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Customer Services
Around the clock... Around the world

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Two flights exceeding 10 hours each were required for the A340-500 fuel system certification and for the evaluation of the ADIRS performance. In addition, the behaviour of the navigation system and the Electronic Instrument System (EIS) had to be checked in the polar area including flying over the North Pole itself.

Both flights were planned and operated by the Airbus Flight Test Division: Toulouse-Keflavik and Keflavik-Toulouse, each time via the North Pole.

This article recalls some aspects of the polar navigation observed during these flights.

Capt. Michel Brandt
Airbus Test Pilot
Flight Operations Support
On TRUE heading

We left Toulouse on 12 September 2002 with 12 people on board, maximum fuel uplift and full flight-test equipment, including ballast, which gave a take-off-weight (TOW) of 325,000kg. Our flight plan led us to Vigra VHF Omnidirectional Range (VOR) in Norway to intercept the Polar Track System (PTS) route “November”. This route follows the meridian 10°E to the North Pole.

Although Magnetic Heading (MH) is available until 82°N at this longitude, we selected TRUE heading reference as soon as we were established on the PTS. With this selection, the indications on navigation display (ND) (Figure 1 below) and Multipurpose Control and Display Unit (MCDU) were in line with the True Tracks (TT) given on our navigation charts.

When passing 65°N latitude the grid track (GT) appeared on the navigation display.

Although the Flight Management and Guidance System (FMGS) remained in GPS PRIMARY mode of navigation update all the time, we were able to cross-check the FMGS navigation with the Automatic Direction Finder (ADF) sometimes at a very great distance, up to 500 nautical miles (nm) from the Non-Directional Beacon (NDB). However, the wave propagation may not be always as good, for example, during periods of aurora borealis.

Flying in NAVigation autopilot (NAV) mode, nothing significant happened until approaching the North Pole. We observed the relative position of each Inertial Reference System (IRS) to anticipate the system behaviour while flying over the North Pole.

When passing 65°N latitude the grid track (GT) appeared on the navigation display.

DIGRESSION ON GRID TRACK

When flying east to west or west to east at very high latitude on an orthodromic (great circle) route, the true track changes quite rapidly due to the convergence of the meridians. On older aircraft, the true heading was not directly available to the crew. “Old style” Horizontal Situation Indicators (HSI) were set in a so-called free gyro mode on the Grid North reference. The characteristic of the grid track is that it remains constant on an orthodromic route as indicated in the drawing below, right.

With our modern navigation system, the grid track would not be mandatory, as the true track is always available and the navigation charts indicate the outbound and inbound true tracks at each waypoint for cross-check. But the grid track indication on the navigation display provides the crew with at least a convenient stable indication for navigation monitoring in this moving display environment.

Note: Where words are spelt in capital letters it refers to their use as cockpit labels, messages and displays.

Traditionally, the polar area was defined as an area of magnetic compass uncertainty and the limit was sometimes set where the earth magnetic field is less than 6 microtesla. Except for the standby compass, modern aircraft no longer have magnetic sensors “slaving” the gyro-compass to the magnetic north. The magnetic variation is extracted from tables in the Air Data/Inertial Reference System (ADIRS) and the Flight Management System (FMS). These tables give an accurate magnetic variation up to a latitude of 82° N, or 73° N in function of the longitude. Beyond this latitude TRUE reference must be used. Consequently, the 6 microtesla limit has no meaning for these navigation systems. We nevertheless observed during these flights that the standby compass indication was coherent well above the charted 6 microtesla limit.
HEADING BEHAVIOUR

At about 20nm before the Pole the heading discrepancies on ND became noticeable and finally triggered, as expected, the HDG DISCREPANCY Electronic Centralised Aircraft Monitor (ECAM) caution (Figure 2) and CHECK HDG on the ND and Primary Flight Display (PFD) (Figures 3a and 3b).

The heading discrepancy is due to the fact that each IRS has a different position relative to the Pole. The ECAM procedure cannot be followed, as all heading indications start to move very quickly and switching ATT HDG on IRS3 would not help. The autopilot remained engaged in NAV mode and the aircraft continued nicely straight ahead.

When flying exactly (with GPS accuracy) over the North Pole the ND display swung over by one hundred eighty degrees from a True Heading (TH) close to 000° to a TH close to 180° (the drift was small). But very quickly all headings were again in agreement as shown on the flight test traces given in Figure 4 (below), and the ECAM caution disappeared.

At 20nm outbound from the North Pole, everything was nominal and it was time for us to turn left to intercept “another” 180° course to the VOR of Thule (THT).

Despite the magnetic variation of 66°W at Thule, the VOR THT is magnetically oriented (some VORs in north Canada are oriented to the geographic North). As we were flying with TRUE reference, the VOR needle on ND in MAP mode or ROSE NAV mode is automatically corrected with the magnetic variation, so as to get a TRUE bearing. Otherwise the needle would not indicate the direction to THT. This is marked by the magenta color of the needle and the label CORR next to each IRS.

Figure 2

Note: The TAXI CAMERA was selected “on” in flight so the flight test engineers could see the landscape from their station in the cabin.

