

Safety **First**

The Airbus Safety Magazine



5

DECEMBER 2007



AIRBUS

Editorial

05 | December 2007



Yannick MALINGE

Vice President
Flight Safety

Dear Customers and Aviation Safety colleagues,

The 14th Airbus Flight Safety Conference, which took place on October 15th to 18th, was an opportunity to remind the trends and to show lessons learned. As we all know, CFIT and runway excursions remain two of the highest risk areas.

It also emphasized the fact that we are learning much more than we ever have: with your flight data monitoring systems we know of more near events than would have ever been possible before

As accident prevention is often a matter of repeating lessons learned from the past and sharing them with new comers, either new airlines or younger pilots, we have decided to include in this 5th issue of Safety First magazine 2 articles about lessons already known (near CFIT, managing unreliable airspeed).

Then, as soon as the investigations will be completed, we intend to share with you in a coming issue, the lessons learned from the 2 major runway excursions, which occurred on the Airbus fleet since the last Safety Conference.

I hope you will enjoy reading this issue and share it widely within your airline.

The Airbus Flight Safety Team wishes you and your family a very good new year 2008.

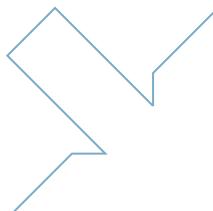
Yours sincerely

Yannick MALINGE
Vice President Flight Safety



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Safety First

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For the enhancement of safe flight through
increased knowledge and communications.

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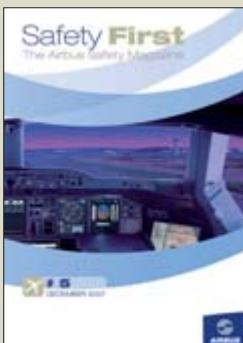
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Airbus

Flight Safety Department (GSE)
1, rond point Maurice Bellonte
31707 Blagnac Cedex - France
E.mail: nuria.soler@airbus.com
Fax: +33 (0)5 61 93 44 29



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Editors:

Yannick Malinge,

Vice President Flight Safety

Christopher Courtenay,

Director of Flight Safety

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Hervé Berenger

Philippe Masclet

Hervé Goussé

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New Head of Airbus Product Safety

Claude Lelai has replaced John Lauber as head of product safety following John's retirement in September.

Claude joined airbus in 1988 as an experimental test pilot and since 1994 has led the Airbus flight test team in the development, certification and acceptance of all Airbus aircraft including most recently the A380.

He has accumulated over 15000 flight hours on more than 200 aircraft types.

On taking this new appointment Claude said that he was very much looking forward to his new responsibilities. "As a company we have an enormous obligation to ensure that we are providing the safest possible aircraft for airlines and passengers," he said. "And it is an honour and a great responsibility to take on such an important role for Airbus.



14th Flight Safety Conference



The 14th annual Airbus Flight Safety Conference has been very successfully completed in Barcelona, Spain and we hope you all benefited from the information sharing between us all.

The numbers continue to grow each year with 141 participants, representing 82 companies, including many new airlines operating Airbus aircraft. As always there were presentations made by some operators, which encourages an open environment to talk about the important safety issues.

Note that even if you or your airline were unable to be there, the presentations are sent on CD to all the airline flight safety officers.

15th Airbus Flight Safety Conference

The planning for the next year's conference is already in progress and the dates and location are already defined. So put in your calendars:

Date: 20th to 23rd October 2008

Location: **Paris, France.**

Your articles

As already said this magazine is a tool to help share information. Therefore we rely on your inputs. We are still looking for articles from operators that we can help pass to other operators through the magazine.

If you have any inputs then please contact us.

Contact: Chris Courtenay e-mail
christopher.courtenay@airbus.com

Phone: +33 (0) 562110284

Mobile: +33 (0) 616036422

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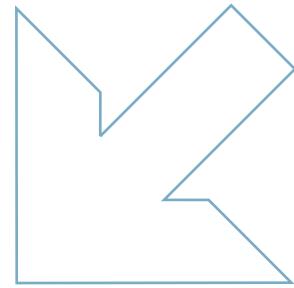
If you have any questions about the distribution of the magazine either electronically or in hard copy then please contact us.

Contact: Mrs Nuria Soler
e-mail: nuria.soler@airbus.com
fax: +33 (0) 561934429





Near CFIT event during Non Precision Approach



By: Panxika Charalambides
Flight Safety Manager

1 | Introduction

Today most of major incidents and accidents belong to one of the following categories:

- Controlled Flight Into Terrain (CFIT)
- Loss of control in flight
- Landing short
- Runway excursion

In particular CFIT events make up 45% of approach-and-landing accidents, that represent 55% of global accidents.

This article details a near CFIT event encountered on a single aisle aircraft as well as the associated lessons learned.

This event presents numerous classical components conducive to a CFIT and approach accident.

of fog closing and opening the station. On final approach, due to low visibility, the crew initiated a go-around and hit electrical lines. The crew then diverted to the scheduled alternate airport."

The investigation performed on site revealed that 25ft high electrical lines, located perpendicularly to the runway axis, at about 1100m from the runway threshold, were found sheared.

The aircraft was damaged subsequently to the impact with the electrical power lines. Damage was present all across the aircraft (fuselage, engine, wings) indicating that the aircraft impacted the lines head-on. Furthermore, some pieces of electrical lines were found in the area of the nose landing gear and it was concluded that the initial impact occurred at nose landing gear level.

The aircraft diverted and landed at the scheduled alternate airport. There were no passenger or crew injuries during this incident.

This article is mainly based on the analysis of the DFDR, which was provided to Airbus. Human factors aspects, in particular, will not be covered, due to lack of information.

2 | Reported event

The following was reported to Airbus:

"This flight was uneventful until the approach phase that was a non precision approach performed in VMC conditions. Weather report indicated a partly cloudy sky with 10 miles visibility at destination, but, during the descent, ATC informed the crew about variable weather conditions due to banks

3 | DFDR analysis

Note: for de-identification reasons altitudes are given in heights with reference to QFE.

This was a step-down VOR-DME approach conducted in daylight, early in the morning, autopilot engaged.

As a consequence, the approach was a succession of descent and level flight phases so that autopilot longitudinal modes were alternatively OP DES mode and ALT*/ALT modes, while the auto-thrust modes were respectively idle mode and speed mode (with speed managed by the FMS). The successive constraint altitudes were fully respected.

Shortly before over-flying the last altitude constraint "P1" (859ft QFE situated at 3.7NM from the runway threshold) the aircraft was in level flight at 860ft QFE. The minimum descent height was 459ft.

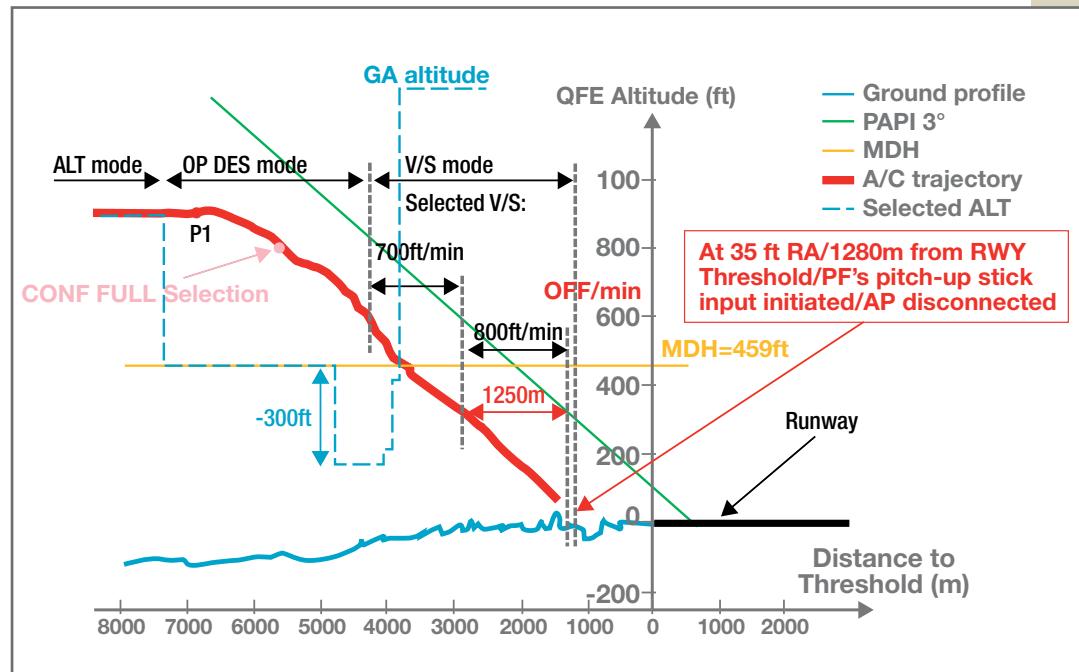
The figure here below presents the descent profile from "P1"

This sequence can be detailed as follows:

- Shortly before over-flying "P1", MDA altitude was selected on the FCU, and the OP DES longitudinal autopilot mode was selected so that a thrust reduction was progressively commanded to target idle thrust, while the autopilot pitch mode maintained the speed target.
- At that stage the aircraft was in slats/flaps configuration 3, gear down, both flight directors engaged, autopilot N°2 engaged.

- For the whole approach the autopilot lateral mode remained in NAV mode.
- **At 800ft QFE, 3NM from runway threshold**, shortly after over-flying the last altitude constraint "P1" full slats/flaps configuration was selected.
- **At 680ft QFE, 2.6NM from runway threshold**, whereas the rate of descent was 1000ft/min, an altitude 300ft below MDA was selected on the FCU.
- **At 600ft QFE, 2.3NM from runway threshold**, while the current rate of descent was -1400ft/min, the crew selected the autopilot V/S mode with initially a selected V/S of -700ft/min. From that time auto-thrust was therefore engaged in speed mode. Target speed was Vapp (VLS +5kts).

- While descending **below MDA about 2.1 NM from runway threshold**, go-around altitude was selected on the FCU.
- **At 325ft QFE/ 1.54NM from runway threshold**, the crew selected a vertical speed of - 800ft/min.
- **At 47ft RA at about 0.72NM from runway threshold** the crew selected a vertical speed of 0ft/min.
- **At 35ft RA, at 0.70 NM from runway threshold**, the Pilot Flying applied 2/3 of full back stick input that disconnected immediately the autopilot.

