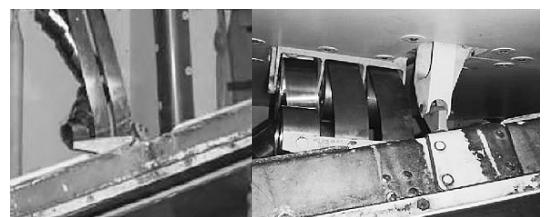
- The bulk cargo door 'hold open' mechanism is damaged due to mishandling. When opening and stowing the bulk cargo door, the handle is not positioned back to the LOCKED position and is thrown open with excessive force, striking the 'hold open' mechanism.

Once the damage has been initiated, it will worsen at each opening. If the damage is left unrepaired and is repeated, the 'hold open' mechanism could be completely destroyed and the bulk cargo door primary structure will be affected, potentially leading to costly repairs or its replacement.



- The bulk cargo door balance mechanism springs are found entangled and consequently inoperative.

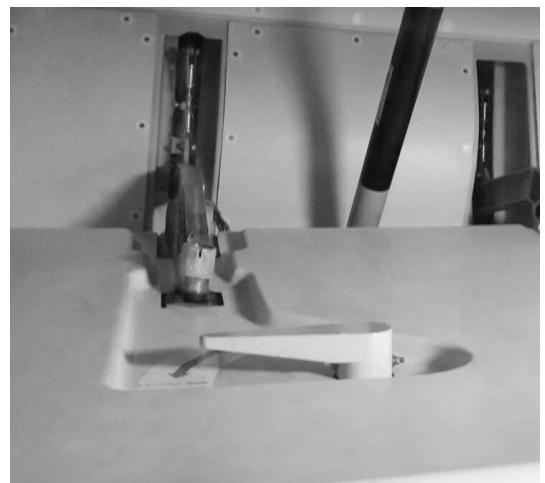
This happens when cargo hold area divider nets are not used, allowing cargo items to fall on the balance mechanism and/or when the bulk cargo door is opened too fast without care.



A380 and A350

- The bulk cargo door experiences a hinge arm disconnection. This happens during the door closing sequence.

This type of event may happen if the 'hold open' mechanism is locked and the bulk cargo door is forced down for closure.





CONCLUSION

Good ground handling practices are essential to ensure smooth aircraft operations without interruption and without incurring additional operating costs.

Attention needs to be focused on the fact that 'bad habits create big burdens'. Actions such as opening a latch using a screwdriver, or skipping waste service panel cleaning to save time may be regarded as 'acceptable and common' practices, but they often result in a grounded aircraft because of the damage they cause. Inappropriate handling and/or lack of training can lead to extremely costly issues; a wrongly handled A330/A340 bulk cargo door may lead to its replacement (up to 280,000 USD). Regular deterioration to latches leads to replacement and may eventually result in an access/service door detachment in flight.

In addition to the recommendations listed above, the Airbus Training Centre provides a ground handling course to help airlines and ground service providers improve the quality of ground handling.

*For further information on ground handling training,
contact Airbus Training at commercial.training@airbus.com*

N-Tracking for flights

Smarter tracking for decision-making and analysis



Article by

Thomas STANISLAWIAK
Head of Portfolio Development
& Innovation
NAVBLUE, Toulouse
thomas.stanislawiak@airbus.com

N-Tracking is a flight tracking application, developed by NAVBLUE, in response to new requirements from the International Civil Aviation Organisation (ICAO) which will be applicable in November 2018. This tracking tool detects and shares information about abnormal aircraft behaviour, enabling decision-making to help alleviate issues and to contribute to safety.

Why track a flight?

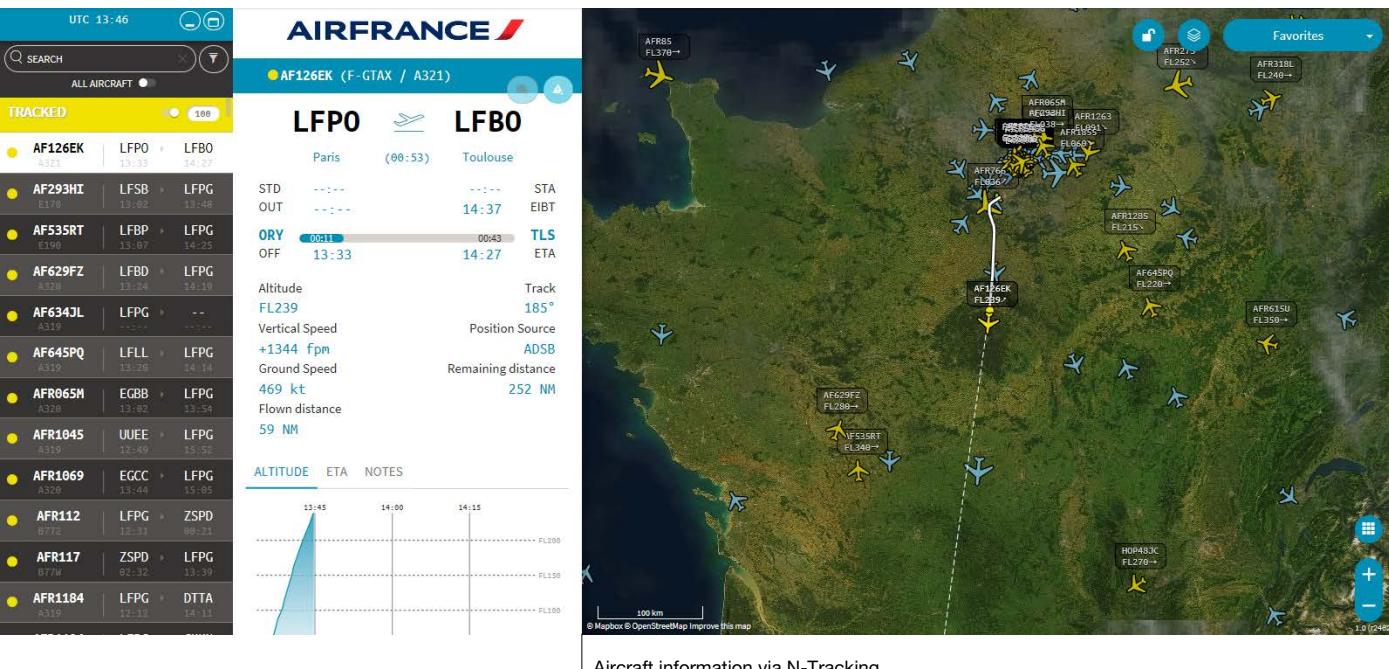
The push to track commercial flights grew after the loss of the Air France Rio-Paris flight in 2009, but gained unprecedented momentum after the disappearance of the Malaysia Airlines flight MH370 in 2014. Two months after the incident, the international civil aviation community, led by International Civil Aviation Organization (ICAO), established the Global Aeronautical Distress and Safety System (GADSS) and recommended establishing standards.

The standards require every airline to record the location of all flights every 15 minutes during normal operations, as of November 2018. Airlines are left to decide individually how to meet this requirement. In the longer term, ICAO is looking to also develop requirements for abnormal and distress tracking. This will require more development time, due to the complexity and potential reliance of these standards on new technologies.

The NAVBLUE N-Tracking solution

Background

Participating in the ICAO Working Groups tasked with defining standards for abnormal situations, NAVBLUE developed this flight tracking solution enabling airlines to comply with the expanded ICAO requirements that come into effect in November 2018.