Figure 3a

Figure 3b

Figure 4

HDG of each IRS plotted versus time in seconds.

The red line indicates the time of the flight over the North Pole.
Before reaching the North Pole the heading calculated by each IRS was close to 360°/000°.
After passing the North Pole all headings converged rapidly to approximately 180°.
Leaving the oceanic airspace we deselected TRUE to revert to magnetic reference and continued to destination, arriving at Keflavik after 10 hours 45 minutes flight time, having enough fuel to return to Toulouse with more than the required reserves.

The next day we left Keflavik for Toulouse and headed north east to join and follow the PTS route “Romeo” up to ROGSO, a waypoint located 230nm to the north of Thule. At this waypoint we turned right to the North Pole. On PTS “Romeo” we selected TRUE reference, as it is better for navigation monitoring; but this time, before crossing 82°N, we deselected TRUE to revert to magnetic reference in order to see how the ECAM will advise us to select the right heading reference.

to the VOR2 display as shown in Figures 5 and 6. The indications of the Digital Distance and Radio Magnetic Indicator (DDRMI) and the ND in ROSE VOR mode are not corrected, as they would be on a conventional aircraft. When we were at 77nm to THT, the DDRMI needle of VOR2 (not shown here) was pointing towards 255° magnetic instead of 184° True as shown in Figure 5.

After passing THT (Figure 6) the outbound true track to the 7440N waypoint was 095°. On this leg the true track changed significantly, from 095° to 123° due to the convergence of the meridians, but the grid track remained conveniently constant and equal to 163°.
With the polar navigation capability of the Airbus Long Range family of aircraft using the flight management system, polar flights are no longer different from standard navigation.

Conclusion

As shown on Figure 7, we were on a magnetic track of 090° on course to Alert NDB (identification code LT) corresponding to a true track of 025°, giving a magnetic variation of 65°W.

When we reached 82°N, we got the amber message SELECT TRUE REF on ND (Figure 7) and on MCDU (Figure 8).

Intentionally we did not follow this instruction, waiting for the next step, the ECAM caution at 82°30’N. At this latitude, the IRSs switched automatically to TRUE reference, which triggered the EXTREME LATITUDE ECAM amber caution (Figure 9).

The autopilot went off as well, because each IRS crosses the latitude limit at slightly different times. We performed the ECAM procedure, confirming the TRUE reference selection and re-engaged the autopilot.

For the purpose of the test, we decided to fly nearby the North Pole this time with autopilot in HDG mode. As the North Pole was a turning point, to join the PTS “November” route southward we passed abeam it by about 10nm. This distance was sufficient to limit the heading discrepancy, so that we were able to steer the aircraft with sufficient accuracy. The recommended procedure is to fly with the autopilot in NAV mode, but in a situation where the BACK UP NAV would have to be used, this test confirmed that flying in HDG is easy, even close to the North Pole.

We continued heading south on PTS “November” until Trondheim VOR in Norway. Leaving the oceanic area, we resumed normal navigation and landed in Toulouse after 10 hours flight time.

The time of exotic instruments like the astrocompass illustrated here is gone.

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Figure 7

Figure 8

Figure 9
The 6th Airbus Training Symposium was organised in two separate events for the first time with content specific to the areas of Maintenance Training and Flight Crew Training. Maintenance attracted 134 attendees, 71 of which represented 48 airlines; Flight Crew Training attracted 242 participants, of which 146 were from 70 airlines. Generally speaking, attendees were highly satisfied and both events were perceived as beneficial and well organised. Innovations such as a cyber café and a brand new audio-visual display generated positive feedback.

16th HUMAN FACTORS SYMPOSIUM
Singapore, 8-10 October 2002
(in association with Singapore Airlines)

This 16th Human Factors Symposium was held in co-operation with Singapore Airlines, was attended by 160 delegates from 23 airlines and covered topics ranging from A380 Cockpit Human Factors to Fatigue and Alertness Management Solutions for long-haul operations. The feedback from participants was very positive, praising the practical operational perspective and highlighting the uniqueness of these symposiums. General Bey Soo Khiang, Executive Vice President (Technical) from Singapore Airlines said he would like to have such a symposium organised every two years. Preparations for the 17th Airbus Human Factors symposium in Helsinki, July 2003, are already well under way. The event coincides with the 80 year anniversary of the co-host, Finnair.

The purpose of this symposium was to launch a series of meetings regarding Airbus warranty processes. The aim was to develop a frank and constructive exchange of ideas for the benefit of all parties concerned, be they customers, vendors or Airbus. This symposium offered the opportunity to analyse and debate the most important subjects and to present the enhancements already implemented by Airbus. Each daily session contained presentations, Q&A sessions and workshops on selected subjects.

Airbus has successfully added this new symposium to its regular conference cycle as an exchange of information on technical data, products, services and media.

More efficient and cost effective digital technical data and solutions are now rapidly replacing the ‘classic’ paper and microfilm used for decades. These replacements require adaptations by customers, manufacturers and service providers and, in order to benefit from increased efficiency potential, this may require significant modification of existing processes.