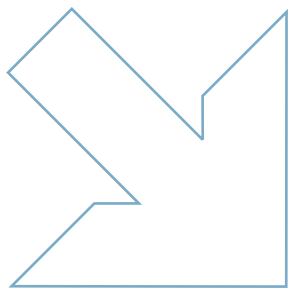


Descent profile

Notes:

- 1/ As this approach was performed in GPS primary (In this case only GPS and IRS data are used for the aircraft position computation) the accuracy of the recorded aircraft position is very good.
- 2/ In managed guidance only (FINAL APP mode engaged) when the aircraft reaches MDA (MDH) -50ft or 400ft (if no MDA/MDH entered) the autopilot automatically disengages.
- 3/ As noticeable on the figure here above, from MDA altitude this final descent was performed on a 3° slope.

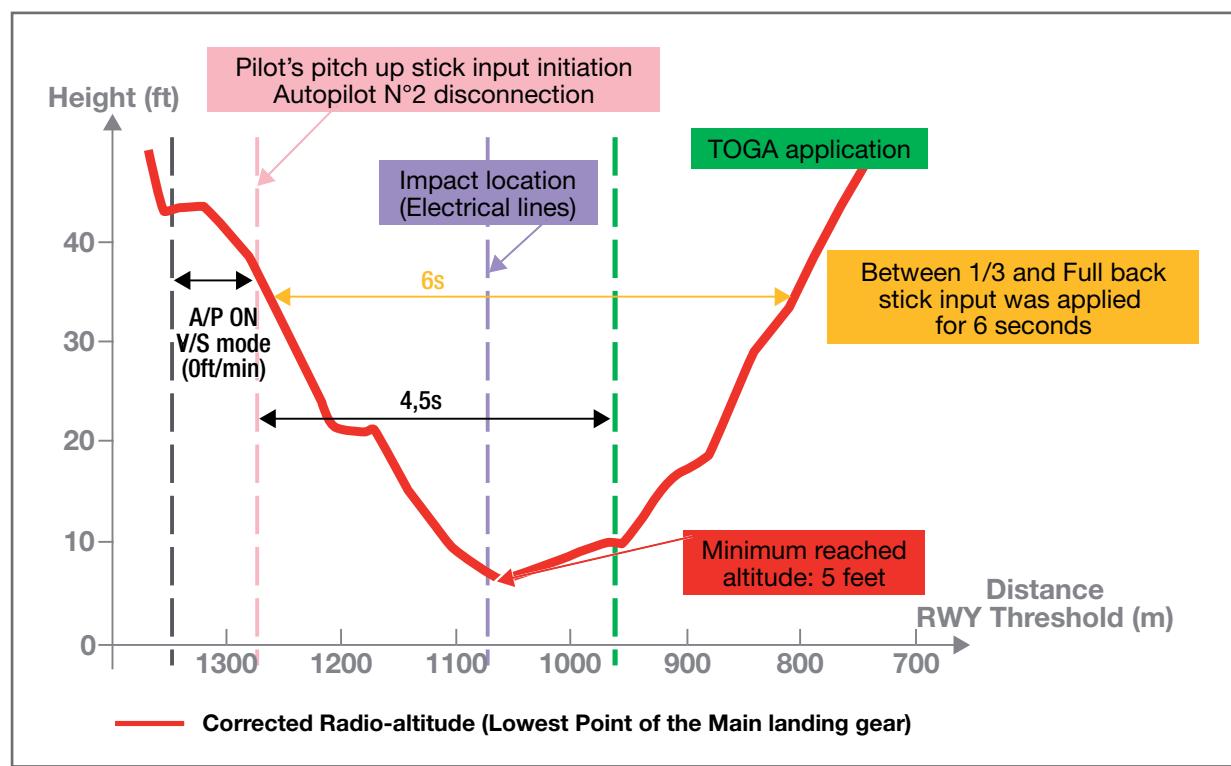




The figure here below presents a zoom on the pilot's take-over phase:

- The radio-altimeter parameters recorded in the DFDR (here plotted in red) indicate the distance between the lowest point of the main landing gear and the ground.
- The initial PF's pitch-up stick input was followed by permanent pitch-up stick input (between 1/3 and full back stick input) applied for 6 seconds, so that the aircraft stopped descending and started to climb.
- Minimum recorded altitude was 5ft RA reached at about 1100m from the runway threshold.

- The estimation of the impact location indicates that, at that moment, the aircraft impacted the electrical lines.
- At 10ft RA, 4.5 seconds after the initial PF's pitch-up stick input, thrust levers were moved forward to TOGA detent.
- 43 seconds after TOGA application, landing gears were selected up.
- 2 minutes after TOGA application, Slats/Flaps configuration 3 was selected.
- The aircraft diverted to the scheduled alternate airport.



Zoom on pilot's take-over phase

4 | Lessons learned |

Following are the lessons to be learned from this near CFIT event:

4.1 Descent below MDA requests adequate visual references:

When conducting a non precision approach, it is recommended to apply the “Non Precision Approach” Standard Operating Procedures. In particular, when the aircraft is properly established at MDA, the runway in sight must be confirmed by both PF/PNF, before disconnecting the autopilot and descending for a visual approach.

Furthermore, **if the required visual references are met at MDA but are lost at any time below MDA, a go-around procedure must be immediately applied.**

This is also highlighted in Chapter 7.3 (Acquisition of visual references) of the “Getting to Grips with...” ALAR brochure (Approach And Landing Accident Reduction).

This brochure can be downloaded from the Flight Operations Community at <https://w3.airbus.com/>.

4.2 Parameters monitoring

When conducting this particular approach, successive radio-altimeter callouts triggered below 200ft RA, while the aircraft was getting closer and closer to the ground, should have alerted the crew.

It is recommended as soon as the radio-altimeter is activated (at 2,500 feet AGL) to call out “radio altimeter alive”. The radio altimeter reading should then be included in the instrument scanning for the remainder of the approach. See Flight Operations Briefing Note “Altimeter Setting – Use of Radio Altimeter.”

This FOBN can be downloaded from the Flight Operations Community at <https://w3.airbus.com/>.

4.3 Step-down Non Precision Approach:

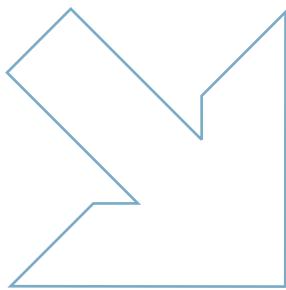
For non precision approaches, Airbus recommends implementing the Constant Angle Non Precision Approach (CANPA) rather than the classical step-down non precision approach. Flying a constant-angle approach profile will reduce the risk of CFIT. Indeed it will provide a more stabilized flight path, will reduce the workload during this critical flight phase and will minimize the risk of error in step-down distances/altitudes and the need for a level off at the MDA (MDH). This technique is detailed in the chapter 7.2 (Flying Constant-Angle Non Precision Approaches) of the “Getting to Grips with...” ALAR brochure (Approach And Landing Accident Reduction).

4.4 No EGPWS alert was triggered during the flight phase where the aircraft was getting very close to the ground:

As the aircraft was in landing configuration (full slats/flaps, gear down...) no GPWS (Ground Proximity Warning System) basic modes could have been triggered, but as the aircraft was fitted with an E(enhanced)GPWS, the EGPWS mode “Terrain Clearance Floor (TCF)” could have been triggered. Indeed, the TCF function uses a Terrain Clearance Floor envelope (see drawing here below) stored in the EGPWS database for each runway for which terrain data exists, and warns in case of premature descent below this floor, regardless of the aircraft configuration.

If the aircraft descends below this floor a “TOO LOW TERRAIN” aural warning sounds. In case of such alert, it is recommended by the Standard Operating Procedures (SOPs) either to adjust the flight path (In daylight with terrain and obstacles clearly in sight) or to initiate an immediate go-around (during night or IMC conditions).





But as shown on the sketch here below there is a progressive desensitization of this function when the aircraft approaches the runway. In particular, in a circle centered on the runway, a full desensitization exists i.e. no warning when the aircraft is very close to the runway.

With the EGPWS software version fitted on this particular aircraft, the Terrain Clearance Floor function had a higher desensitization zone than current EGPWS, so that no alert was given when the aircraft descended very close to the ground. With the latest EGPWS software version (the aircraft was equipped with a GPS), an alert would have been triggered about 20s before impacting the electrical lines (at about 200ft QFE).

Note: The desensitization area depends on the FMS estimated position accuracy.

In particular this software release allows for the GPS position data to be used directly, resulting in much smaller estimated error values that allow for smaller desensitization areas.

This latest software version was revised to optimize the envelope profile and to reduce the minimum desensitization area to a circle with a radius of 0.25NM, whereas such radius was 1NM for the software version installed on the aircraft at the time of the event.

This results in significantly improved protection for "landing short" accidents.

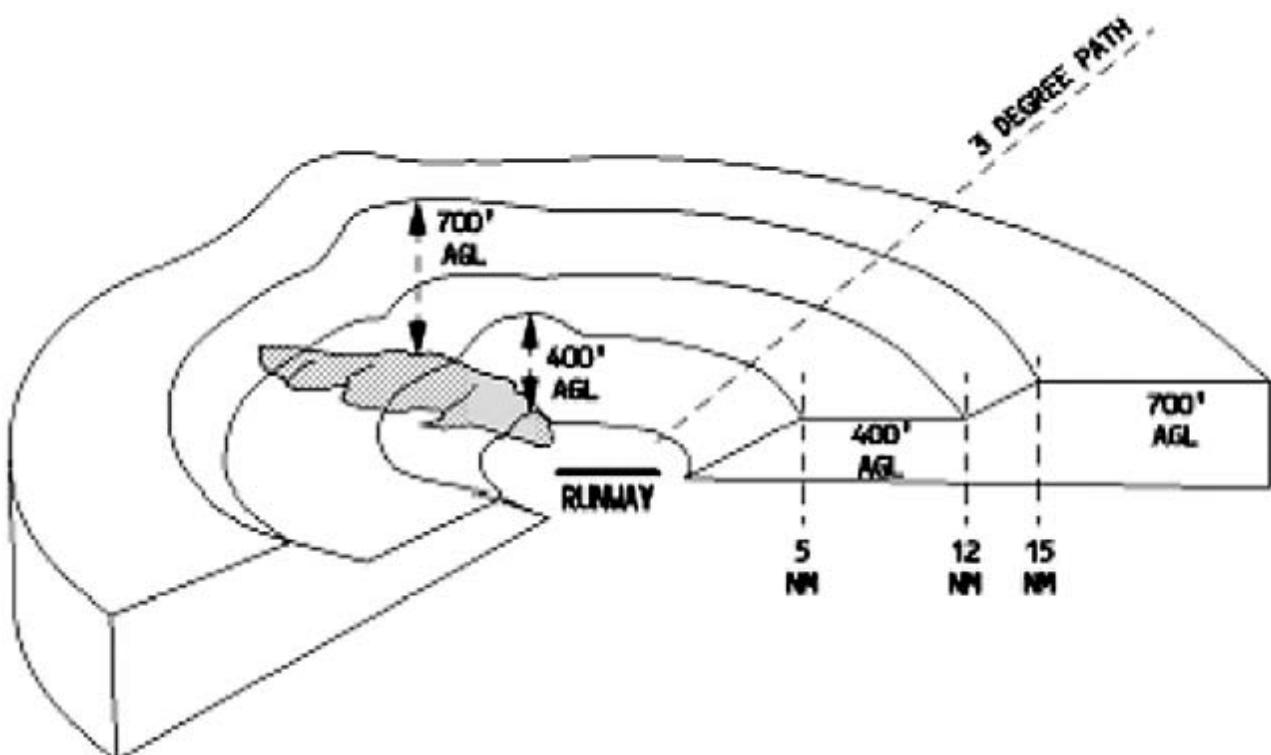
Upgrade to last EGPWS software standard (P/N 965-1676-002) for any Airbus aircraft type:

Please refer to OIT ref.