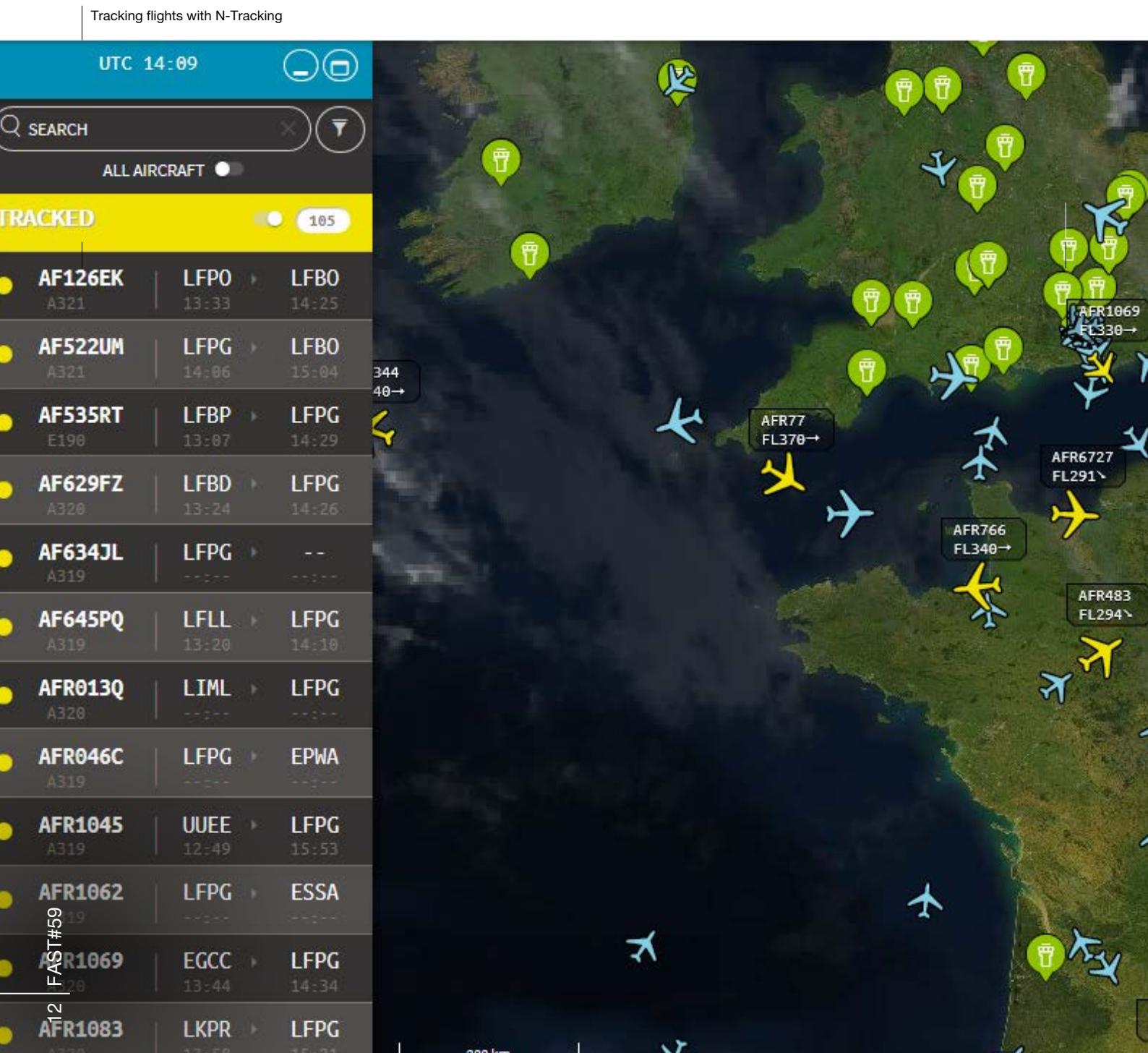
NAVBLUE collaborated with dispatchers and maintenance engineers in various airline Operation Control Centres (OCC) to learn how they track fleets and communicate with aircraft and to incorporate their needs.

N-Tracking is a web-based application that is compatible with most common web browsers facilitating communication between commercial, operational and maintenance staff. As all parties work from shared, identical information, collaborative decisions are easier to make.

The most accurate and cost-effective solution

In order to track fleets, some airlines prefer to use solely ACARS* reports, which can be costly as each message has a fee associated with it. As oceanic or remote regions do not have ADS-B* receivers, N-Tracking obtains the position of the aircraft by merging ADS-B data from Flightradar24* with ACARS data. Technology specialists at NAVBLUE believe that taking advantage of ADS-B data, which covers the majority of the flight area, and utilising solely ACARS data for oceanic and remote areas, provides the most accurate and cost-effective flight tracking solution. For ADS-B data, NAVBLUE has partnered with Flightradar24, a Swedish company with by far the widest coverage in the market.

In the N-Tracking user interface, all aircraft are displayed on a map in one of three intuitive colour codes: yellow for own fleet, blue for other aircraft moving to/from an airport of reference, red/amber alerting to own aircraft's deviation from its expected location. Deviations could include events such as loss of position, significant altitude change or excessive vertical speed. By clicking on symbols representing their aircraft, dispatchers can obtain other data elements such as ETA*, altitude, vertical speed, ground speed and flown distance to help manage their fleets more proactively.



NAVBLUE

N-Tracking also provides multiple overlays of weather information such as FIR*, tropical cyclone, wind pressure data, METARS*, Satellite, Radar, SIGMETS*, AIRMET* and PIREPs* to provide a holistic visual of the aircraft's actual flying conditions for situational awareness.

For weather information, NAVBLUE has partnered with Schneider Electric, an industry leader in weather forecasting.

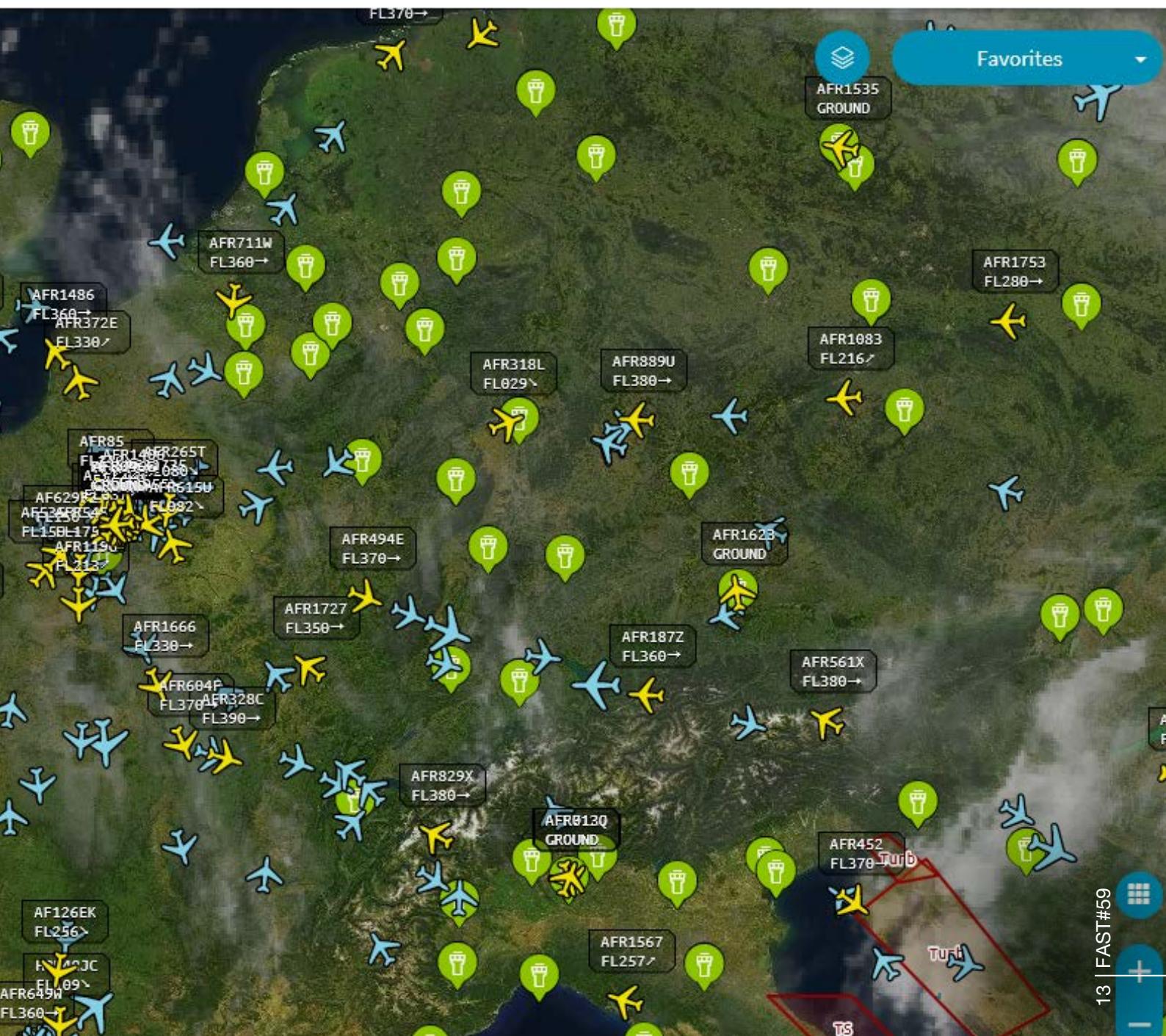
NAVBLUE is a wholly-owned subsidiary of Airbus and a key unit of Services by Airbus*, providing a new generation of digital, user-friendly flight operations and air traffic management solutions.

NAVBLUE's portfolio integrates the existing product offer of Navtech*, supported by Airbus ProSky's air traffic management solutions, as well as Airbus' flight operations innovations such as ROPS* and FlySmart*.

The NAVBLUE solutions and services are not just limited to Airbus aircraft, but are also for mixed fleets and are built on the knowledge and expertise of Navtech.

The products support both civil and military environments, on the ground or on board any aircraft. Following the same product philosophy, N-Tracking has been developed to track any aircraft, regardless of the manufacturer.