With these changes in mind, customer needs and issues are of paramount concern for Airbus and the symposium was an excellent opportunity to express these issues. It provided a forum for Airbus to present actions that addressed known airline needs and issues, plus improvement of Airbus data content.

Airbus’ vision of future products, services and improvements was also presented. Daily sessions included Airbus and airline presentations along with Q&A sessions.

Flight crews, operations, flight operations engineering and performance specialists are invited to attend and actively participate in the four-day conference, which will offer numerous opportunities to constructively exchange views and information, and increase mutual co-operation and communication. More than 80 subjects will be addressed, including LPC, Flight operations, Performance and New Cockpit Operation Information Management.

Along with the different sessions, numerous daily booths will be available in order to discuss issues and view demonstrations of the newly developed Airbus Flight Operations software. Our 12th Performance and Operations Conference represents a significant milestone in Airbus’ Flight Operations Support & Line Assistance activities. This event has been organised every two years since 1980.

This next Technical Symposium, one day longer than in the past, was due to take place in November 2002 but was rescheduled due to the hurricanes in Mexico. It will include actual in-service issues covering the A320 programme and general interest subjects concerning the A320 family with a dedicated session for the A319 Corporate Jet customers. The main themes will be structures, engines and systems with time for Q&A sessions and general topic discussions.
Have you ever thought about the purity of water coming out of the water faucets at your home? Probably yes. “Oh, what a taste (or odour) of chlorine today!” When you travel, have you ever thought about the purity of water coming out of the water faucets in hotels, trains, ships ... and passenger aircraft?

Maybe not. If yes, you might say: “Well, I do not use that water for drinking or brushing my teeth – I use bottled mineral water only and I do not brush my teeth on board aircraft or other transport.” However, this is not the end of the story. Sometimes you wash your hands and face on board aircraft and you expect acceptable water purity.

“Are there specific regulations to ensure a certain water purity?” Yes there are, but they vary, from country to country. In any case: water provided for use as potable water in lavatories and galleys of passenger aircraft has to be treated within given limits as per the regulations of the country where the aircraft is registered.
Key question

How can the purity of potable water, stored and supplied on board passenger aircraft be ensured and controlled?

Answer

Water purity on board passenger aircraft is ensured by following procedures to disinfect or sterilise potable water systems at regular intervals. Water purity is controlled by analysis of water samples. The degree of purity is measured by the number of certain types of bacteria found in the samples. Bacteria are living organisms. They reproduce themselves rapidly if their living conditions are good; they reproduce themselves slowly if their living conditions are bad.

Bacteria live in water. Potable water to be supplied to the airport by the local public supply system is controlled and treated as per local authorities’ rules and regulations. To protect the public health the presence of some bacteria in potable water is forbidden or strictly limited (e.g. coli and coliforme bacteria types, or pseudomonas aeruginosa). To control the presence of bacteria in potable water, local authorities require regular or periodic sampling and analysis of the water.

DEPOT EFFECT

Certain amounts of disinfectants (up to maximum limits given by local authorities’ rules and regulations) are added systematically to the potable water supplied in the public water supply system to avoid bacteria and reduce bacteria reproduction. Local authorities are responsible for the purity of the water from the public potable water supply system. The airline is responsible for the purity of the potable water supplied on board their aircraft, whenever and wherever they fly passengers.

The chlorine level in the potable water from the public supply or the airport ground cart is in general not sufficient to ensure the required water purity on board an aircraft, because the maximum allowed level of chlorine in this water is too low to ensure the required water purity level on board. For this reason, sterilisation or disinfection of aircraft potable water systems using disinfectants with higher chlorine levels or other disinfectants is needed.

IMPROVING WATER PURITY

The existing disinfection or sterilisation procedures for potable water systems do work, using certain chemicals based on chlorine or hydrogen peroxide.

However, they are long, need preparation and a lot of manual control. Water filters remove chlorine (taste) from the water, but the interior of the housing for the water filter has been identified as a good place for bacteria to build biofilms or colonies.

Biofilms (deposits) are thin layers of bacteria, a mix of dead and live ones. The living bacteria eat the dead ones and all of them are ‘bonded’ to the inner surface of water tanks, tubing or filter housings.

These biofilms are hard to remove as the outer layer of dead bacteria protects the deeper layers of live bacteria from the disinfecting action. In other words: The disinfection or sterilisation procedures for potable water systems in service have to be improved.

CONSEQUENCES

Airlines have to ensure a certain level of purity of the potable water on board their aircraft, whenever and wherever they fly passengers. The level of purity has to be controlled regularly, following the regulations given by authorities where the aircraft is registered.

COLI AND COLIFORME BACTERIA

They should never be present in the potable water from the public supply system to be used in the aircraft potable water system. They can cause illness as diarrhea or infections in human beings. Their presence has been observed after accidental ‘short-circuits’ between public potable water and waste water systems (e.g. after flooding).

PSEUDOMONAS AERUGINOSA BACTERIA

This type of bacteria is always present on human skin where it can cause wounded skin infections (pus in skin wounds).
Airbus provides a procedure for disinfection and sterilisation of the onboard potable water systems, including dosing recommendations for certain Airbus-approved disinfectants.