SE 999.0050/06/VHR dated 18 April 2006.

Please refer to last ref. SIL 34-080 revision

This last, free of charge, EGPWS software version is available for any Airbus aircraft type since May 2006.



4.5 MDA and then an altitude lower than MDA were successively selected on the FCU during the final approach:

When performing non precision approaches, Airbus does not recommend MDA selection and even less so an altitude below MDA. Indeed, this may cause unwanted ALT* mode engagement and consequently approach destabilization at a critical stage of the approach. Therefore FCU altitude should be set at go-around altitude after over-flying the final approach fix (FAF).

5 | Conclusion

Five main recommendations should be particularly highlighted:

- **To be go-around prepared and go-around minded**

When performing an approach, even and because the go-around is not a frequent occurrence, it is of prime importance to always be go-around-prepared and go-around-minded. This will help in performing the go-around appropriately, in the optimal conditions and as per procedures.

In particular the flight crew should have a clear view of excessive deviation and should be ready to interrupt the approach if:

- Ceiling and visibility are below the required weather minimums
- Criterias for stabilized approach are not achieved
- Doubt exists about the aircraft position
- There is confusion about the use of automation
- The aircraft is destabilized below MDA
- The visibility is lost below MDA

- **To adhere strictly to SOPs for Non Precision Approaches**

In particular altitude/distance checks and respect of MDA are crucial when performing Non Precision Approaches.

- **To retrofit a GPS on aircraft not already equipped with this system**

The installation of a GPS improves the efficiency of the EGPWS by providing a more accurate aircraft position to the system.

- **To upgrade the EGPWS software standard**

The EGPWS software should be upgraded with the last version (free of charge for any Airbus aircraft type), which reduces the desensitization area.

- **Constant Angle Non Precision Approach**

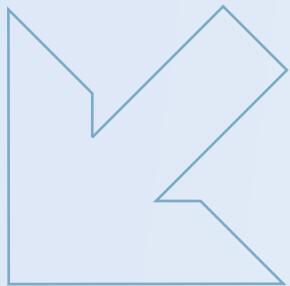
Airbus encourage the operators to work with their Authorities in order to translate step down Non Precision Approaches into Constant Angle Non precision Approaches.



A320 Tail strike at Take-Off?



By: Marc Baillion
Flight Safety Manager



1 | Introduction

This article describes an event that was first thought to be a tail strike. Further investigation allowed the operator to dismiss this belief. The subsequent analysis of this occurrence brought three interesting points to highlight, from which lessons can be drawn. These experiences are particularly addressed to the cockpit, cabin crews as well as to the engineers in charge of analyzing flight data.

The engineering department analysed the Flight Data Monitoring and reported to Airbus as follows: *"The FDM trace shows a maximum pitch angle of 16.52 degrees nose up, with both main gears on the ground (presumably at least partially compressed), and the nose wheel is in the air. Even if the main gear was fully extended, a strike should have occurred at 13.5 degrees. Assuming that the runway undulations were not a factor, it would appear that either the FDM software, or the data provided in the FCOM Bulletin No.22/4, is inaccurate."*

2 | Description of the event

At rotation, a member of the crew in the rear galley felt a thump and heard a bang at the rear of the aircraft. This information was forwarded to the cockpit crew when the aircraft had reached FL 160. At this time, the crew contacted the tower, which initiated a runway inspection, but found no sign of a tailstrike. They then consulted with the airline's engineering department and decided to divert the aircraft. After landing, it appeared that about 20 bags had shifted in the rear hold.

The airline reported no sign on the aircraft aft lower fuselage indicative of a tail strike. The take-off weight and center-of-gravity location were inside the normal envelope. The operator kindly provided Airbus with a copy of the DAR data.

3 | Analysis of the event and lessons learned

Take-off was performed in the following conditions:
Configuration 3

Thrust levers position was set to TOGA

TO weight: 73.690 T

TO center-of-gravity: 31%

Stabilizer position: 0.5° down

V1 = 123 kts VR = 133 kts V2 = 138 kts

3.1 Stick inputs and rotation

Rotation was initiated at the expected VR. Analysis of the DAR data shows that about half forward stick was applied until 80 kts, as per SOP. When the stick was released (at approx. 100 kts) the aircraft experienced a pitch attitude increase of +1°.

The rotation was initiated through a square input of about 1/2 full back stick deflection (-8° of stick) that was then slightly increased (up to -9° of stick) and maintained.

Under these conditions, the A/C initiated its rotation at about +1.4°/sec before stabilizing at a rotation rate of about +5°/sec, whereas the recommended value, as per SOP, is 3°/sec.

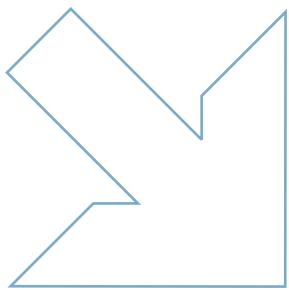
A subsequent calculation of the event lift-off conditions was conducted, using as inputs: longitudinal sidestick inputs, THS trim position, a/c weight and center-of-gravity, TO configuration, thrust lever position. The calculation results correlate well with the 12-13 degrees at lift-off and confirm also that a high pitch rate (5°/sec) was achieved, **while the minimum distance between the tail and the runway was 2 feet.**

A too high rotation rate is one of the main causes of tail strike at take-off and should therefore be avoided. Airbus recommends adhesion to the Flight Operation Briefing Note titled "Take-off and departure operations - Preventing tailstrike at take-off", which states:

"At VR, the flight crew should initiate the rotation with a smooth positive backward sidestick input to achieve a continuous rotation rate of approximately 3°/sec. Avoid aggressive and sharp inputs."

See also FCOM bulletin 806/1 "Avoiding Tailstrike".





3.2 Cabin-to-cockpit communications

According to the crew report, the purser informed the cockpit at FL160, and not before, because of the application of a sterile cockpit concept by this operator.

In the event of a tailstrike, the abnormal and emergency procedures call for LAND ASAP and MAX FL100 (see hereafter), in order to avoid cabin depressurization:

Airbus' "Getting to Grips with Cabin Safety", chapter 9 "Crew Resource Management" recommends that **"any situation, feeling, word, behavior, observation that alerts cabin crewmembers to a possible threat to flight safety, must immediately be reported to the purser and the flight crew."**

For good crew coordination, training should include instructing flight crewmembers and flight attendants on each other's emergency procedures, codes, signals, and safety-related duties.

A318/319/320/321 <small>FLIGHT CREW OPERATING MANUAL</small>	ABNORMAL AND EMERGENCY <small>MISCELLANEOUS</small>	3.02.80	P 21	
		SEQ 001	REV 39	
TAILSTRIKE				
<i>In the event of a tailstrike, apply the following procedure :</i>				
<ul style="list-style-type: none"> – MAX FL 100 or MSA <i>500 feet/minute should be targeted for the climb, to minimize pressure changes, and for passenger and crew comfort. Similarly, the rate of descent must be limited to about 1000 feet/minute, except for the final approach that must be performed normally.</i> <i>Notify the ATC of the aircraft's rate of climb.</i> – RAM AIR ON – PACK 1 and 2 OFF 				

The sterile cockpit concept comes from FAR 121/542, which among others, prohibits non essential communications between the cabin and cockpit crews below 10 000ft. This regulation may explain why cabin crews may hesitate to report occurrences which have no obvious safety implications. A concern addressed by Advisory Circular AC 120-48, which states: **"hesitancy or reluctance on the part of a flight attendant to contact the flight crewmembers with important safety information because of a misconception of the sterile cockpit rule is potentially even more serious than the unnecessary distraction caused by needless violations of the sterile cockpit".**

Conducting joint crew briefings will help in creating a working environment that is more conducive to a safe operation:

- Cabin crewmembers should be encouraged to report to the purser, or the flight crew, anything that they feel may pose a threat to the safety of the flight
- Discuss the "Sterile Cockpit" rule with the pilots, and the circumstances that are acceptable for contacting the flight crew during this time

See also CCOM chap 08.045 "SOP Preflight Briefing".

3.3 Determination of the lift-off time when analyzing flight data monitoring information

The flight data analysts of this particular airline wondered how the aircraft could have reached a nose up pitch angle of 16.5 degrees, “**with both main gears on the ground (presumably at least partially extended)**”, without striking the tail, considering that the FCOM calls for a pitch limitation of 11.7 degrees with the MLG fully compressed and 13.5 degrees with the MLG fully extended.

The explanation lies in the fact that the main gears were in fact not on the ground any more when the pitch reached the 16.5 degrees. **The reason for the confusion lies in the time difference, due to the gears' damping function, between the actual lift-off time and the MLG full extension.**

The actual lift-off can be reasonably well determined by the aircraft normal load factor variation. Recorded data shows that when the load factor began to increase, the pitch angle was in the range of 12 to 13 degrees i.e. within the published limitations for the A320 (as per FCOM bulletin 806/1).

A further analysis has been performed by Airbus to substantiate the time difference between the actual lift-off time and the MLG full extension. A flight test A320 was equipped with MLG load measurements and the results fully confirm the good correlation of the actual lift-off time with the normal load factor variation. The full extension of the MLG may take place more than 2 seconds later, depending on the aircraft weight and center-of-gravity location. This confirmed that the use of the gear squat parameters¹ is not accurate enough to give precise lift-off times.