* See glossary

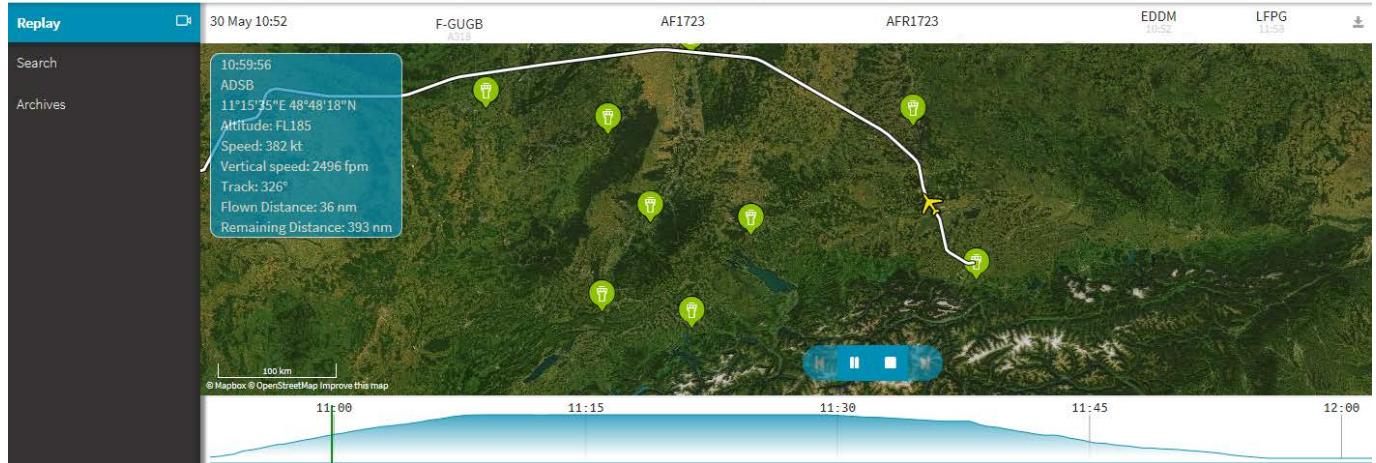


Tracking and recording for flight analysis

N-Tracking displays the flight plan and tracks the aircraft's position against it. It is highly compatible with N-Flight Planning from NAVBLUE's N-Software services family. N-Tracking is capable of reading flight plans in XML format (standard ARINC633).

A key feature of this application is that it records and plays back an aircraft's actual flight path taken against its planned path, thus helping airlines to capture valuable fleet performance information for later reporting and analysis (either in CSV or TXT format). A historical display of the aircraft's previous positions can also be viewed with the click of a button.

N-Tracking's Collaborative Decision Making (CDM) module



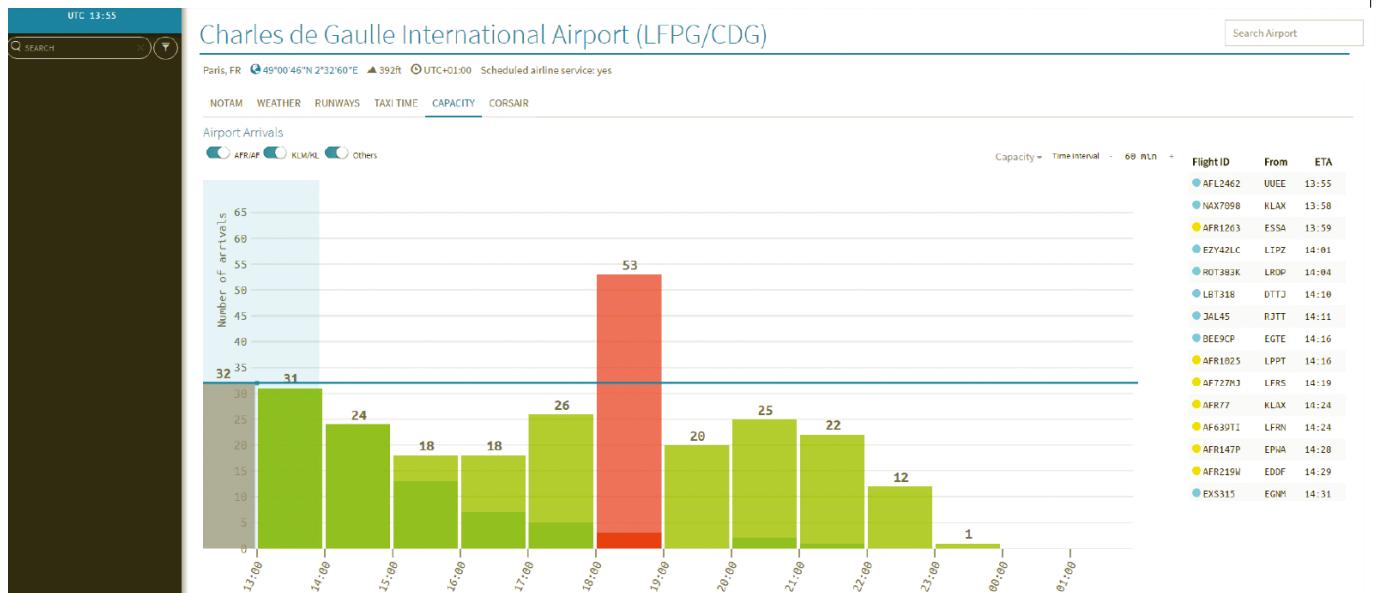
Real-time updates and decision-making module

N-Tracking automatically downloads NOTAM*, TAF* and METAR information. It checks NOTAMs in real-time and whenever a current flight is affected by a NOTAM update, a notification will be displayed to indicate that the flight watcher or dispatcher should check and possibly take actions regarding this NOTAM (for example, ILS* unserviceable, or runway closed).

NAVBLUE incorporated a Collaborative Decision Making (CDM) module. The CDM is a true decision support platform that provides web-based access to operational data to improve operational efficiency. It does this by providing a configurable look ahead at the airlines' flight operations for a particular airline hub. It enables an airline to estimate the expected holding time per hour (average, maximum and total), based on the current capacity at the airport. A simple action that can be taken by the flight operations team is to instruct the pilot (via the chat function) to reduce the aircraft's cruising speed in response to airport congestion. Additionally, if identified far enough in advance, the aircraft's fuel can be adjusted accordingly to account for specific holding durations.

- Landed flights
- Inbound flights not landed yet – landing demand below airport capacity
- Inbound flights scheduled – landing demand below airport capacity
- Inbound flights scheduled – landing demand exceeding airport capacity: holding and flight delay expected
- Inbound flights not landed yet – landing demand exceeding airport capacity: holding and flight delay expected

Recording and replaying a flight with N-Tracking



Features:

- Aircraft position display (Map)
- Flight list
- User alerts
- Aircraft chat
- Weather information
- Airport information
- Recording and replay capability

Flight attributes:

- Aircraft identification
- Aircraft type
- Departure airport
- Arrival airport
- Estimated time of arrival
- Position report information (latitude, longitude, altitude)
- Time of last position report
- Flight plan information merge

CDM (Airport related information):

- NOTAM
- Weather information (TAF/METAR)
- Runway information
- Average taxi time
- Capacity information for the airline selected airport(s)

CONCLUSION

N-Tracking, with its utilisation of both ADS-B and ACARS data, offers a simple, cost-effective flight tracking application that enables airlines to comply with future ICAO requirements. On top of this, it also offers powerful airport capacity intelligence via the CDM Module. ■■■

*** GLOSSARY**

ACARS - Aircraft Communications Addressing and Reporting System

ADS-B - Automatic Dependent Surveillance–Broadcast

AIRMET - Airmen's Meteorological Information

ETA - Estimated Time of Arrival

FIR - Flight Information Region

FlightRadar24 - Live flight tracker that shows air traffic in real time

FlySmart - A set of hardware and software that optimises operations through flight operations, maintenance, ground and cabin solutions used onboard aircraft.

ILS - Instrument Landing System

METAR - Meteorological Terminal Aviation Routine Weather Report

Navtech

A leading global provider of flight operations solutions, acquired by Airbus in December 2015 and now integrated in NAVBLUE.

NOTAM - Notice to Airmen

PIREPs - Pilot Reports

ROPS - Runway Overrun Prevention System

Services by Airbus

A business unit within Airbus' Customer Services operation, bringing a more integrated approach for worldwide operators and reinforcing the company's service offering. Areas of focus include flight hour packages; material services; flight operations; training; upgrades for cabin, airframe and systems; digitalisation.

SIGMET - Significant Meteorological Information

TAF - Terminal Aerodrome Forecast

Transferring aircraft between operators

Key factors for successful handovers



Transferring an aircraft to a new operator requires numerous steps with the involvement of several stakeholders. Detailed preparation and coordination are key factors to ensure a successful handover in a timely and cost efficient manner.

Although the industrial setup can be prepared in advance, it requires the utmost attention at all stages, as each and every aircraft transfer has its own specificities and/or difficulties.

With its sound industrial setup and procedures for aircraft transfers, Airbus can ease the process by offering tailored solutions adapted to its different customers.