The purity of potable water coming from the local airport’s aircraft water service vehicle is often beyond the control of the airline. For that reason the successful disinfection or sterilisation of the aircraft’s potable water system can take a very long time, and it has to be repeated until the analyses of water samples show that the acceptable limits for bacteria presence are reached.

As the repetition of the disinfection or sterilisation procedure can have a significant effect on maintenance costs, Airbus now provides improved procedures and recommendations for using approved alternate and more effective disinfectants.

DEPOSITS

- Bacteria, light deposit
- Bacteria, medium deposit
- Bacteria, heavy deposit

IMPROVING POTABLE WATER SYSTEM DESIGN

Certain features are already under study to improve the design of the on-board potable water systems:

- To avoid concentration of bacteria, the water tubing network should not contain water filters. The equipment suppliers of potable water system equipment in any part of the aircraft shall ensure that the self-ventilating and self-draining features meet Airbus specifications. For example, in galleys and lavatories, no air bubbles shall remain in the system when it is filled and no water shall remain in the system when it is drained.

- An efficient procedure with alternate and efficient disinfectants and suitable dosing shall be used and a tool to make the procedure more efficient shall be developed.
Most passengers nowadays assume that potable water systems in aircraft are to drinking quality. To ensure their passengers are not disappointed, airlines are recommended to frequently flush the potable water system by performing the potable water system servicing procedure as shown in the AMM, to undertake regular water sampling to ensure that the water quality meets the authorised standard.

Airbus continues to search for ways to make these tasks easier, more efficient and less time-consuming.
Less maintenance, less costs

With the next issue of the A330/A340 Maintenance Review Board (MRB) Report and related Maintenance Planning Document (MPD), the A, C and 2C check intervals have been escalated to 600 flight hours (FH) from 500FH, to 18 months from 15 months, and to 36 months from 30 months respectively. A simple message, which is good news for Airbus customers and a further step to reduce the maintenance costs for the A330/A340 aircraft.

Many people believe that the decision to escalate maintenance check intervals is taken by the manufacturer alone. This article describes the processes and requirements behind the evolutions and developments of a maintenance programme.
The overall industry process for the initial development and evolution of maintenance programmes, has been defined by the Air Transport Association (ATA) and is followed by each aircraft manufacturer. The main body is the Industry Steering Board (ISC) and associated Maintenance Working Groups (MWG). In both are a number of representatives from airlines, authorities, engine manufacturers, suppliers and aircraft manufacturer maintenance organisations.

A specific aircraft maintenance programme is developed according to a Policy and Procedure Handbook (PPH). PPH is dedicated to an aircraft type, covers ATA MSG-3 procedures and provides specific information regarding aircraft operation and ISC organisation as well as more detailed guidelines for MSG-3 analysis development.

Airbus PPHs have always been developed and updated according to the latest MSG-3 revision. Together with additional guidelines, this has led to optimised and consistent maintenance programmes in terms of integration of latest maintenance regulation constraints and significant economical advantages in maintenance, compared with other aircraft for which older versions of MSG-3 were used.

ORIGIN

As per JAR/FAR 25-1529 “Instruction for Continuous Airworthiness”, manufacturers have to deliver an approved aircraft maintenance programme at entry into service at the latest. An aircraft maintenance programme is essential to safe and economical aircraft operation, and is also part of the Type Certificate. Any change in the manufacturer’s maintenance programme requires the approval of the Airworthiness Authorities.

Developing a maintenance programme

A senior engineer from the Airbus Maintenance Engineering Department chairs each MWG. The MWGs are divided by specialty (systems, structure, powerplant, zonal, avionics…) and develop their part of the maintenance programme using the MSG-3 analysis method. As an example, for the recent revision of the A330/A340 MRB Report, including development of the maintenance programme for the A340-500/600, there were seven MWGs with, in total, about 70 participants.

The ISC consolidates and validates the output of the various MWGs, and a maintenance programme proposal (MPP) is then presented to the Maintenance Review Board (composed of representatives of the Airworthiness Authorities) for formal approval. The maintenance programme is therefore the result of the joint efforts of the airline representatives, suppliers, airworthiness authorities and aircraft manufacturer.

WHAT IS MSG-3?

It is the use of pre-defined decision diagrams for a logical analysis of maintenance programmes. It was first developed by ATA in 1969 as MSG-1, and since then further refined until today’s MSG-3 revision 2002.1. The MSG-3 method was used first during the development of the A310 maintenance programme. New maintenance regulations, new technologies and economical constraints are the main factors that trigger MSG-3 method evolution.

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On the occasion of the revision of the A340 MRB Report to include the A340-500/600 models, Airbus decided to perform at the same time a task interval escalation exercise based on the in-service experience of the A340-200/-300. Due to the Airbus Long Range family concept, this exercise also benefits the A330, as well as the A340-500/-600 at their entry into service.