4 Conclusion

This event did not jeopardize the safe continuation of the flight, but the conducted investigation allowed to highlight some shortcomings, which could have led to a critical situation.

Lessons can be drawn from this occurrence for the benefit of all operators in the following fields:

- Rotation technique
- Cabin to crew communication
- Understanding DFDR data

This illustrates the benefit of reporting events for the advancement of safety.

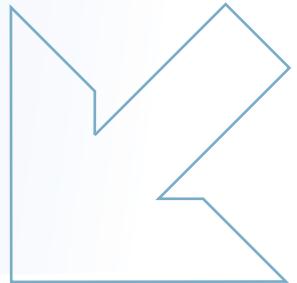
Airbus safety and operational materials, including the Flight Operation Briefing Notes and Getting to Grips with... brochures, can be found in the Flight Operations section of the secure area of www.airbusworld.com.

Alternatively, the FOBs can be consulted at www.airbus.com/en/corporate/ethics/safety_lib/

¹ RHSQUAT and LHSQUAT parameters shift to zero when, respectively RH and LH MLG are fully extended.



Unreliable Speed



By: Joelle Barthe
Flight Operations Engineer

1 | Introduction

Unreliable speed is one of the difficult situations that a pilot has to face. Once the failure has been identified, a procedure, based on pitch angles and thrust settings, will assist the pilot in safely flying the aircraft.

But the main difficulty is to rapidly detect an unreliable speed situation. Reaction time is crucial, since the aircraft may stall and overspeed conditions could cause aircraft damage.

In issue #3 of the Safety First magazine (December 2006), an article described the effects of pitot probes obstruction on ground. It intended to make ground and flight crew more sensitive to the consequences of obstructed probes, and to prevent take-off with unreliable speed.

But once airborne, how can the crew handle an unreliable speed situation?

This article therefore provides guidelines to recall how an unreliable speed situation can be identified, but also how to deal with it.

Note: this article is based on A320/A330/A340 design. Cockpit effects, identification and troubleshooting, remains similar for wide body aircraft and A380, with some specificities covered in the operational documentation.

2 | Effects and consequences in the cockpit

Water, ice, dust, ashes, etc. may partially or totally block pitot probes and static ports. Equally, tubes misconnected to the Air Data Modules (ADM), plastic covers not removed from the probes, insect nests, radome damage, may lead to erroneous pressure measurements.

The consequences of this erroneous pressure information, once used by the ADRs and/or the standby instruments, are the computation and the display of unreliable speed and/or altitude for all users.



CAPT PFD



F/O PFD

Erroneous speed or altitude indications can be suspected, among others, in the following cases:

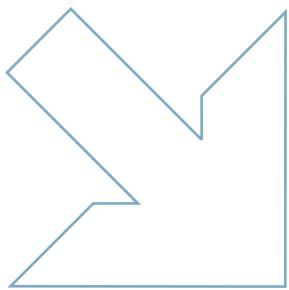
- Speed discrepancy (between ADR 1, 2, 3 and standby indication),
- The fluctuation of the Indicated Air Speed or of the Pressure Altitude,
- Abnormal correlation between basic flight parameters (IAS, attitude, pitch, thrust, climb rate),
- Abnormal AP/FD/ATHR behaviour,
- STALL and OVERSPEED warnings or FLAP RELIEF on ECAM that are in contradiction with at least one of the indicated airspeeds,
- Inconsistency between radio altitude and pressure altitude,
- Impossibility of extending the landing gear by the normal landing gear system.

Nevertheless, it should be emphasized that identifying an unreliable speed indication is not always obvious: no single rule can be given to conclusively identify all possible erroneous indications and the display of contradictory information may confuse the flight crew. Pilots should therefore be aware of unreliable speed symptoms and consequences.

Depending on the affected probe, i.e. pitot probe or static port, different indications in the cockpit will become unreliable. Therefore the crew should be aware that some of the usual cues to fly could be unreliable as indicated:

Data	Pitot probe obstructed	Static port obstructed
Indicated Speed/Mach	Erroneous	Erroneous
Altitude	Ok	Erroneous
Vertical Speed	Ok	Erroneous
FPV	Ok	Erroneous
AP/FD	Erroneous	Erroneous
ATC altitude report	Ok	Erroneous





3 | Identification and Handling of Unreliable Speed situations

Airbus has developed procedures and guidelines to help crews identify and handle an unreliable speed situation.

The Volume 3 of the Flight Crew Operating Manual (FCOM) and the Quick Reference Handbook (QRH) provide the UNRELIABLE SPEED INDIC / ADR CHECK PROC procedure.

In addition, Airbus has developed training material in the Flight Crew Training Manual (FCTM, available for A320/A330/A340/A380). The FCTM provides information about the causes and consequences of unreliable ADR computations. It also provides information on how to apply the UNRELIABLE SPEED INDIC / ADR CHECK PROC of the QRH.

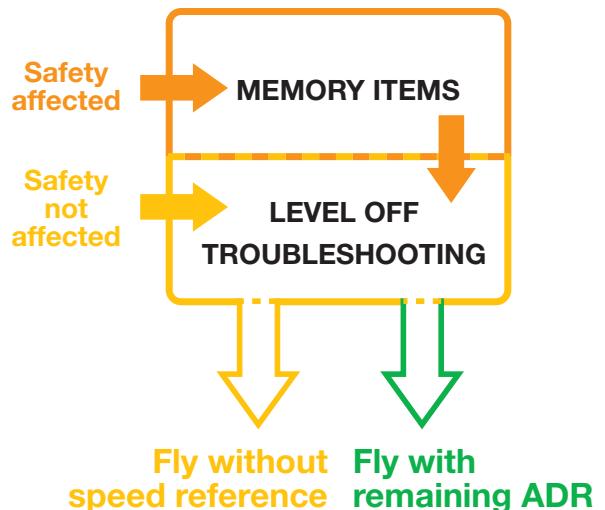
An interactive training tool, the e-Briefing, is also available on <https://w3.airbus.com/> in the Flight Operations community, under the heading "Safety and Operational materials".



4 | Procedures

As soon as a doubt about airspeed indication arises, or a relevant ECAM alert is triggered (relative to ADRs failure or discrepancy for instance), the UNRELIABLE SPEED INDICATION/ADR CHECK PROC procedure should be applied by the crew, following this sequence:

- 1) **If the safe conduct of the flight is affected, APPLY THE MEMORY ITEMS, i.e. fly a pitch with TOGA or CLB thrust,**
- 2) **If the safe conduct of the flight is not affected, or once the memory items have been applied, LEVEL OFF, if necessary, and start TROUBLESHOOTING,**
- 3) **If the affected ADR can be identified, fly with the remaining ADR.**
- 4) **If the affected ADR cannot be identified or all airspeed indications remain unreliable, FLY WITH PITCH/THRUST REFERENCES.**



4.1 Memory Items

If the safe conduct of the flight is affected, the flight crew applies the memory items: these allow “safe flight conditions” to be rapidly established in all flight phases (take-off, climb, cruise) and aircraft configurations (weight and slats/flaps). The memory items apply more particularly when a failure appears just after take-off.

A318 A319 A320 A321	ABNORMAL PROCEDURES	REV 41	2.15
SEQ 210			
UNRELIABLE SPEED INDICATION/ADR CHECK PROC			
<ul style="list-style-type: none"> ● If the safe conduct of the flight is impacted : 			
MEMORY ITEMS <ul style="list-style-type: none"> - AP/FD OFF - A/THR OFF - PITCH/THRUST : <ul style="list-style-type: none"> ● Below THRUST RED ALT 15°/TOGA ● Above THRUST RED ALT and Below FL 100 10°/CLB ● Above THRUST RED ALT and Above FL 100 5°/CLB - FLAPS Maintain current CONFIG - SPEEDBRAKES Check retracted - L/G UP 			
<ul style="list-style-type: none"> ● When at, or above MSA or Circuit Altitude : <ul style="list-style-type: none"> - Level off for troubleshooting 			
<ul style="list-style-type: none"> - GPS ALTITUDE Display on MCDU 			
<ul style="list-style-type: none"> ● To level off for troubleshooting : 			

Once the target pitch attitude and thrust values have been stabilized at or above minimum safe altitude, or when the safe conduct of the flight is not affected, the flight crew will enter the 2nd part of the QRH procedure: level off the aircraft and perform troubleshooting.

4.2 Troubleshooting and isolation

The table provided in the QRH gives the pitch (°) and thrust (%N1) to be applied to level off the aircraft according to its weight, altitude and configuration, along with flying technique advices.

● To level off for troubleshooting :

NOTE : Check the actual slat/flap configuration on ECAM, since flap auto-retraction may occur.

PITCH / THRUST FOR INITIAL LEVEL OFF

		SLATS / FLAPS EXTENDED		
CONF	Speed	Pitch (°) / Thrust (% N1)		
		Above 60 t	60 t - 52 t	Below 52 t
3	F	6.8 / 59.9	6.7 / 55.8	6.0 / 52.3
2	F	7.9 / 58.65	7.9 / 54.4	7.1 / 50.6
1+F	S	3.8 / 57.9	3.8 / 54.1	3.8 / 50.6
1	S	7.1 / 55.6	7.1 / 51.8	7.1 / 48.3

		CLEAN		
FL	Speed	Pitch (°) / Thrust (% N1)		
		Below FL 240	250 kts	2.4 / 61.4
FL 240 - FL 320	275 kts	1.7 / 75.6	1.5 / 75.0	1.2 / 74.4
Above FL 320	M 0.76	2.1 / 81.0	1.9 / 80.1	1.6 / 79.3

In situations where most primary flight data are erroneous, some indications may still remain correct and should consequently be used to help the crew stabilize the flight path. This is the case for the Flight Path Vector (FPV), reliable if the static ports are not blocked, and for the GPS altitude displayed on the MCDU, when GPS is installed.

When the flight path is stabilized, the flight crew will start the troubleshooting, keeping in mind that sometimes two or even all three ADRs might provide identical but erroneous data (e.g. due to icing conditions, flight in volcanic ashes, etc.).

Therefor, **do not instinctively reject an ADR that is suspected to be affected.**

If the troubleshooting procedure enables the crew to identify the affected ADR(s), then a normal situation can be resumed.

But if the affected ADR cannot be identified, or all ADRs are affected, then the flight crew will fly without speed reference, using the pitch and thrust tables.





4.3 Flying using pitch/thrust tables

First, the crew has to switch OFF two ADRs and keep one ADR ON, to keep the Stall Warning Protection.