Article by (left to right)

Erick CIRILLO

Director, Embodiment Operations
AIRBUS

Emmanuel RAHM

Fleet Manager Embodiment Operations
AIRBUS

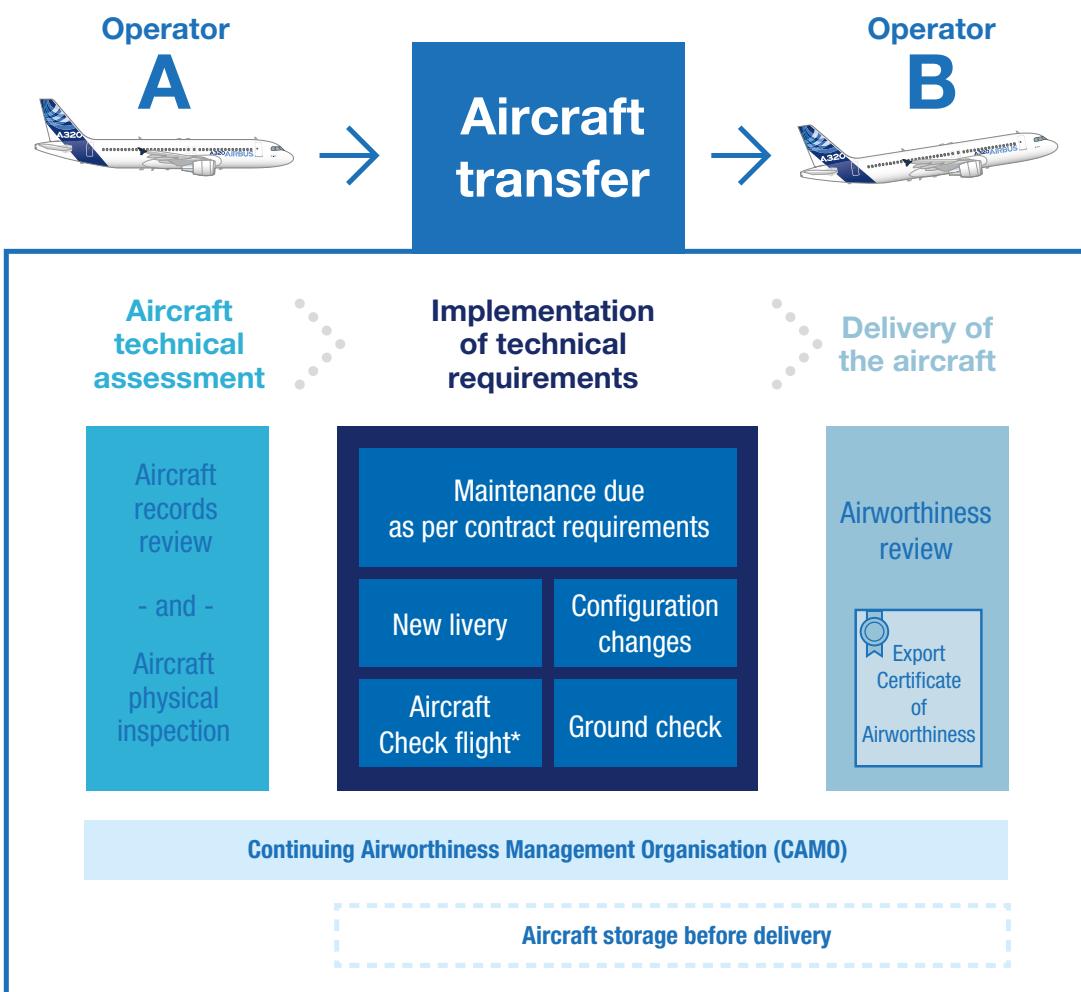
Aurélien PERSON

Fleet Manager Embodiment Operations
AIRBUS

turnkey.services@airbus.com

Contributing stakeholders

Different stakeholders who may be involved in a transfer include the aircraft owner, the previous operator, a maintenance organisation, paint shops for livery change, Continuing Airworthiness Management Organisations (CAMOs), the service bulletin provider, the next operator's planning and engineering department, and the relevant airworthiness authorities. Ideally, these stakeholders need to work on the aircraft transfer in a very limited time frame, the common goal being to get the aircraft back into operational service, with its new operator, as soon as possible. (read more about CAMOs and MROs on page 19).



The procedure timeline

The aircraft transfer procedure starts with a physical inspection of the aircraft and of its records supplied by operator A. The aim is to ensure that the aircraft meets contractual conditions and airworthiness requirements.

During the next phase, the aircraft may undergo configuration changes relating, for example, to livery, cabin or systems upgrades. At the same time, maintenance checks are carried out, in line with delivery contractual requirements. The CAMO manages the airworthiness of the aircraft and issues the work orders to the MRO, updating the aircraft records accordingly.

Upon the MRO release of this work package, the aircraft is tested on ground and in flight. The airworthiness review is conducted to obtain the Export Certificate of Airworthiness.

During the delivery process to operator B, the aircraft and its records are inspected again, to ensure that they match re-delivery conditions.

*Check flight

Often an airworthiness authority will require that the next operator carries out a Check flight prior to the aircraft being registered in the importing country. This check is also part of most contractual re-delivery conditions to the next operator.

The purpose of a Check flight is to test the aircraft's systems, cabin, and In-Flight Entertainment in real conditions, observing their behaviour and recording parameters.

If these parameters are in their nominal range, the aircraft is technically acceptable.

Assessing the aircraft's technical status

Aircraft physical inspection

The aircraft physical inspection takes place during the re-delivery check and at operator A's location and ensures that the aircraft meets its contractual requirements.

Among others, this visual inspection checks:

- Items beyond normal wear and tear in the cabin, any fuel or hydraulic leaks
- That brakes and tyres are not worn beyond contractual provisions
- That structural repairs are reported in the aircraft records
- That part numbers and serial numbers are identical to those listed in the aircraft records (by sampling)

The physical inspection protocols highlight equipment to be visually checked in every aircraft area, thus avoiding the possibility of overlooking or duplicating an inspection item. All discrepancies are added to a Defect Item List that is delivered to the operator for rectification by the MRO.

Review of aircraft records

Aircraft records must be checked against airworthiness and contractual requirements.

For an aircraft which has accumulated many years of operation, the volume of records in paper format can be as much as 15m³, weighing several tons. As each operator has its own way of working, the records can come in different languages, forms and means. In addition, the way the records are sorted differs widely from one operator to another. The task of checking records usually takes place at the previous operator's premises, or at the MRO location. In both cases, it often involves travel and several weeks at the on-site location. For operators not equipped with dedicated teams for aircraft returns, this can represent a significant workload which comes in addition to the day-to-day activity of a maintenance control centre and planning and engineering department.

Despite the constraints involved, this paperwork is of paramount importance as it provides evidence of all maintenance interventions on a given aircraft since its initial delivery from the Final Assembly Line. These records are then used as the basis for the physical inspection to check if the aircraft corresponds. They also form part of the supporting documents required when applying for a Certificate of Airworthiness and must be complete and accurate, as any shortfall may delay the issuance of the certificate for the next operator.

Implementing technical requirements

Due maintenance

The aircraft must be prepared to meet the contractual return/delivery conditions. This may include completing scheduled maintenance tasks, airworthiness directives, service bulletins, and defect rectifications.

Configuration changes and new livery

In preparation for the aircraft transition for the next operator, cabin changes may be needed. These may go from simple carpet and seat cover replacement to a full reconfiguration including seats, galley changes, seating capacity certification, and even IFE replacement.

The minimum configuration change for the next operator is a new external livery and systems upgrades to meet regional regulations, but very often this also includes cabin upgrades in order to rebrand the cabin interior.

To comply with airworthiness regulations, these configuration modifications need to be developed by a DOA Part 21 J organisation able to produce service bulletins, along with a DOA Part 21 G organisation that is able to manufacture the kits and parts needed for the modifications. Last-minute changes being quite common, it is advisable to have a flexible set of solutions prepared.

The pre-requisite for developing these modifications is a good knowledge of the aircraft configuration and control of the pre-modification aircraft status. This encompasses both the configuration when the aircraft left the production line, as well as the list of modifications embodied by the previous operator(s) since the aircraft was manufactured. Configuration changes are reported to Airbus by operators and MROs throughout the aircraft's life.

Check flight and Ground check

When the next customer is identified, contractual requirements generally demand that the aircraft be inspected and tested, both on the ground and in flight. This is to ensure that the aircraft complies with the delivery conditions of the next customer and the aircraft systems and engines are performing as expected.



The Design Organisation

It is in charge of the engineering and certification of the aircraft modifications, including cabin, systems and avionics. Airbus holds a Design Organisation Approval (DOA) and is recognised as complying with the requirements of Part 21 Subpart J.