The initial objective was an A-check interval of 700 flight hours and C-check interval of 18 months for the A340-500/-600. Approval of such escalations is obtained based on sound justifications from in-service experience together with engineering judgement. The airlines participating in the ISC are thus providing for each concerned maintenance task their task findings – or preferably no findings – to the MWG for further evaluation. About 1100 individual maintenance tasks have been investigated, and the whole process, including MSG-3 analysis was equivalent to about 50,000 man-hours of work.

Although there were technical justifications to show that the A330/A340 could operate with an A-check interval of 700 hours, as per the MSG-3 analysis, the ISC took the decision to increase it to 600 hours in the MRB Report/MPD. The objective for the C-check escalation of up to 18 months, and 2C interval up to 36 months has been achieved. As the A340-200/-300 entered service only 10 years ago, the ISC has considered that such escalation cannot be justified for the 4C/8C intervals today. Striving for continuous improvement and further contributions to maintenance cost reductions, and once sufficient in-service experience allows, the next target for the A330/A340 fleet will be to extend the 4C/8C as well as structure intervals, currently at 5/10 year intervals, to 6/12 years.
Improving the competitive advantage of the Airbus aircraft in terms of maintenance costs is an ongoing process. That’s why Airbus proposed and got support from the A320 ISC to embark on an escalation exercise for the single aisle fleet.

The objective is set to increase:
- A-interval from 500 flight hours (FH) to 600 FH
- C-intervals from 15 months to 18/20 months
- 4C/8C and structure intervals from 5/10 years to 6/10 years, including, of course, also other evolutions in the A320 family maintenance programme.

### Improvements

#### A320 escalation of check periods

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<th>Interval (flight hours)</th>
<th>'A' check escalation</th>
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<tr>
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</tr>
<tr>
<td>1993</td>
<td>400</td>
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<td>1998</td>
<td>500</td>
</tr>
<tr>
<td>2003</td>
<td>600</td>
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</table>

**600 Planned position**

**Current position**

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<th>'C' check escalation</th>
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<td>8</td>
</tr>
<tr>
<td>1999</td>
<td>9</td>
</tr>
<tr>
<td>2003</td>
<td>18</td>
</tr>
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</table>

**18/20 Planned position**

**Current position**

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<th>'Heavy' check escalation</th>
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<td>1994</td>
<td>5</td>
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<tr>
<td>1999</td>
<td>6</td>
</tr>
<tr>
<td>2003</td>
<td>8</td>
</tr>
</tbody>
</table>

**6 Planned position**

**Current position**

The A320 Family maintenance programme escalation process has just started with approval estimated for the 4th quarter of 2003. The diagram shows the progress achieved since Entry Into Service.

### Conclusion

An MRB Report is under the responsibility of the relevant Industry Steering Committee approved by the Airworthiness Authorities. Any evolution or revision has to be initiated by an ISC, illustrated through an updated Policy and Procedure Handbook and approved by the Airworthiness Authorities.

The MPD is a non-approved document under the responsibility of the Aircraft Manufacturer, although it includes information in the approved MRB Report. The Airbus MPD provides the airlines with a comprehensive list in one document of all maintenance tasks with their recommended intervals. This allows the airlines to easily prepare their own customised task cards should they so desire. Reducing the amount of maintenance on Airbus aircraft, by increasing the periods between scheduled checks, is an ongoing process, incorporating the experience of the Airlines, Airworthiness Authorities and Airbus engineers.

### A300/A310/A300-600 FAMILY (WIDE BODY)

Currently most evolutions on Wide Body (WB) family maintenance programmes are dedicated to consideration of Extended Service Goals (ESG) and new maintenance regulations. The next WB ISC is scheduled for last quarter 2003 and will offer the opportunity to discuss future maintenance programme evolutions.

### A380

The A380 maintenance programme development has already started. At the time this article is being written, an exhaustive preparatory meeting with all involved MRB authorities is taking place. Thanks to early consideration of maintenance programme objectives in the aircraft’s design process – including associated verification and validation plans – it is likely that the A380 will have the highest maintenance thresholds and intervals ever achieved for a new aircraft entering service.
The aviation industry has only recently started to fully recognize the value of digital technical data, but Airbus has been working on the necessary foundations for today's digital data products and services since the beginning of the 1990s.

Let's go back to the 90s. Airbus was already working hard towards the “paperless” aircraft/hangar, not quite the “paperless” hangar that airline maintenance executives and technicians dreamed about for years, but Airbus was well on the way to decrease costly and voluminous paper and microfilm documentation that comes with every aircraft and must be updated.

This was being achieved by the introduction of interactive CD-ROM (Compact Disc – Read Only memory) retrieval systems for aircraft documentation.
ADRES, CAATS

In 1994, after several years of development and pilot testing with Lufthansa (DLH) and Canadian (CDN), Airbus introduced digital data consultation tools using this CD-ROM technology. It was developed in two parts: ADRES (Aircraft Documentation Retrieval System) containing the Aircraft Maintenance Manual (AMM) and Illustrated Parts Catalog (IPC), and CAATS (Computer Assisted Trouble Shooting), being a specific trouble shooting tool.