Then, the crew will **fly the aircraft without speed references**, using pitch ($^{\circ}$) and thrust (%N1) settings.

A318 A319 A320 A321		ABNORMAL PROCEDURES		REV 41	2.18A		
				SEQ 110			
UNRELIABLE SPEED INDICATION/ADR CHECK PROC (CONT'D)							
INITIAL AND INTERMEDIATE APPROACH IN LEVEL FLIGHT							
The approach phase between Green Dot speed (clean configuration) and the landing configuration (CONF 3), is flown in level flight.							
LANDING GEAR UP IN LEVEL FLIGHT							
CONF	Speed (kts)	Above 60 t	60 t - 52 t	Below 52 t			
0	G-DOT	4.8 / 55.3	4.9 / 51.9	5.0 / 48.5			
1	S	7.1 / 55.5	7.1 / 51.9	7.1 / 48.3			
1+F (a)	S	3.8 / 57.9	3.8 / 54.1	3.8 / 50.6			
2	F	7.2 / 58.8	7.8 / 54.5	7.8 / 50.8			
LANDING GEAR DOWN IN LEVEL FLIGHT (EXPECT GRVITY EXTENSION)							
3	F	7.0 / 64.1	6.9 / 60.5	6.9 / 56.6			
(a) Due to the fact that the speed is unreliable, the SFCC may select the 1+F configuration in approach, instead of 1.							

To fly the aircraft using pitch and thrust settings, the crew will find in the QRH the tables relative to each phase of flight: Climb, Cruise, Descent and Approach, taking into account the aircraft weight, configuration and altitude. With these tables, the crew will be able to safely land the aircraft.

5 | Back Up Speed Scale (BUSS)

In order to decrease the crew workload in case of unreliable speed, Airbus has developed the Back-Up Speed Scale (BUSS) that replaces the pitch and thrust tables. The BUSS is optional on A320/A330/A340. It is basic on A380, being part of the ADR Monitoring functions.

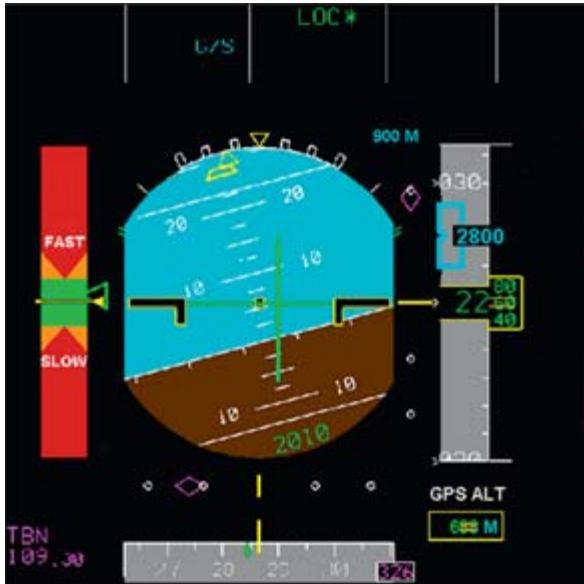
This indication is based on angle of attack (AOA) sensor information, and is therefore not affected by erroneous pressure measurements.

The BUSS comes with a new ADIRU standard (among other new system standards), where the AOA information is provided through the IRs and not through the ADRs. This enables selecting all ADRs off without losing the Stall Warning Protection.

The AOA information provides a guidance area in place of the speed scale. When the crew selects all ADRs OFF, then:

- The Back-Up Speed Scale replaces the PFD speed scale on both PFDs,
- GPS Altitude replaces the Altitude Scale on both PFDs.

The Back-Up Speed Scale then enables to fly at a safe speed, i.e. above stall speed and below maximum structural speeds, by adjusting thrust and pitch.



Buss: "Fly the green"

The BUSS will be displayed once all ADRs are switched OFF. Therefore, on aircraft that have the BUSS, when the flight crew cannot identify the faulty ADR(s) when performing the troubleshooting, or when all ADRs are affected, the flight crew will switch OFF all ADRs, and will fly the green area of the BUSS.

However, if the safe conduct of the flight is affected, the memory items must still be applied before troubleshooting.

As the BUSS is associated to the ADR monitoring functions, some unreliable speed situations can be automatically detected (e.g. new ECAM warning "**NAV ADR 1+2+3 FAULT**"), and some ECAM procedures will lead to the BUSS activation by requesting to switch OFF all ADRs.

6 | Conclusion |

An unreliable speed situation may be difficult to identify, due to the multiple scenarios that can lead to it. Therefore, training is a key element: indeed the flight crew's ability to rapidly detect the abnormal situation, and to correctly handle it, is crucial.

In case of any doubt, the pilot should apply the pitch/thrust memory items, and then refer to the QRH to safely fly the aircraft, and to positively determine the faulty source(s) before eliminating it (them).

In addition, to further assist the pilot in detecting the failure and safely fly the aircraft, Airbus has developed the BUSS, which provides a safe flying range indication.

Finally, to reduce the probability of experiencing unreliable speed situations, on-ground actions, such as comprehensive maintenance and thorough pre-flight exterior inspection, should be stressed.



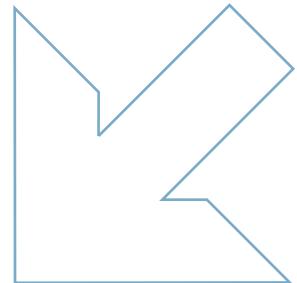


Compliance to Operational Procedures

Why do well trained and experienced pilots not always follow procedures?



By: Claire Pelegrin
Director Human Factors



1 | Introduction

In the aviation domain, the purpose of introducing procedures was to enhance safety in normal and abnormal conditions, by reducing uncertainty and thus risks. The rationale was obvious, and the benefits so blatant that the aeronautical industry has been using procedures for many years. It is now undisputed that pilots shall adhere to the procedures designed for them. But real life is not always that simple.

The objective of this article is to understand the complete picture: good procedures design is important as well as appropriate explanations to ensure pilots have sufficient confidence in their skills and judgment to manage the situation.

Each procedure is designed as the best and safest way to do a given task. Flight deck procedures are the skeleton of flight operations. They are the structure and the organisation by which a pilot can fly and interact with the aircraft and other crewmembers.

For years, everybody has shared that same idea that safety will be guaranteed if pilots are selected and trained, so as to strictly apply procedures.

The method was:

- **tell them**
- **train them**
- **enforce them**

to follow procedures.

When incidents or accidents occur, most of the time a non-adherence to procedures is mentioned. But this is not sufficient to explain accidents, because every day pilots do not follow procedures and this does not always lead to accidents!

2 | Role of procedures

Everybody knows the obvious role of procedures as a guide for action (individual and collective guide). It tells the pilot

- What to do
- When to do it
 - Sequence, order, synchronisation
- How to do it
- Who should do it
 - Organised task sharing
- What to observe and what to check
- What type of feed back is provided to the other crewmember

But procedures also have additional safety functions, which sometimes are not taught and explained well enough:

They support:

1) Situation awareness and anticipation

- a) They support a shared plan of action and shared awareness. The organised task sharing creates a shared action plan, that will be the “mental template” to act, synchronize actions and manage time. Thus, this shared action plan will be a support to build and manage situation awareness.
- b) The call out which represents a collective reading of the procedure is a basement for coordination.

2) Decision making by providing

- a) Elements of diagnosis to prepare the action,
- b) Elements of execution,
- c) Elements of control: cautions, what to do under different conditions and what to check.

3) Error management

- a) Guideline prevents the likeliness of errors,
- b) Common reference allows error detection.

Built around an organised task-sharing, the procedures allow each crewmember to stand back from the actions performed by the other one, which gives a kind of “fresh eye” on the tasks performed by the other crewmember.

4) Support risk management within complex and dynamic situations

3 | Procedures implementation

Not everything is predictable, and there is no magic in procedures. Mismatches do exist between procedures and actions. Implementing a procedure is not a simple automatic process.

A procedure implementation is by nature different from the procedure itself: the first one is an action, the second one is an instruction. The procedure specifies the tasks, then the pilot will have his/her own way for implementing the task.

Human performance is not stable, and can be impaired by a variety of factors such as fatigue, stress, workload or operational pressure. This can impair procedure implementation. This is why it is important to understand the triggering factors behind procedure deviations in order to minimize them.





Most of the time, crew action includes much more than what is written. It requires sophisticated mental functions such as:

1) Understanding the situation

This requires an organized perception and good situation awareness, which means a clear and up-to-date understanding of what is going on around the crew

2) Understanding the procedure and its meaning

3) Ensuring that all pre-conditions are checked

4) Anticipating the expected results

This is possible because pilots do more than just follow procedures. A procedure is more than a mere instruction: it refers to the pilot's own skills and experience, his "good judgment", "common sense" and "airmanship". Confidence in oneself, in the aircraft and in the other crewmember is paramount because it supports decision and action.

5) Ensuring that all actions requested by the procedures are performed in the right order, with good judgment and with good synchronization between crewmembers

This requires dedicated skills. It is thus linked to the pilot's knowledge of his own skills, his self-confidence, his confidence in the other crewmember and in the airplane. It also implies the ability to manage time and priorities.

4 | Role of managers

Once a procedure is designed and disseminated, the managers' duties are not over. They also have responsibility for how the pilots use them. The pilots should be convinced that procedures are useful and relevant to the situation.

The probability for an instruction to be followed is based on:

- the perceived risk
- the user's knowledge
- the situation
- the presentation of information
- the user's attitude

This means that procedures need to be explained and taught at all phases of pilot activities.

While developing procedures, airline managers may use the **4Ps model**.

- **Philosophy:**

is the over-arching view of the top management on how they conduct the business.

- **Policies:**

are a broad specification of the way the management expects things to be done. For example, the commercial role of the Captain to stand at the cockpit door when passengers disembark will influence the "Shut down" procedure, to be then performed by the Copilot alone.

- **Procedures:**

shall be consistent with the policies and overall philosophy.

- **Practices:**

cover all flight deck activities.

If philosophies and policies are articulated, then it will be easier to generate logical and consistent procedures, and it will allow detecting the discrepancies and inconsistencies between procedures.

While the lack of procedures may generate risk and poor standards and standardisation, too many of them will sometimes create complacency.

Alike, pilots experiencing trouble with a specific procedure may end up with lack of confidence in all other procedures. *"I have already experienced this, I know a better way to do the task".*

The rationale for procedure changes should be documented and explained. Human beings often resist a change if they do not understand its justification and benefits (whether in terms of effectiveness or safety).