Delivering the aircraft

During the implementation of the technical requirements and the configuration updating, all stakeholders are under pressure to get the aircraft into operational service with its new operator as soon as possible. Interruptions in these steps may delay the aircraft delivery planning and have a significant financial impact on one or more of the stakeholders.

The delivery phase of the aircraft to operator B encompasses activities including aircraft inspection by operator B and its airworthiness authorities, Check flight, airworthiness review and final touch-ups as required.

Very often, the pressure on the project team reaches a peak at the delivery phase. This is when the real benefit of anticipating and coordinating is most keenly felt.

Continuing Airworthiness Management Organisation

The role of the CAMO during aircraft transfer

The continuing airworthiness activities for an aircraft in transition are different from those required for an aircraft in operation. The responsibility for managing the airworthiness of the aircraft is taken from the previous operator and the CAMO must be able to quickly identify all maintenance actions necessary to maintain and control the airworthiness of the aircraft, until its re-delivery.

CAMO Part M Subpart G & I regulation

Since September 2008, all air transport aircraft registered under a European Aviation Safety Agency (EASA) member state have to be managed by a CAMO*. This includes commercial as well as non-commercial aircraft (parked, stored or corporate jets).

The Continuing Airworthiness Management Organisation (CAMO) must demonstrate to the authority (EASA or their National Aviation Authorities (NAA)) that they are continuously compliant with all relevant rules for the concerned scope, and then the authority may grant and maintain an approval to the organisation.

Part M Subpart G - CAMO

The Part M Subpart G defines all activities to be undertaken by a CAMO organisation,

- Definition of pre-flight inspections
- Rectification of defect and damage (MEL, CDL)
- Compliance with an approved maintenance programme
- Analysis of maintenance programme effectiveness
- Embodiment of airworthiness directives and Service Bulletins
- Approval of repairs
- Definition of a modification policy
- Check flight procedures

Part M Subpart I - Airworthiness Review Certificates (ARC)

The Part M Subpart I defines the requirement for an approved organisation to issue Airworthiness Review Certificates, and the issuance of Certificates of Airworthiness (CofA) and Export CofA.

*Airbus is a certified CAMO since 16/04/2009

Maintenance, Repair and Overhaul organisation

The role of the MRO during aircraft transfer

Maintenance organisations are key players in aircraft transfers. It is these organisations that physically prepare the aircraft for its next operational life. The maintenance organisation can be either the operator's MRO or any contracted MRO with the appropriate rating. In both cases, a close relationship and monitoring of progress against the aircraft transfer planning is essential. Changes to this planning could have repercussions on the operating start date of the next operator.

For an aircraft in operation, maintenance checks are scheduled some time in advance, and unscheduled maintenance or additional tasks are anticipated in the schedule to minimise turnaround time.

Unlike scheduled maintenance inputs while the aircraft is in operation, the work package for an aircraft to be transferred is the basic work package, plus a variable amount of additional work that may be required during the transfer phase. This additional work is driven by the next operator's requirements or findings during the acceptance checks, the requirements of the airworthiness authorities, or the configuration change.

In some cases, the aircraft's operational availability is disrupted for several weeks by maintenance and conversion. However, in the case of a leased aircraft there may be an additional delay if the lessor does not yet have a new lessee. In this event, the aircraft is stored at an MRO, or any suitable location where an MRO has access to it.

The management of work performed by the MRO during the transfer phase is key to keeping the planning under control. This involves resource allocation and work package preparation, but also implementing ways of working with all the stakeholders present on the MRO premises at the same time.

Airbus aircraft transfer solutions

With its robust industrial setup and efficient procedures, Airbus can facilitate the transfer for customers by being their single point of contact.

The Airbus transfer service coordinates stakeholders and manages part or all of the process, including planning & resource management and technical & airworthiness activities. This customizable service agreement offers end-to-end accountability for the transfer until final aircraft delivery.



Airbus has been a certified CAMO since 2009

Aircraft records and physical inspection

To ease the burden of collating aircraft records, Airbus can set up an IT system with the previous operator, which is usually web-based, for remote access to the records. The system requires the scanning of all paper records, with Optical Character Recognition capability enabling searches by keywords wherever possible. This feature helps retrieve evidence of accomplished tasks such as airworthiness directives, service bulletins and repairs.

The previous operator's planning & engineering department then receives the list of deviations from contractual and/or airworthiness requirements which must be answered and/or rectified in almost real time. This way of working with a web-based, remote-access IT system, especially on a difficult transfer, offers a win-win situation for all teams.

The physical inspection protocols are customized taking into account the aircraft age, environment, and operating conditions.

The list of discrepancies raised by the physical inspection are compiled in a electronic file, with a picture, location of the defect & technical proposition for its resolution by the MRO. The file is shared on a collaborative platform, and the evolution of snag rectification can be monitored by the project stakeholders, whether they are in situ or not.

Configuration changes

Configuration changes to an aircraft are reported to Airbus throughout its life. This data is key in determining modifications and drawings required to go from a pre-modification to a post-modification aircraft. This aircraft configuration database helps reduce engineering studies and avoid last-minute adjustments or corrections, although it is still necessary to check the accuracy of the data reported.

In addition, pre-modification studies may come from several aircraft at the same time, to create a single post-modification configuration. This can be helpful when, for example, several aircraft come from different operators and regulatory environments, but will eventually be operated by a single operator after the transfers.

Airbus is able to propose, for each aircraft, a tailored package of modifications to arrive at the definition requested by the next operator/customer.

Livery change

Airbus helps reduce livery change/painting time, thus aircraft downtime, with the development of graphic tools (see FAST #56 August 2015 edition).

Airbus livery solutions reduce aircraft grounding time by about 20% compared to traditional methods, with Mylar™ decals and adhesive stencils to save time at the plotting-out stage.

The result is that any paint shop can attain Airbus' final assembly line quality, and the livery toolkit delivered allows a repeatable process and results.

The Airbus CAMO can adapt its activity specifically for aircraft transitions.

The Airbus CAMO has been granted Part M Subpart G & I privileges on the entire range of Airbus civil models.

The Subpart I privilege allows Airbus to perform airworthiness reviews, renew Airworthiness Review Certificates or apply for Certificates of Airworthiness for Export.

During the transfer phase, the Airbus CAMO provides a temporary registration mark for each aircraft under its jurisdiction.

To save approbation time, the Airbus CAMO has been authorised, as Original Equipment Manufacturer, by the airworthiness authority to issue and approve the maintenance programme under its own approval process.

The Airbus CAMO can arrange for the issuance of a permit to fly, with Airbus DOA Part 21 privilege.

Check flight

The aircraft is tested on ground and in flight in accordance with the In Service Aircraft Test Flight Manual (ISATFM) protocol and flight profile. These flights are carried out by Airbus flight test pilots. The Flight Test Completion Certificate is issued once the ground and flight tests have been passed.

Delivery

In accordance with the service agreement, Airbus can remain accountable and the single point of contact until final delivery of the aircraft to operator B.

Lessors article by**Alberto ORTEGA DIAZ**

Upgrades Sales Director

AIRBUS

alberto.ortega@airbus.com

Marc**TEMBLEQUE-VILALTA**

Upgrades Sales Director

AIRBUS

Airbus aircraft transfer solutions

- upgrades for lessors

The challenges of aircraft transfer are keenly felt by lessors, even more so with the increasing number of leased aircraft and operator transitions.

Simple, flexible and efficient transitions are major considerations in the lessor business model. A key player is the Design Organisation which engineers and certifies the aircraft modifications required to transfer the aircraft.

Leasing institutions have now been part of the commercial aviation landscape for many years. The aircraft transition is the most critical part of the aircraft life from a lessor perspective, so it is important that the right services are available to support the process. The main criteria are remarketing visibility early in the process, flexibility and short lead-times during the transfer preparation phase, and reliable deliveries during the working party operation. Simple, quick, predictable aircraft transfers are paramount to the success of any aircraft type.

The lessor needs to consider the customization options for aircraft transfer at the end of a lease term and may carefully study the financial implications of the available options before the end-of-lease date for every possible remarketing scenario. Prior to any aircraft remarketing activity, a thorough understanding of this financial impact is required.

Except for lease-return maintenance checks, which will happen regardless of who the next lessee is, most of these expenses are linked to aircraft modifications, which can originate from regional regulations or from specific operational and functional requirements of the next lessee.

Remarketing support services

To assist in understanding the financial implications of transition options, Airbus can provide a Remarketing Study that lists the mandatory modifications required should the aircraft be registered under an authority that follows EASA or FAA rules, as well as Russia or China. The list includes an assessment of the current aircraft configuration and is available to provide price and lead-time figures for A320 and A330/A340 fleets.

To ensure a successful transition the Lessor takes into account the operational needs of potential lessees. An important aspect is the ability to match the payload/range characteristics of aircraft and routes. This may mean that an adjustment in the aircraft maximum operating weights is required which also can incur a financial impact. Clear visibility of the past and current configuration is key to predict the price of any aircraft weight modification.