These services were designed to simplify and streamline the access to information for trouble shooting and consulting documentation. Today, about a decade later, ADRES and CAATS are still very popular and nearly all Airbus customers operating fly-by-wire aircraft use these products. In the meantime Airbus has distributed already about half a million copies of these trend-setting products all over the world.

WHY CD-ROM APPLICATIONS?

In the mid-1990s, Airbus produced a business case in which the benefits of the CD-ROM technology, (like ADRES/CAATS) were obvious:

• Due to the replacement of paper/microfilm by the compact CD-ROM, no more voluminous library space needed.
• No more time-consuming updating of the paper manuals. Thus, sorting and filing mistakes are eliminated.
• Due to the speed of access to the data on CD-ROM, document consultation time is reduced by up to 40% compared with paper/microfilm.

Why AirN@v?

Technologies have evolved since the 90s, new ATA Spec 2200 standards (functional retrieval requirements and SGML data) have been developed, and more demanding customers have convinced Airbus to react and set the standard again for the 21st century. The result is the birth of AirN@v; a new-generation tool for troubleshooting and technical documentation retrieval.

AirN@v facts and highlights...

AirN@v design is based on Web technology which gives our customers the possibility to deploy it “stand-alone”, but also on their Intranet, Extranet and even Internet. Furthermore, Airbus has planned to deploy it also via the Airbus On-Line Services (AOLS) starting mid-2004. AirN@v will offer, amongst others, the following advantages compared with the previous product:

• New value-adding functions, like highlights and revision bars, colour schemes for Warnings/Cautions, special navigation buttons.
• In addition to AMM, IPC and Trouble Shooting Manual (TSM), extension of the document family to include Aircraft Schematics Manual (ASM), Aircraft Wiring Manual (AWM), Aircraft Wiring Lists (AWL), and Electrical Standard Practices Manual (ESPM) for A320 and A330/A340 aircraft programmes.
• Enhanced interactive aircraft troubleshooting.
• Multi-document, multi-programme and multi-customisation application (switching between documents, aircraft programmes and customisations without leaving the application).
• Delivery off-line on DVD (Digital Versatile Disk).
• Being based on ADOC Navigator, one module of the ADOC Family, easy integration with other modules of this family.

Implementation aspects...

AirN@v Version 1.0 is (after intensive pilot testing) planned to be available with the A320 family February 2003 revision and A330/A340 April 2003 revision, and will cover the following:

• Scope of all functions available in existing ADRES/CAATS.
• Interactive trouble shooting in autonomous mode, or in connection with AIRMAN 2000.
• Generation of Requests For Information (RFI) and Requests For Revision (RFR).
• Extended dynamic update for Airbus Temporary Revisions, Technical Follow Ups (TFUs) and customer internal data.
To ease introduction of AirN@v, existing ADRES/CAATS applications will be supported in parallel until the end of 2003. One year after AirN@v introduction, with A320 family February 2004 and A330/A340 April 2004 revisions, AirN@v will become the only product available.

**AirN@v future developments...**

Later versions planned in 2004/2005 will introduce:

- Integration into AOLS
- Job Card generation
- Shopping List generation

**Information to airlines**

A revision of the Digital Deliverables Status – SIL 00-075 and Operator Information Telex (OIT) SE 999.0100/02/MA were issued to inform airlines of the improvement features, functions and supply conditions of AirN@v.

**Hardware and software requirements**

Considering the above, it would be advisable for airlines to prepare for the introduction of AirN@v in 2003 by being ready to read DVDs. Therefore it is Airbus’ recommendation to acquire DVD drives, which are backward compatible with CD technology.
AirN@v functions and features

WHY A BRAND-NEW USER INTERFACE?

You will notice that user interface and documentation layout differ from ADRES/CAATS and from PDF documentation (Figure 1).

The main reasons for changing the application layout are:

• Proposing a Windows-like interface to minimize specific training requirements (menus, toolbars, tree view for table of contents, tabs, etc. including a comprehensive on-line Help function).

• Giving access to all new value adding functions of AirN@v.

• Accommodate Web Technology constraints as easily as possible while preserving performance. One of the consequences is that technical manuals are divided into a set of HTML pages.

Documentation layout has also been adapted for electronic viewing:

• Search through forms replaces sorted lists or cross-reference tables (IPC detailed Parts List and Part Number information, Wiring Lists),

• Links allow the user to jump easily from one piece of information to another. Information duplication is no longer required.

FUNCTIONS

Functions can be accessed through both Menu and Icon Bars. Users not yet familiar with AirN@v may position the mouse pointer for a moment on the Icon and a “ToolTip” will appear with the icon’s specific meaning. The same will happen for the (truncated) Document Views, table of contents (TOC) titles and effectivities, which are displayed full-size when holding the mouse pointer on them.

Menu Bars in the top of the AirN@v application and their applicable sub-menus ("pull-down menus") are always applicable.

ACCESS TO ANY PIECE OF INFORMATION

• After first log-in, the “CATALOG” page will be displayed. Select the manual by clicking. If you have already opened the document during the session, you may select the document by clicking the corresponding Manual tab.