The level and type of explanations should be adapted to the context. When transitioning onto a new type, the focus will be on the link with design principles. Recurrent training will rather focus on routine situations, emergency situations and return of experience.

In some circumstances, the role of airmanship and good judgment should be clarified.

Example: Land ASAP

Even in this situation (red warning), procedures do not decide on behalf of the crew. The level of emergency and the time available should be evaluated. Crew good judgment and decision are based on the time available, the type of failure, the flight situation and the environment (weather, characteristics of surrounding terrain, etc...)



Sometimes, the main reasons behind the procedures should be explained.

For example, in case of **Tail pipe fire**

The flight crew must perform the following actions:

Shut down the engine
(MASTER switch set to OFF)
Do NOT press ENG FIRE pushbutton

Why? Because (FCTM02.03):

- this would stop power to the FADECs and would stop the motoring sequence
- the fire extinguisher must not be used, as it will not extinguish any internal engine fire
- as a first priority, the engine must be ventilated

5 | Conclusion |

To repeat: “Follow procedures” is not sufficient. Not even the best procedures can be considered perfect. Extensively tested before implementation, SOPs are the outcome of a lot of expertise. However, the environment is dynamic, and procedures can only provide baselines. No set of procedures can substitute for human intelligence and flight experience.

SAFETY
=
Safe aircraft
+ **procedures**
+ **pilot's competence**
as an ability to manage
the expected and unexpected



The Future Air Navigation System FANS B

Air traffic communications
enhancement for the A320 Family



By: Sophie de Cuendas
Design Manager, Airbus Customer Services

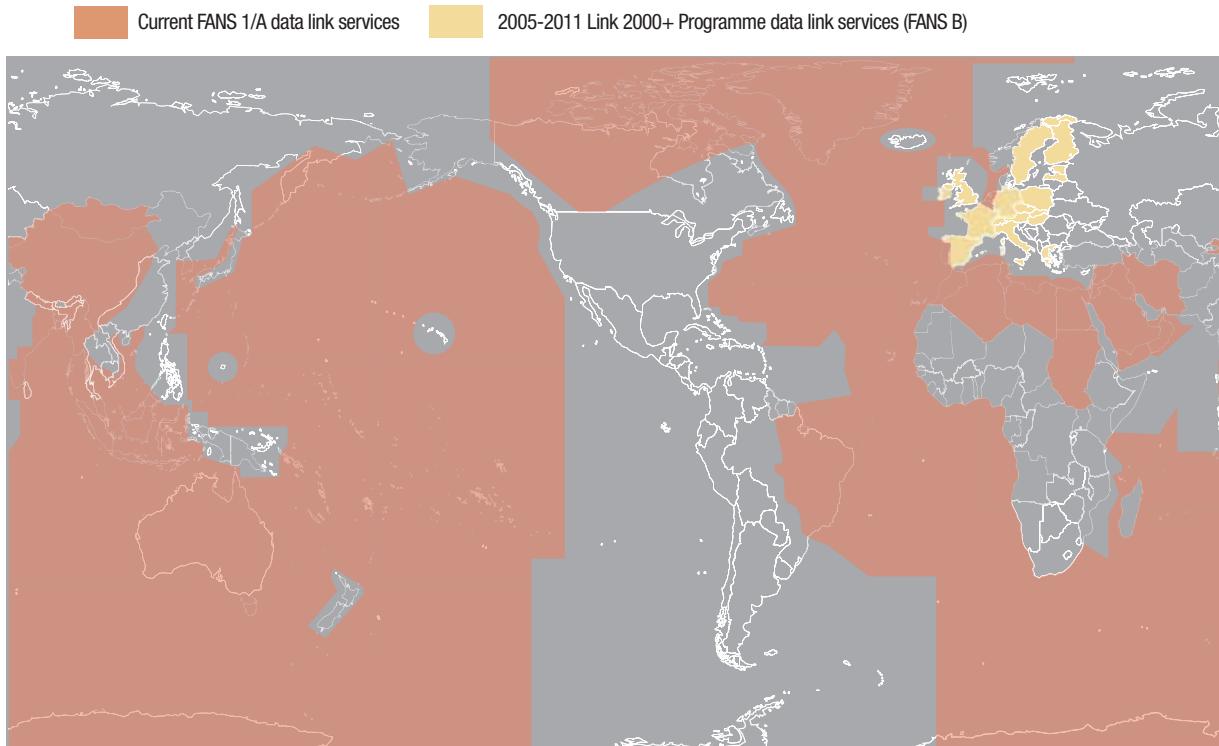
This article first appeared in **FAST**
issue 40

In today's busy Air Traffic Control (ATC) environment, and especially in high-density continental airspace, congestion on the voice channels used by air traffic controllers and pilots can be one of the limiting factors in sector capacity and safety.

Most messages on the voice channels are for routine activities such as the transfer of voice communications, flight level requests and clearances, route and heading clearances and requests, speed clearances and Secondary Surveillance Radar (SSR) code changes. Pilots and controllers need to exchange information in a flexible, reliable and secure manner.

A Preliminary Eurocontrol Trial (PETAL), the Eurocontrol test of air/ground data link, a project at Airbus and the Maastricht Upper Airspace Centre (UAC), and its follow-on PETAL II, also conducted until the end of 2001 at the Maastricht UAC, demonstrated that the transmission of digital data via air/ground data link offers a reliable alternative to voice communications in relieving spectrum and ATC congestion and improving safety in air transport. The Maastricht UAC controls the upper airspace of Belgium, the Nether-lands, Luxembourg and part of Germany, which carries a lot of Europe's air traffic.

The experience gained from the PETAL projects was used for a new project in Europe known as the Link 2000+ Programme, which provides air traffic controllers and pilots with a second communication channel: An air/ground data link, over an Aeronautical Telecommunications Network/VHF Data Link (ATN/VDL) Mode 2 infrastructure in the core area of Europe. VDL mode 2 compared to VDL mode A improves the data rate exchanges between aircraft and the ground station (data rate multiplied by ten, new modulation scheme, new communication protocol).



2007 Worldwide air traffic data link services

1 | Link 2000+ Programme phased implementation

Link 2000+ Programme will start with a pioneer phase whose objective is to gain operational experience on ATC data link use, with pioneer airlines and pioneer ATC centres, to prepare for full deployment of ATC data link in Europe's upper airspace. The product needed for the Link 2000+ Programme pioneer phase requires a voice readback in accordance with European Organization for Civil Aviation Equipment (Eurocae) standard ED-110A, which provides an interoperability requirements standard for the initial implementation of the Aeronautical Tele-communications network (ATN), which supports several Air Traffic services.

The pioneer airlines are presently: Finnair, Aeroflot-Russian International Airlines, Air Berlin, Air Europa, Airbus Transport International, Alitalia, American Airlines, Federal Express, Niki, Hapag-Lloyd, Luftransport Unter-nehmen, Lufthansa,

Lufthansa City Line, Malev, Scandinavian Airlines and SAS Braathens. Tarom-Romanian Air Transport is also considering joining. Currently, these airlines operate more than 600 Airbus aircraft and have committed more than 160 Airbus aircraft to the Link 2000+ Programme pioneer phase. Operator acceptance for the pioneer phase is planned to end during 2007.

Following the pioneer phase, the Link 2000+ Programme is currently investigating introducing incentives for those aircraft that are Controller Pilot Data Link Communications/Aeronautical Telecommunications Network (CPDLC/ ATN) equipped and operate in Link 2000+ Programme airspace. The intended follow-on from this incentive phase will be a 'mandate' phase where all aircraft operators flying in Link 2000+ Programme airspace will be required to equip with CPDLC/ATN avionics, subject to certain conditions.

Incentive and mandate phases will require an upgrade of existing products to be compliant with the Eurocae standard ED 110B to remove the requirement for voice readback.



2 Link 2000+ Programme applications and services

The Context Management Application (CMA)

This application provides the Data Link Initiation Capability (DLIC) service that is mandatory prior to any CPDLC connection. This function will typically be initiated when an aircraft is either at the gate in the pre-departure phase of flight, or before entering a new Flight Information Region (FIR) supporting data link communications. It provides the ground with the necessary information to make data link communications possible between the controller and the aircraft:

- Aircraft 24 bit address
- Aircraft flight identification
- Departure/destination airport
- Facility designation
- Information about available air applications

The Controller Pilot Data-link Communication (CPDLC) application

The CPDLC application provides direct pilot/controller communication using data link between an aircraft and the controlling ATC centre. A voice readback is required for any messages related to any changes of the aircraft trajectory.

This application provides a set of data link message elements corresponding to existing Inter-national Civil Aviation Organization (ICAO) phraseology.

Functions provided by the CPDLC application are:

- The ATC Communication Management (ACM) Service

- The ATC Clearance (ACL) Service
- The ATC Microphone Check (AMC) Service

Air Navigation Service Provider (ANSP) commitment

Maastricht centre (the pioneer ATC centre) has been controlling flights using CPDLC since 2005. Most of the European ATC centres have committed themselves to the Link 2000+ and their deployments are proceeding to schedule. Other ANSPs are split into two groups, those able to achieve by 2008 and the others able to achieve by 2011.