It is therefore crucial for lessors to have a clear visibility of their fleet's current and historic maximum operating weights as this impacts the actual payload/range capabilities and the aircraft asset value. Having this visibility also helps predict the transition costs well in advance, in case a change in the weight becomes a requirement by the next lessee. Airbus can deliver an Aircraft Operating Weight Report (AOWR) for the lessors' fleet, as part of the transition support services portfolio. The remarketing report and the AOWR, together with transfer packages, can be used to analyse the viability of current or future transactions.

Upgrades for lessors

Engineering	Materials	Transition support services	Logistics
<ul style="list-style-type: none"> • FAST TRACK Systems SB • Airframe SB • Cabin SB • Certification • Livery service 	<ul style="list-style-type: none"> • Modification kits • Supplier Furnished Equipment (SFE) material • Airbus SFE seats • Second-hand parts 	<ul style="list-style-type: none"> • Remarketing studies • Aircraft Operating Weight Reports • Transfer services • ACM+: extended Aircraft Configuration Matrix 	<ul style="list-style-type: none"> • Consolidated Service Logistics (CSL) • Material consolidation and storage service

More agility and flexibility for systems and airframe upgrades

Changes in the country of aircraft registration or the current airworthiness landscape can also trigger the requirement for configuration changes in the aircraft avionics and systems, for example water conduction freezing protection for Russian operations or Fuel Tank Inerting System (FTIS) for aircraft registered in the United States.

The pressure on lessors to quickly adapt the aircraft to these requirements is clear and therefore the rapid availability of Service Bulletins (SB) and kits is crucial.

A FAST TRACK SB service is available to cut the SB lead-times for selected products which are typical requirements in the frame of lease transitions. These include regional mandates that are sometimes in the critical path for aircraft transition: from changing cockpit units from imperial to metric, to installing a dual ice detector or an ozone converter, the lead-time of the overall upgrade development becomes shorter which results in enabling short-term aircraft remarketing opportunities. Upgrade parts in the frame of the FAST TRACK service are now available in stock for certain products so that shipment lead-time for parts is even shorter.

Solutions for more cabin efficiency

During the period of a long term lease contract, new market trends and technology can create new needs; this is especially true for the aircraft cabin. The transition may offer an opportunity to transform the aircraft into a more re-marketable product. As an example, an increase in the maximum certified seating capacity on the A320 Family has become a selectable option in the last few years.

Seats are also usually in the critical path for cabin reconfiguration. In order to ensure lead times, Airbus has entered into an agreement with a seat supplier to guarantee quick delivery of specific seats for the A320 family. These elements are designed to simplify and speed up the transition process with shorter delivery lead-times and increased flexibility. Additionally, nose-to-tail turnkey packaged solutions covering different aircraft transition programmes are available.

Packaging not only concerns the actual aircraft modification SB or parts, but also everything around it. Airbus can provide consolidated material shipping services, and also design customized shipping solutions for lessors. Responsibility over logistics can be transferred to Airbus with a daily link highlighting shipping status and information for all ordered material. During the working party intervention, several shipments of parts may arrive at the MRO location from different places, at different times, making it difficult to ensure installation on time. For this reason, the kit consolidation service presents a significant advantage by ensuring that parts arrive in a single shipment at the MRO, thus simplifying tracking of the material.

Flexible Fleet SBs - Up to 50% lower lead-time by ordering engineering in advance

Under the Flexible Fleet SBs process, lessors can purchase an upfront engineering study for an upgrade on a particular fleet. Airbus uses this study to work on a modification before releasing the SB or the kit. This approach enables Airbus to deliver a short and guaranteed lead-time for SB issuance and kit delivery once the concrete list of MSNs is confirmed. It can also lead to economies of scale when compared to single recurrent orders.

As with all Upgrade Services, this offer includes the Airbus standard documentation package and update of the Airbus configuration database.

Flexible Fleet SBs offer more flexibility, more visibility over costs, and shorter lead times for the lease transition, all with minimum upfront costs.



Livery change

Airbus has created dedicated livery design and masking systems that reduce aircraft downtime (see FAST #56 August 2015 edition).

CONCLUSION

Aircraft transfer from one operator to another can be a long and complex operation involving technical, contractual, economic and regulatory constraints. To ensure a time-efficient and cost-effective transfer, the stakeholders such as the CAMO, the Part 145 and the service bulletin providers need to work on the same agenda. The thorough coordination of these stakeholders, as well as of the previous and next operators, the aircraft owner and the airworthiness authorities, is key.

To support these transfers, Airbus Embodiment Operations offers end-to-end turnkey solutions which can be tailored to each aircraft, covering all or part of the transition process, from initial assessment to delivery.

For the specific needs of lessors, Airbus Upgrade Services facilitates decision-making regarding configurations and financial costs, and provides solutions to simplify and accelerate transfers. ■

Contact turnkey.services@airbus.com for further information about Airbus' aircraft transfer solutions.

Staying on line

**Eliminating unwanted offset
from the steering system**



Article by

Laurent COUTURET

Braking and Steering System Senior Engineer
Product Leader A380 & A300/A310
AIRBUS
laurent.couturet@airbus.com

Aircraft veering phenomenon is described as the aircraft's deviation during taxi operations.

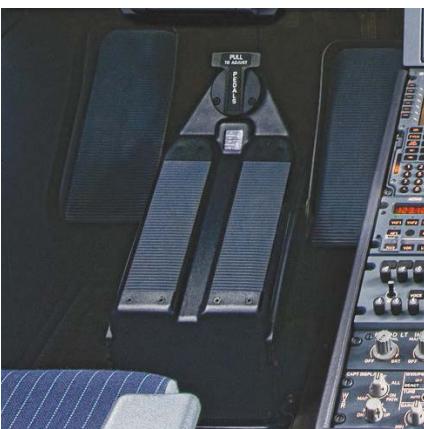
To correct these deviations, Airbus has over the years implemented solutions for each of the three main causes of abnormal veering:

- Steering demand offset
- Servo valve offset
- Rotary Variable Differential Transducer (RVDT) offset



What is veering?

Steering handwheel (tiller)



Rudder pedals

Veering is a progressive tendency of the aircraft to steer to the right or left of the taxiway (or runway) centreline, without steering inputs from flight crew (i.e. steering handwheels, rudder pedals and rudder trim all at neutral position). It is most noticeable during taxiing at low speeds.

Note: Veering is not a sudden swerve movement of nose wheels.

Instances of aircraft veering have been reported, requiring sometimes extensive trouble shooting actions to fix the issue. Flight crew may need to correct using the steering handwheel or rudder trim to taxi the aircraft in a straight line.

When the correction exceeds the threshold, a maintenance action is required to find the cause of this veering tendency.

Finding the cause

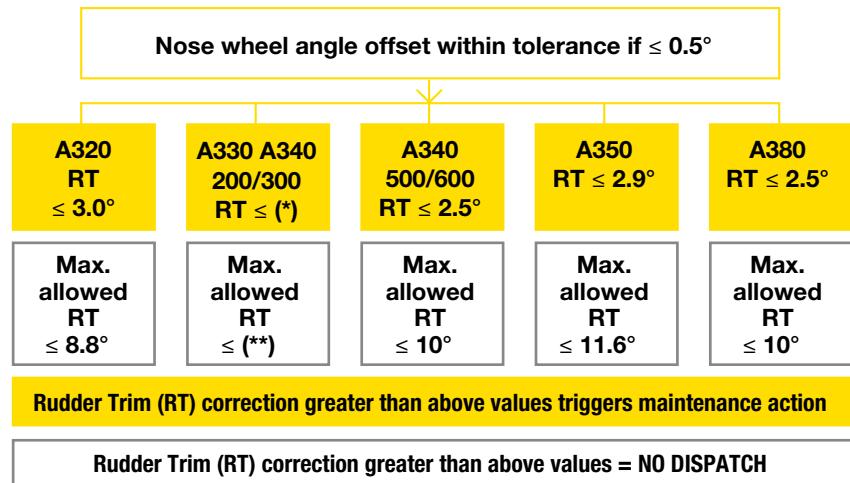
Abnormal veering can be due to either internal or external factors. This article will focus on the internal factors in relation to the steering system.

The Nose Wheel Steering (NWS) system architecture is based on a computer acquiring cockpit inputs to calculate the steering order. This order is compared to the actual position of the nose wheels (nose wheels' angle measured by the Rotary Variable Differential Transducer (RVDT)) to calculate and generate a current to the servo valve.

NWS system principle:

- For the A320 Family and A330 Family, the computer is the Braking and Steering Control Unit (BSCU)
- For the A350 XWB, the computers are the Core Processing Input Output Module (CPIOM) and Common Remote Data Concentrator (CDRC)
- For the A380, the computer is the Core Processing Input Output Module (CPIOM)

Correction thresholds



* = 3.0° with electrical rudder control
= 3.5° with mechanical rudder control

** = 10.4° with electrical rudder control
= 12° with mechanical rudder control

RT - Rudder Trim

Steering-By-Wire

The use of 'Steering-By-Wire', compared to the former hydro-mechanical architecture using mechanical cables and pulleys, has made it possible to reduce aircraft weight whilst ensuring a better integration of the steering system with other aircraft systems such as Auto-Pilot for Auto Land and improving maintenance through the on-board Central Maintenance System.