• Within the manual (AMM, IPC etc.), you may access any document by the Document view ("tree type" Table of Contents – TOC). Click on “+” or “-” to respectively deploy/collapse a given element of the TOC. For full-sized text of the title/ effectivity, leave the mouse for a moment on the title (see sample). Then, click the title of the element you want to view.

Figure 1

![Figure 1](image-url)
Hyperlink buttons in the icon bar of the frame are designed for easy navigation within and between manual(s). Crossing a link is performed by a simple click. In Figure 1 selecting the “See IPC” button leads directly from the “AMM Installation of the IDG Oil Filter” to the corresponding IPC Figure, Detailed Parts List (DPL) with part number, vendor code and replacement information, if any. Links can also be highlighted in the text flow itself as standard web links (e.g. hyperlinks to figures/sheets, other tasks etc. A mechanism of off-line links is also used to access to attached document.

When receiving a new revision, the engineer and mechanic are specially interested in that piece of information that has been revised since the last revision. To respond to this requirement, the Manual Front Matter includes Change highlights, classified by ATA chapters, including the elements subject to change, the reason for the change and a link to the considered part of the manual. Of course, modified text is clearly displayed with a yellow background for easy reference.

If the whole element (task, page block, SB-List etc.) fits in a single "HTML page", it is completely loaded and the Windows-like slider bar may be used to scroll through the pages (scroll up, down etc.). However, when the element is too large to be loaded, the beginning of the element is displayed with mention “Truncated page” at the bottom. Arrows in the Icon bar (see figure 1) can be used to access next or previous information pages.

For more advanced retrieval, “word search” may be used and search through “forms” features in AirN@v.

WORD SEARCH

A Word Search can be accomplished through the “Search” menu (Figure 2) or by clicking the corresponding icon.

The panel appears, offering the possibility to type in the word(s) to be searched and to select the document(s) for which the search should be performed. AirN@v will search in the AMM and IPC for the exact contents, for example “bleed valve”.

(Word search is not case sensitive, thus typing in lower or upper case is possible). Furthermore, also more advanced Word Searches are offered by AirN@v within a page, with number of occurrences (hits) at all levels in the table of contents, navigation through next hit and previous hit, and the possibility to filter hits by effectivity:

- Wild cards at any location (“*” for any sequence of characters and “?” for a single character).
- Exact content search for combined words.
- Proximity search with Boolean operators (connectors AND, OR, NOT).

After having opened the required document, the number of hits is displayed for each table of contents entry. “Next hit” and “previous hit” buttons allow navigation among the hits. When an entry is selected in the table of contents, the button “Next hit” will display the first hit in this selection.
SEARCH THROUGH FORMS

Searching for technical information may be much more complex than simply searching for words for example, when searching in the AWL for all Wire Number connected to the Connector pin “AB” with Functional Item Number (FIN) “1CA1”. To perform such queries, search forms, accessed through the menu bar (as depicted in Figure 3) have been designed.

The list of relevant wires is then displayed. It may be truncated if there are too many results. In this case a more specific query is required. To view the information on the wire, double-click on the appropriate line in the results table. This line can be selected by pressing “Open”.

When entering data in the search form, when the exact value of a the field is unknown, possible values may be obtained through a Drop-down list, or by using (*) wildcards in the text field.

AIRCRAFT TROUBLESHOOTING

AirN@v offers also intelligent interactive guided trouble-shooting (as previously covered by CAATS) and as shown in figure 4. It guides the mechanic to the right trouble-shooting procedure based on the data collected from the aircraft, being the Logbook and the Central Maintenance System reports, i.e. the Post Flight Report (PFR).

From the Trouble-Shooting Manual (TSM) procedure, AirN@v gives access directly to any AMM procedure referenced in it (test, removal/installation, servicing,...) and allows also further navigation inside the AMM and ASM.

AirN@v provides also the possibility to associate complementary data coming either from the airline, “Airline comments” or from Airbus “Technical Follow-up (TFU)”, to the Airbus documentation. The information is stored on the hard disk and integrated in AirN@v.
The Trouble Shooting function (Figure 5) allows selection of a primary Entry Point. It then proposes a sequence of possible associated “Warnings/malfunctions”.

The Selected Entry Points are displayed on the upper part of the screen and the proposal of associated “Warning/malfunction” messages in the lower part of the screen.

An isolation procedure is displayed when it corresponds to a complete Fault Symptom.

From the TSM, hyperlinks to AMM/ASM or other documents can be used to perform the fault isolation.

Other AirN@v features...

EFFECTIVITY SELECTION

AirN@v supports data filtering by effectivity. In other words, either customised fleets (Effectivity: “ALL”), or individual aircraft data – only valid for that aircraft – can be retrieved.

To activate this function, select Effectivity in System menu or click on the appropriate aircraft icon.

A panel appears with two columns (see Figure 6). The first column lists the aircraft to which the documentation is applicable. The second column lists the selected aircraft. By default, selected effectivity is “ALL”. To select a particular aircraft, first click on “<<” to empty the list of selected aircraft, then double-click on the desired aircraft number. The desired aircraft number can also be selected by clicking on the “>>” button. When pressing “Apply” only the information applicable to the selected aircraft will be displayed.
GO BACK, GO FORWARD AND HISTORY

- **Go Back** function gives access to the piece of information previously displayed.
- **Go Forward** can be used to undo the Back function.
- **A History** function allows viewing and access to information already accessed during the session. An option in Preferences (“System” menu) allows automatic saving and restoring of historical information.