ANSPs committed for 2008	
Country	ANSP
Germany	DFS
Switzerland	Skyguide
Italy	ENAV
Ireland	IAA

ANSPs committed for 2011	
Country	ANSP
Portugal	NAV Portugal
France	DSNA
UK	UK NATS
Spain	AENA

3 Future Air Navigation System B (FANS B)

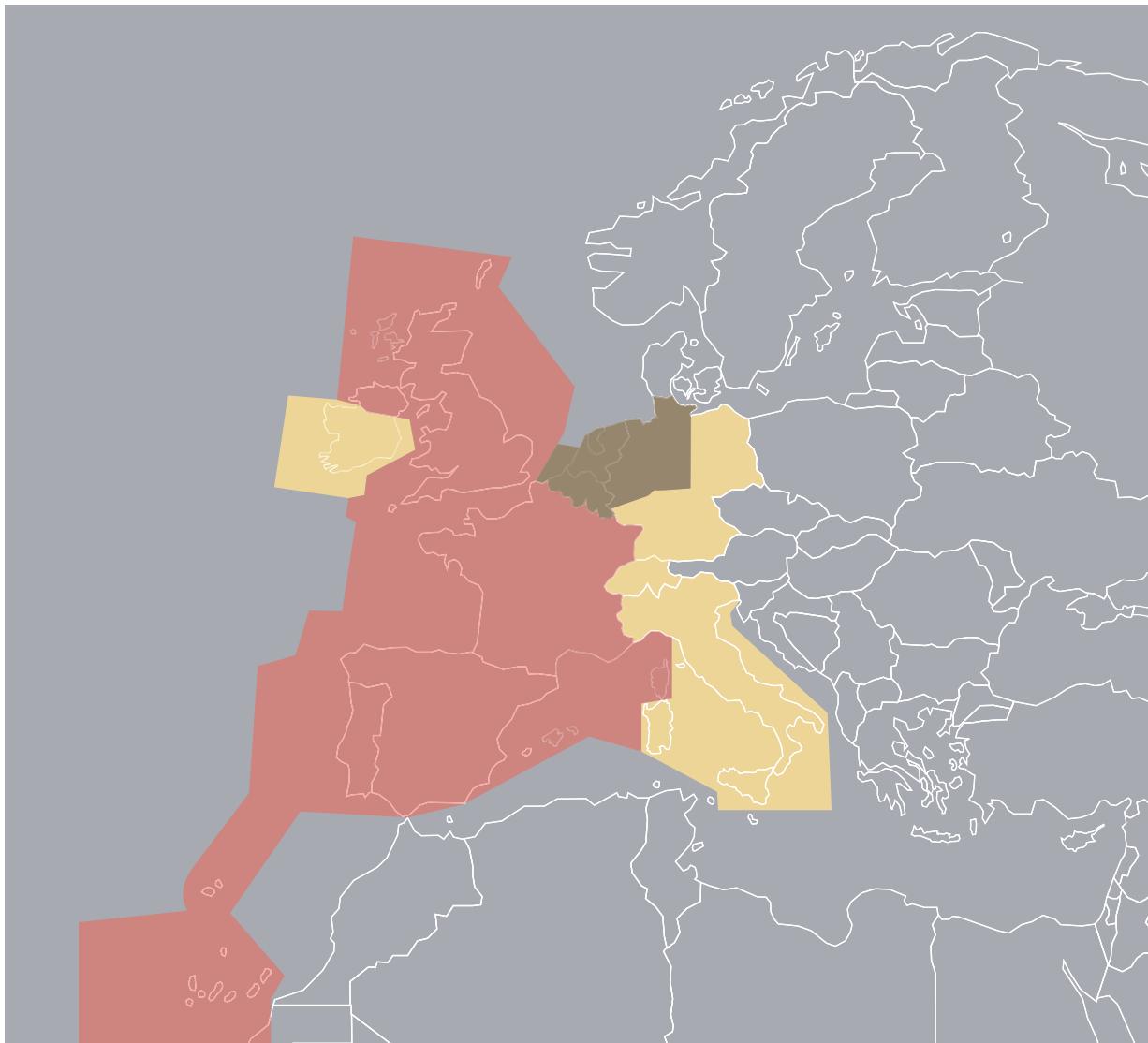
The FANS B product is Airbus response to the Eurocontrol Link 2000+ Programme for utilization of ATC data link in continental areas (high density airspaces with radar surveillance) in the en-route phase, using the ATN air-ground communication network. As ATN is operational only in Europe, FANS B is proposed only on A320 Family aircraft for the time being.

The first FANS B package allows airline participation in early implementation phases of the Link 2000+ Programme - the 'pioneer phase'. Airbus pioneer

2005

2008

2011



ANSP implementation plan

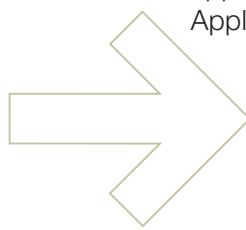
customers are Aeroflot-Russian International Airlines, Alitalia, Finnair, Niki, Luftransport Unternehmen, Royal Jordanian, and Tarom-Romanian Air Transport.

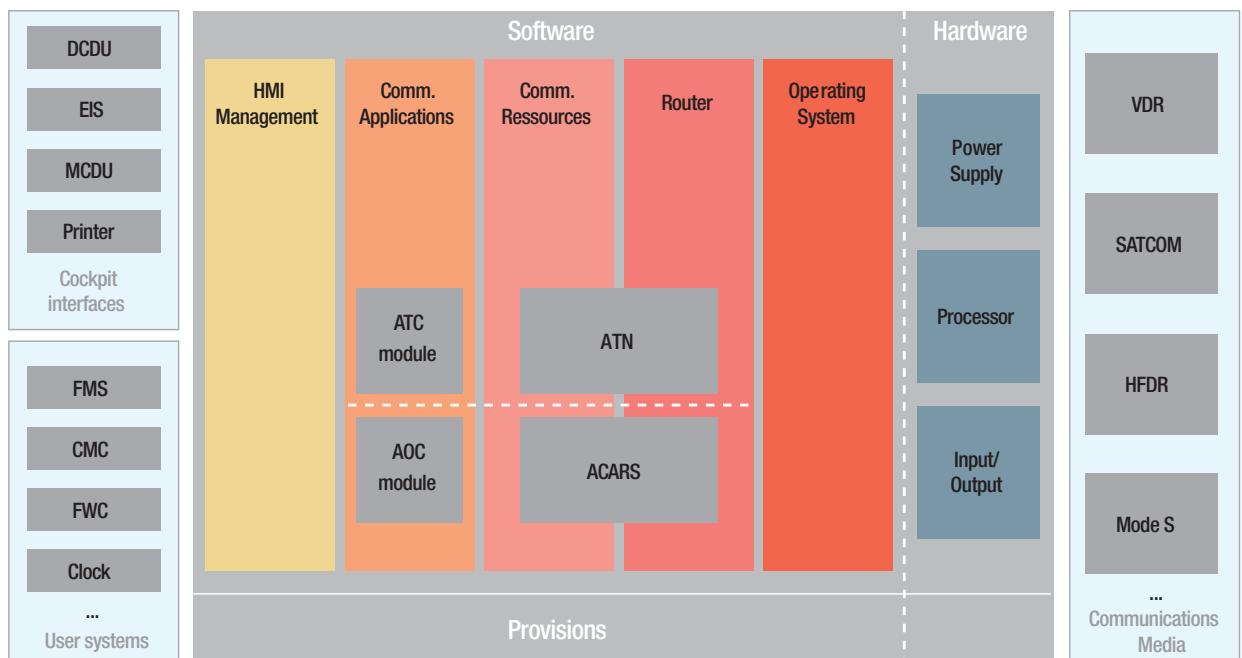
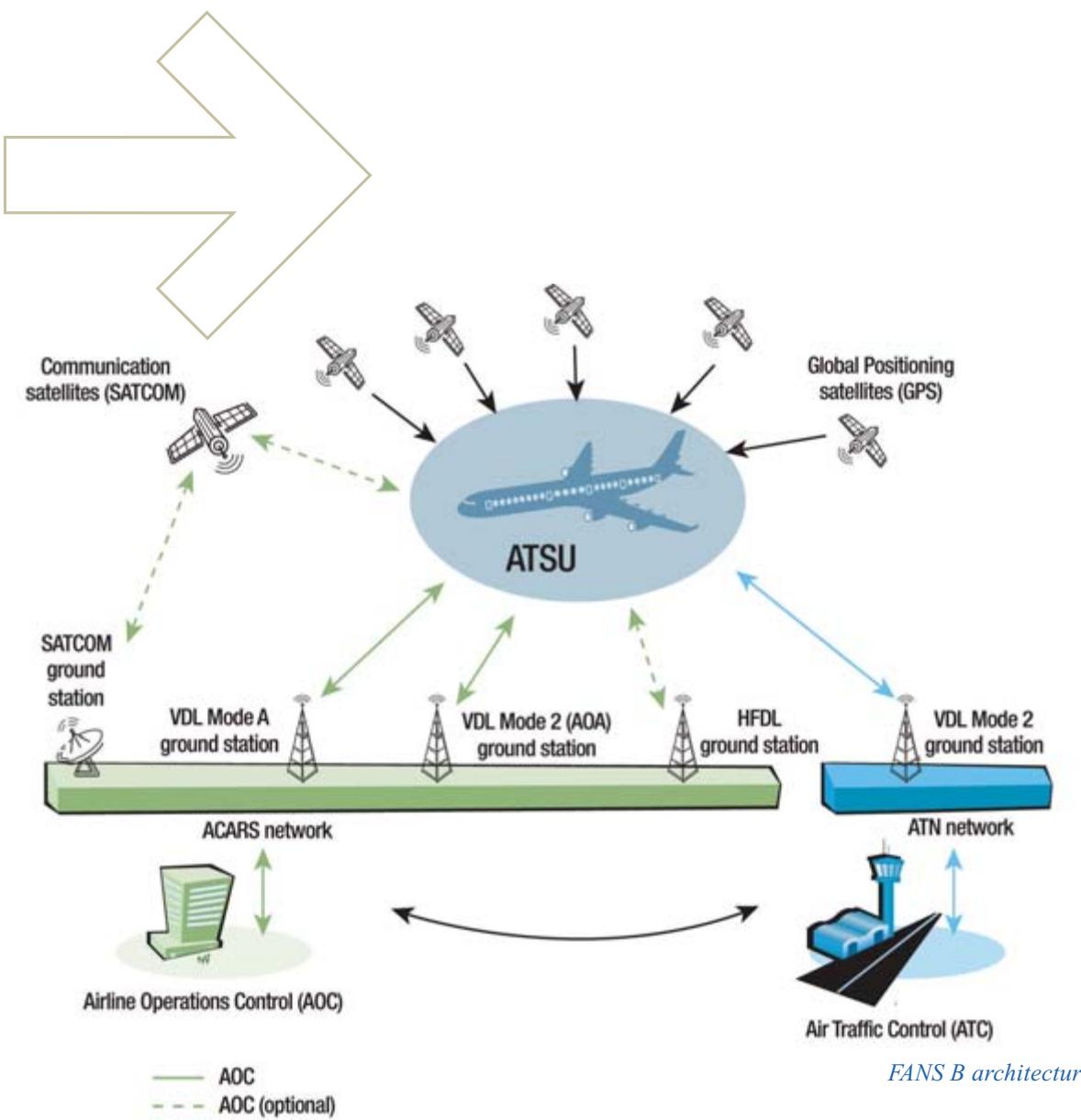
For the following phases Airbus is aiming at a single FANS B evolution enabling airlines to be eligible and benefit from the incentive phase, and also be compliant with the Link 2000+ Programme mandate. Airbus is closely cooperating with Link 2000+ Programme management to finalize

incentives and mandate conditions in the best interests of Airbus customers.