'Steering-By-Wire' was first introduced on A320 aircraft and has evolved over the past decades for continuous reliability and operation enhancement.

The solutions implemented to correct veering

From the above architecture it can be determined that three typical offsets can lead to abnormal aircraft veering tendency:

- 1 Steering demand offset generating unwanted steering order while in neutral position
- 2 Servo valve offset generating hydraulic flow and steering the nose wheels away from neutral position
- 3 RVDT* offset shifting the electrical zero position vs. zero mechanical position of nose wheels

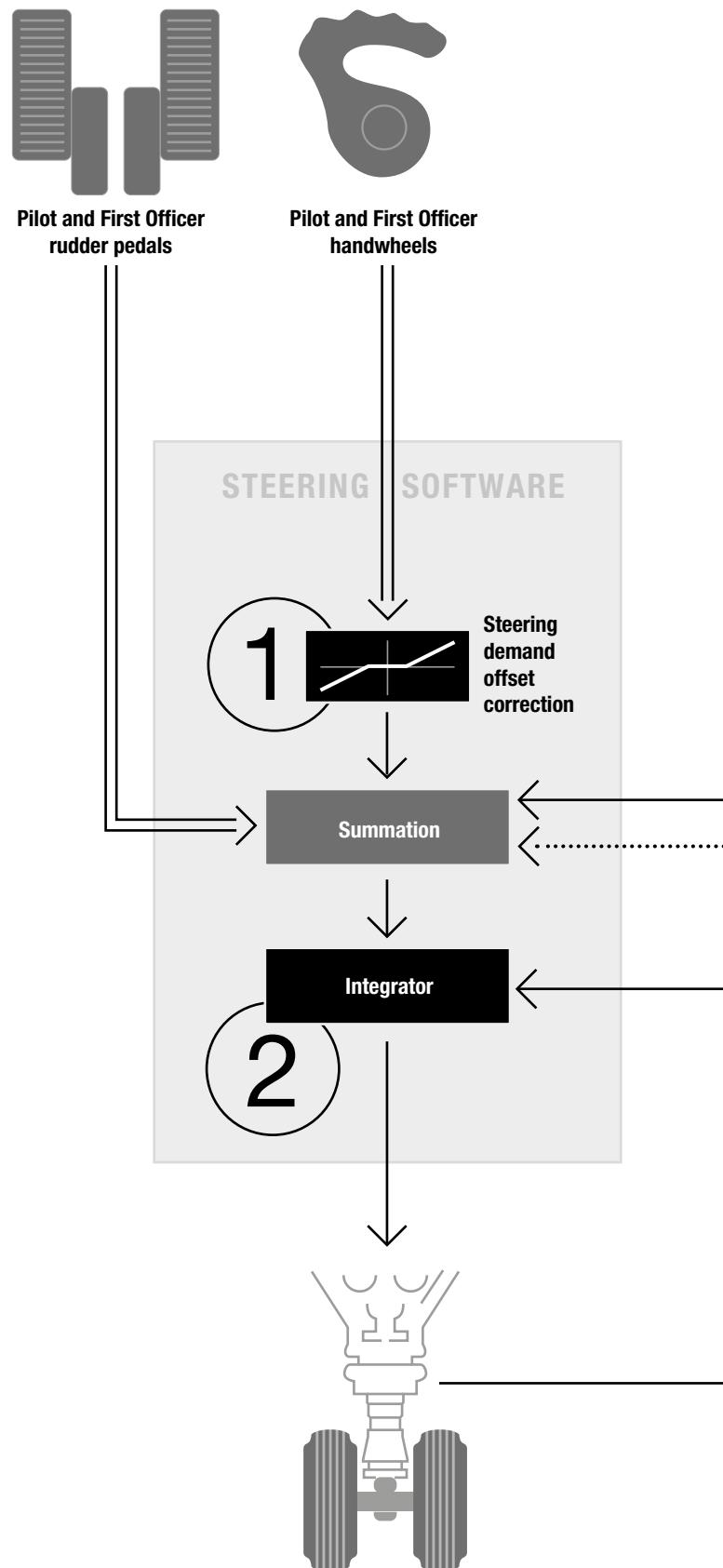
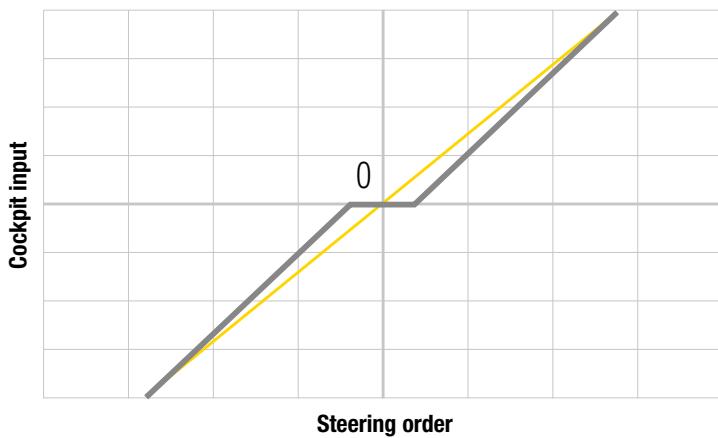
*RVDT - Rotary Variable Differential Transducer

1 Steering demand offset correction

In order to account for small undesirable cockpit inputs possibly leading to unwanted steering order, a dead band (or flat zone) has been introduced in the control loop.

The principle is to move from the green curve (linear law starting from 0 degrees to output a steering order) to the blue curve zeroing small inputs prior to generating a steering order.

This new control law is implemented in the avionics part of the steering system for the A320 Family, A330 Family, A350 XWB and A380.

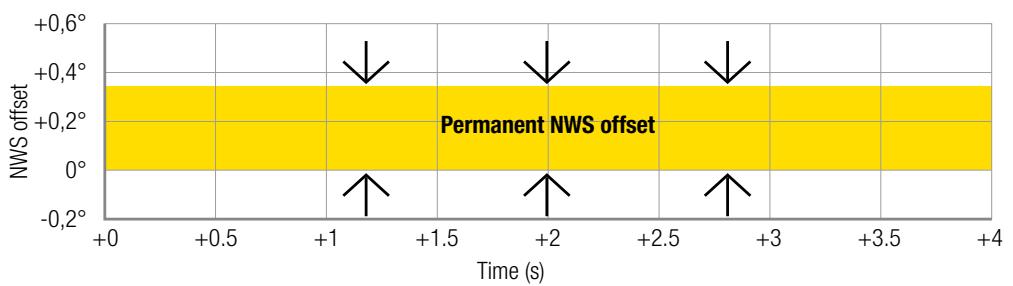


2 Servo valve offset correction

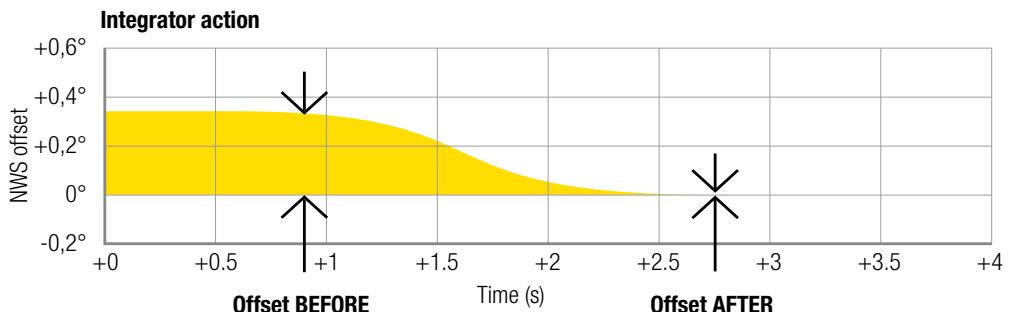
The steering servo valve provides hydraulic flow as a function of current. This means that the current is based on the difference between the steering commanded order and the actual position of nose wheels. When the position of the nose wheels is equal to the steering commanded order the current sent to the servo valve is null. With a null current there is no hydraulic flow and the nose wheels hold the requested position.

An offset (or drift) of the servo valve may cause hydraulic flow leading to nose wheels steering movement with a neutral commanded order. The steering movement of the nose wheels is fed back to the avionics (angle measured by RVDT), which sends a current to the servo valve in the opposite direction of the nose wheels movement. When the current sent to the servo valve corresponds to a hydraulic balanced position with no flow, the nose wheels hold the new position but are not aligned with the steering order, hence aircraft veering tendency.

Depending on the servo valve drift, a permanent offset will take place. This offset may require flight crew correction to re-centre the nose wheels.