ANNOTATIONS, BOOKMARKS AND ATTACHED DOCUMENTS

- **Bookmarks** (markers in document for later access or printing) and **notes or links** to **external attached documents** (PDF, TIFF etc.) may be created, at any level in the document structure. The Modifications may be defined as **Public**, giving access for all AirN@v users, or **Private** when only for the current log-on user.

GRAPHICS

The Active CGM Browser 7.1 gives advanced graphic manipulation features, which may be accessed by clicking the corresponding Icon shown in the top right of the window, see figure 7:

- Previous image
- Next image
- Synchronise with view (show corresponding text)
- Zoom in/out
- Select area
- Rotate
- Pan
- Print.

PRINT

Two print modes are proposed.

- Clicking the print icon prints out that information block.
- A print icon is also included in the TOC of the document. This icon prints the complete content of the selection in the table of contents including referenced graphics.

**Caution:** Please note that when clicking e.g. on the AMM manual in the TOC, the whole AMM will be printed, when not out of buffer capacity.
Conclusion

Endless hours have been spent by engineers and mechanics looking for technical information on traditional supports such as paper, micro-film or even PDF. Huge amounts of time and energy have been put in updating the documentation before it can be released to the end users.

In 1994, Airbus paved the way to easy access to technical data with its two interactive products ADRES/CAATS. With the replacement of ADRES/CAATS by AirN@v in 2003, Airbus is now taking one major step forward in terms of giving end-users easy access to information at the right time wherever they are.

Compared to previous supports and applications, AirN@v (based on a fully owned Airbus technology “ADOC N@gimator”) – significantly reduces information look-up time, information distribution and aircraft troubleshooting time, thus generating significant cost savings for Airbus operators.

Airbus is once again setting the standards with its modular set-up.... Airlines who want to extend the AirN@v capabilities to other in-house manuals or to other aircraft types can do so by acquiring one or several modules of the ADOC Family.

The ADOC family is a comprehensive modular software suite for multi-fleet SGML Technical Data handling. Various modules can be chosen independently for airlines to build a Technical Data Management system tailored to their needs.

The main modules of the ADOC Family are (see figure below):

- ADOC Manager for Content and Revision Management
- ADOC Electronic Publisher for data preparation and customisation of applications
- ADOC N@gimator for interactive consultation and aircraft troubleshooting
- ADOC Job Card Publisher for dynamic production of customised Job Cards triggered from the Maintenance Planning System.

For any commercial questions on ordering and supply of AirN@v, please contact your regular Airbus Customer Support Manager.

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The first flights over the North Pole took place in the late 1920s. Richard Byrd and Floyd Bennett in a Fokker-VII tri-motor called Josephine Ford were the first on 9th May 1926. It took them 23 hours on a return flight from Spitzberg (Svalbard) during which they circled the Pole for 14 minutes.

Two days later on the 11th of May at 14:00 Roald Amundsen the well-known explorer and Umberto Nobile took off from Spitzberg in an Italian built airship named Norge.

They over flew the Pole 11h 30min later and continued in a straight line towards Nome in Alaska.

They eventually moored nearby at Teller at 08:30 on the 14th of May 1926. The flight, which covered 5100 kilometres and took 68h 30min, was severely hampered by a build up of ice on the nose of the airship. A ton of ice destabilised the airship and froze over the antenna, depriving the crew of vital weather information.

Two years later on 15th April 1928 the Australian explorer Wilkins and his pilot Eielson, in a Lockheed Vega powered by a single Wright 230hp, crossed the North Pole from Point Barrow to Spitzberg in 20 hours. The wooden fuselage “provided good insulation”.

Airship Norge at the entrance to its open-roofed hanger in Spitzberg. It was 106m long and powered by three Maybach 230hp engines.
Customer support

AROUND THE CLOCK...AROUND THE WORLD

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Technical, Spares, Training
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Training centres
Spares centres / Regional warehouses
Resident Customer Support Managers (RCSM)

RCSM LOCATION COUNTRY
Abu Dhabi United Arab Emirates
Algiers Algeria
Amman Jordan
Athens Greece
Bangkok Thailand
Beirut Lebanon
Brussels Belgium
Buenos Aires Argentina
Cairo Egypt
Caracas Venezuela
Charlotte USA - North Carolina
Chengdu China
Colombo Sri Lanka
Copenhagen Denmark
Damascus Syria
Delhi India
Denver USA - Colorado
Derby United Kingdom
Detroit USA - Michigan
Dhaka Bangladesh
Doha Qatar
Dubai United Arab Emirates
Dublin Ireland
Duluth USA - Minnesota
Dusseldorf Germany
Frankfurt Germany
Guangzhou China
Hangzhou China
Hanoi Vietnam
Helsinki Finland
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