In order to enhance the Nose Wheel Steering system operation, the steering control loop was modified to compensate for small servo valve offset. To this end, an extra current called integrator is sent to the servo valve allowing the nose wheels to progressively recover the steering commanded order.



The new control loop with the integrator is implemented in the avionics part of the steering system of the A330 Family, A350 XWB and A380.

This solution can also be implemented on the A320 Family after activation of a dedicated pin-programming.

3 RVDT offset correction

The RVDT provides an electrical signal as a function of the nose wheel angle position. An offset between the mechanical position of nose wheels and the electrical signal sent by the RVDT may cause abnormal veering tendency with the NWS system seeking the electrical zero position of the RVDT.

In order to account for small RVDT offset, the steering control loop has been modified to monitor the aircraft heading and maintain a target heading.

This function, called Heading Control Function (HCF), is implemented in the avionics part of the steering system of the A350 XWB and A380.

Note: The HCF also contributes to reducing flight crew workload during taxi operations by compensating deviation possibly resulting from external factors such as crosswind or taxiway/runway slope.

AP

Autopilot

3

HCF

Heading Control Function

RVDT

Rotary Variable Differential Transducer





In the event of aircraft veering tendency exceeding the tolerance, and irrespective of aircraft configuration, the troubleshooting manual provides instructions to isolate the cause of the deviation (internal or external factor). To this end, it may be necessary to verify if the adjustment of the RVDT is aligned with the aircraft centreline.

Correct and accurate mechanical adjustment of the RVDT is a key factor to prevent abnormal veering tendency due to large offset between the actual position of the nose wheels and the feedback sent by the RVDT.

Basically, the adjustment of the RVDT is to be carried out when the nose wheels are aligned with aircraft centreline. Several procedures can be used to align the nose wheels prior to adjusting the RVDT. Operators can adapt their maintenance depending on the aircraft programme, tool and time available to do the RVDT adjustment.

Summary

Depending on the aircraft programme and avionics architecture, the NWS system was modified to accommodate the new functions.

Aircraft	Forward fit			Retrofit		
	New control law	Integrator	Heading control function	New control law	Integrator	Heading control function
A318	Yes	No	No	N/A	On request*	No
A319	Yes	No	No	N/A	On request*	No
A320	Yes	No	No	N/A	On request*	No
A321	Yes	No	No	N/A	On request*	No
A330	Yes	Yes	No	N/A	N/A	No
A340	Yes	Yes	No	N/A	N/A	No
A350	Yes	Yes	Yes	N/A	N/A	No
A380	Yes	Yes	Yes	N/A	N/A	No

(*) Upon request Airbus Upgrade Services will review the aircraft configuration and propose a Service Bulletin to activate the integrator.

Maintenance and operational procedures have been adapted to account for small and acceptable offset whilst providing clear instructions for maximum allowable limits and troubleshooting activities.

Note: In-Service Information (ISI) ref. 32.51.00004 and 32.51.00005 (A320 Family and A330 Family respectively) was issued to provide guidance during troubleshooting actions.

CONCLUSION

The NWS system has evolved over the years to limit the occurrence of abnormal aircraft veering.

The solutions implemented also improve ground control and reduce flight crew workload.

Operational and maintenance guidelines are available for operators in the event of aircraft veering tendency to better understand the source of the problem and apply the best solution.

For more significant veering phenomena, other tools and troubleshooting actions are at the disposal of the operators.

Operators can also improve their knowledge on veering troubleshooting actions as well as the use of the Laser Alignment Tool with an engineering workshop available in the Airbus catalogue.

FAST from the past

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

At the beginning of civil aviation, when there was little competition between airlines, turnaround time was maybe not a major priority.

Today, ground handling staff still need to clean, check and maintain the aircraft and load cargo with the greatest of care, but the stakes are now much higher for airlines (see The ground handling challenge article, page 04).



Photos courtesy of Airbus Corporate Heritage



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Technical, Material & Logistics

USA/CANADA

Tel: +1 703 834 3484
Fax: +1 703 834 3464

CHINA

Tel: +86 10 8048 6161 Ext. 5020
Fax: +86 10 8048 6162

FIELD SERVICE SUPPORT ADMINISTRATION

Tel: +33 (0)5 6193 3936
Fax: +33 (0)5 6193 4964

Airbus Technical AOG Centre (AIRTAC)

Tel: +33 (0)5 6193 3400
Fax: +33 (0)5 6193 3500
airtac@airbus.com

Spares AOG/Work Stoppage

- Outside the Americas:
Tel: +49 (0)40 5076 4001
Fax: +49 (0)40 5076 4011
aog.spares@airbus.com
- In the Americas:
Tel: +1 70 3729 9000
Fax: +1 70 3729 4373
aog.na@airbus.com

Spares In-Flight orders outside the Americas:

Tel: +49 (0)40 5076 4002
Fax: +49 (0)40 5076 4012
ifd.spares@airbus.com

Spares related HMV issues outside the Americas:

Tel: +49 (0)40 5076 4003
Fax: +49 (0)40 5076 4013
hmv.spares@airbus.com

Spares RTN/USR orders in the Americas:

Please contact your dedicated customer spares account representative
csr.na@airbus.com

Training centres

Airbus Training Centre
Toulouse, France
Tel: +33 (0)5 62 11 82 24
or +33 (0)5 61 93 39 75
Fax: +33 (0)5 6193 2094
training.commercial@airbus.com
customercare.atc-europe@airbus.com

Airbus Maintenance
Training Centre
Hamburg, Germany
Tel: +49 (0)40 7438 8288
Fax: +49 (0)40 7438 8598
training.commercial@airbus.com
atc.hamburg@airbus.com

Airbus Training Centre Americas
Miami, Florida - U.S.A.
Tel: +1 (305) 871-3655 (switchboard)
Fax: +1 305 871 4649
miamicustomertrainingsales@airbus.com

Airbus Training Centre Beijing
Tel: +86 10 80 48 63 40 - 3017/3016
+ 86 10 80 48 65

Airbus Training Centre Bangalore
Tel: 91-080-6638230 (reception)

Airbus Training Centre Delhi
Tel: +91 9880065511

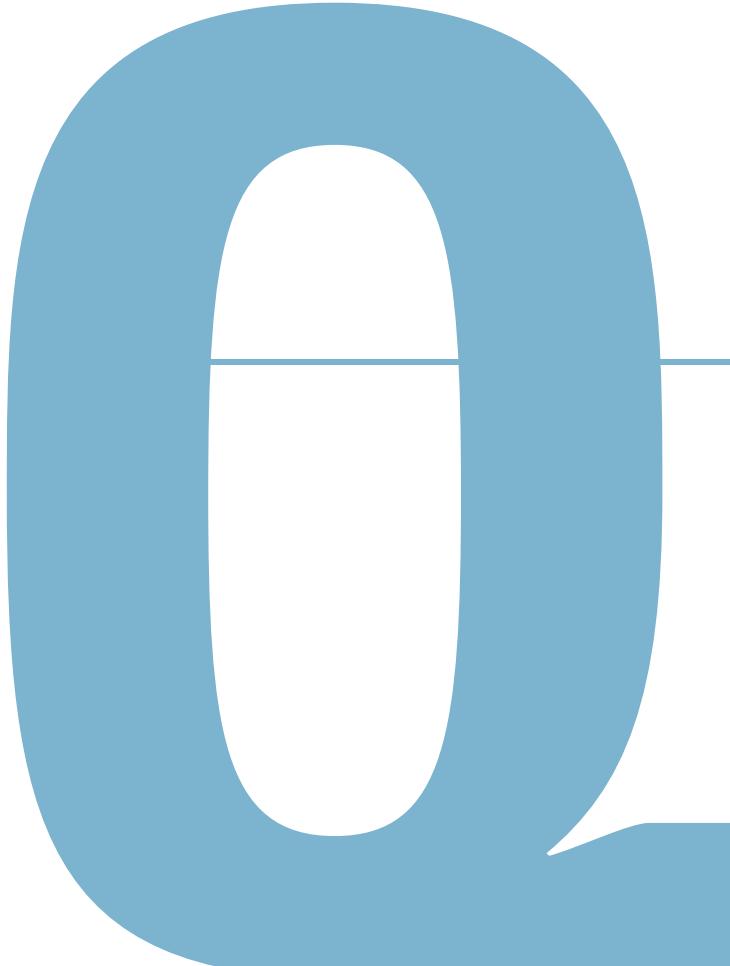
Training by Airbus Dubai,
UAE - Airbus Middle East FZE Dubai
Tel: +971 4 602 78 62
mary-knoll.garcia@airbus.com

Training by Airbus Jakarta
antoine.renaud@airbus.com

Airbus Asia Training Centre Singapore
Tel: +65 6877 4300 (reception)
contact.info.aatc@airbus.com

Airbus Mexico Training Centre
Tel: +52 55 57 86 80 50
(communication and marketing)
training.commercial@airbus.com

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