FANS B applications and services

The Airbus FANS B product offers, at aircraft level, over ATN air-ground communication network and through VDL Mode 2 sub-network, the data link applications and services (Context Management Application, Controller Pilot Data-Link Commu-





Air Traffic Services Unit - ATSU

nication application and ATC Communication Management, ATC Clearance, and ATC Microphone Check services) in accordance with Link 2000+ Programme specifications.

FANS B architecture

The FANS B architecture is the following:

- The airborne part with the ATSU (Air Traffic Service Unit), which is a modular hosting platform that centralizes all data communications (ATC and AOC/Airline Operations Communications) and manages the dedicated Human Machine Interface (HMI)
- The air/ground data link:
 - ACARS (Aircraft Communication Addressing and Reporting System) over VDL mode A/2, Satcom or HFDL (HF Data Link) are used to transmit AOC data. Satcom and HFDL for AOC are optional in the ATSU architecture
 - ATN over VDL mode 2 only, is used to transmit ATC data to the ground for communication purposes
 - The ground/ground data link: Two types of network have to be considered, the ACARS network for AOC messages and ATN network for ATC messages.

Data link communications between the aircraft and the airline operations centre optimize aircraft and crew management, improve data management like engine trend monitoring or maintenance reports, optimize spares management and speed up repairs.

On board equipment

The FANS B installation requires a minimum standard of the following equipment/installation:

- ATSU and Data link Control and Display Units (DCDU) provision
- Two DCDUs that allow the flight crew to read, and answer, to CPDLC messages received from the ground
- Two pushbuttons with 'attention getters' on the glare shield controlled by both Flight Warning Computers (FWCs)
- One VHF Data Radio (VDR 3) capable of VDL mode 2

- Two Multi Purpose Control and Display Units (MCDUs)
- Two Flight Warning Computers
- The Central Fault Display Interface Unit (CFDIU)
- The FANS B Human Machine Interface (HMI)

The preceding product, FANS A+, has been in use for oceanic and remote area operations for several years (see information). The main HMI principles, defined on the A330/A340 and A320 Family FANS A+ installation, are also used on FANS B.

The HMI equipment used in the cockpit for FANS B functions are:

- Two DCDUs
- The MCDU to access the ATC message MENU
- Electronic Centralized Aircraft Monitor (ECAM) pages and alerts for FWC information about abnormal situations
- Two push buttons with visual attention getters, and the two associated aural ATC alerts
- The printer

A configuration with two DCDUs was chosen in accordance with safety studies and human factors studies, because of a clear dissociation of the ATC communication from other communications; absence of interference with the previously existing crew operational procedures; direct full time availability of ATC clearance messages; and its location in the forward field of view near the MCDUs.

The ATC alerts consist of:

- An aural alert: A specific sound named 'RING' (double brief ringing-phone-like alert)
- A visual alert: Two flashing lighted push-button switches labelled 'ATC MSG' (one for CAPT, one for F/O), located in the glare shield. The flashing period is one second.





1 Two visual attention getters

2 Two aural ATC alerts

3 FWC information about abnormal situations

4 DCDUs

5 ATC menu on each MCDU

Information

North Atlantic Region benefits from data link.

- In 2004, traffic levels exceeded pre-2001 levels
- NAV CANADA has reduced communication costs to users by 50%
- 55% of the fleet use either FMC (Flight Management Computer), WPR (Waypoint Position Reporting) or FANS A+ ADS-C for automatic position reporting

Pacific Sub-Region benefits from data link.

- Reduced separations to 50/50nm and 30/30nm (trials)
- User preferred routes and re-route (trials) for all city pairs in South Pacific
- Weather deviations
- Automatic position reporting
- 80% of the fleet in South Pacific use CPDLC (Controller-Pilot Data-Link Communications) and ADS-C, based on FANS A+, 60% in the Central Pacific, and 30% on average in the entire Pacific

4 | Conclusion

The FANS B product is the first Airbus answer to ATN based data link operations. Highly inspired by the FANS A/A+ package, FANS B integrates the same interfaces and operational principles for denser airspaces and for the characteristics of the ATN environment (network architecture, technical acknowledgement timestamp, timers).

FANS B enables aircrew to manage data link communications between the aircraft and the ground Air Traffic Services, as well as communications between the aircraft and the AOC.

The availability of a second means of communication reduces communication errors, aircrew and controller workload and fatigue and will thus contribute to higher safety levels - radio voice communications have a number of drawbacks in today's busy traffic environment and pilots have to listen to each controller-initiated communication.

Other benefits are expected with the entry into operations of the data link technology in European airspaces such as an increase of airspace capacity by:

- 3.4% with a data link equipage rate of 25%*
- 8% with a data link equipage rate of 50%*
- 11% with a data link equipage rate of 75%*

The above benefits are thanks to improvements such as better task sharing between controllers.

The Link 2000+ Programme can only be successful with the wide involvement of air navigation service providers, communication service providers, airlines and of course controllers and pilots. This is now under way – a contribution to safer, on-time aircraft operations.

It is anticipated that other regions will deploy ATN data link capabilities in their environment. A strong international standardization effort, in which Airbus has a key role, is being made to have interoperable standards. In particular CPDLC is part of Federal Aviation Administration (FAA) Next Generation Air Transportation System (NGATS).

Link 2000+ Programme and FANS B are key components of the Single European Sky ATM (Air Traffic Management) Research (SESAR) concept for future European Air Traffic Management System. Any airlines interested in information about FANS B or in upgrading their aircraft to this standard are invited to contact Airbus Customer Services Upgrade Services at upgrade.services@airbus.com or consult the 'getting to grips with Fans B in high-density continental areas part III' brochure distributed by Airbus.

To ensure proper operation of FANS B aircraft in high-density continental data link airspaces an operator needs to ensure the following:

- a)** A contract with a Data Service Provider, DSP (ARINC or SITA*) is signed
- b)** The aircraft is declared to the data link service provider
- c)** The aircraft and its FANS capability is declared to the ATC centres of the operated routes
- d)** The aircraft's avionics are properly configured
- e)** Operational approval is obtained

*ARINC: Aeronautical Radio INC
SITA: Sté. Internationale de Telecommunications Aéronautiques

CONTACT DETAILS

Sophie de Cuendias
Design Manager
Upgrade Services
Airbus Customer Services
Tel: +33 (0)5 62 11 05 60
Fax: +33 (0)5 62 11 08 47
sophie.de-cuendias@airbus.com

* Figures given in the Eurocontrol website



The Airbus Flight Safety Team



Yannick MALINGE

Vice-President Flight Safety
 Phone : + 33 (0)5 61 93 43 60
 Fax : + 33 (0)5 61 93 44 29
 E-mail : yannick.malinge@airbus.com
 Mobile : +33 (0)6 29 80 86 52



Nuria SOLER

Assistant to Flight Safety Dept.
 Phone : + 33 (0)5 61 93 45 19
 Fax : + 33 (0)5 61 93 44 29
 E-mail : nuria.soler@airbus.com



Christophe CALL

Test Pilot
 Operational Advisor to the Vice-President Flight Safety
 Phone : +33 (0)5 67 19 16 06
 Fax : +33 (0)5 61 93 29 34
 E-mail : christophe.call@airbus.com
 Mobile : +33 (0) 6 72 05 91 94



Armand JACOB

Test Pilot
 Operational Advisor to the Vice-President Flight Safety
 Phone : + 33 (0)5 61 93 47 92
 Fax : + 33 (0)5 61 93 29 34
 E-mail : armand.jacob@airbus.com
 Mobile : +33(0)6 22 10 36 09



Thierry THOREAU

Deputy Vice President Flight Safety
 Head of International Cooperation
 Phone : + 33 (0)5 61 93 49 54
 Fax : + 33 (0)5 61 93 44 29
 E-mail : thierry.thoreau@airbus.com
 Mobile : +33 (0)6 16 93 87 24



Jean DANHEY

Director of Flight Safety
 Head of In-Service Safety & Incident Investigation
 Phone : + 33 (0)5 61 93 35 71
 Fax : + 33 (0)5 61 93 44 29
 E-mail : jean.daney@airbus.com
 Mobile : +33 (0)6 23 98 01 16



Christopher COURtenay

Director of Flight Safety
 Head of Safety Information Dissemination
 Phone : + 33 (0)5 62 11 02 84
 Fax : + 33 (0)5 61 93 44 29
 E-mail : christopher.courtenay@airbus.com
 Mobile : +33 (0)6 16 03 64 22



Marc BAILLION

Flight Safety Manager
 Phone : + 33 (0)5 67 19 14 75
 Fax : + 33 (0)5 61 93 44 29
 E-mail : marc.baillion@airbus.com
 Mobile : +33 (0)6 23 98 01 10



Albert URDIROZ

Flight Safety Manager
 Phone : + 33 (0)5 62 11 01 20
 Fax : + 33 (0)5 61 93 44 29
 E-mail : albert.urdiroz@airbus.com
 Mobile : +33 (0)6 23 98 01 13



Panxika CHARALAMBIDES

Flight Safety Manager
 Phone : + 33 (0)5 62 11 80 99
 Fax : + 33 (0)5 61 93 44 29
 E-mail : panxika.charalambides@airbus.com
 Mobile : +33 (0)6 23 98 01 63



Frederic COMBES

Flight Safety Manager
 Phone : + 33 (0)5 62 11 97 42
 Fax : + 33 (0)5 61 93 44 29
 E-mail : frederic.combes@airbus.com
 Mobile : +33 (0)6 16 93 87 37



Nicolas BARDOU

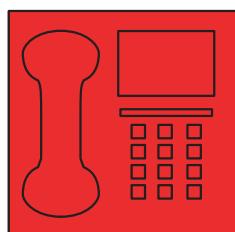
Flight Safety Manager
 Phone : + 33 (0)5 67 19 02 60
 Fax : + 33 (0)5 61 93 44 29
 E-mail : nicolas.bardou@airbus.com
 Mobile : +33 (0)6 23 98 01 71



Armand GASTELLU
 Crisis Logistic Support Manager
 Phone : + 33 (0)5 61 93 41 79
 Fax : + 33 (0)5 67 19 12 26
 E-mail : armand.gastellu@airbus.com
 Mobile : +33(0)6 23 98 00 86



Ania BELLAGH
 Crisis Logistic Support Manager
 Phone : + 33 (0)5 62 11 86 64
 Fax : + 33 (0)5 67 19 12 26
 E-mail : ania.bellagh@airbus.com
 Mobile : +33(0)6 12 65 06 28



Flight Safety
Hotline:
+33 (0)6 29 80 86 66
E-mail:
account.safety@airbus.com

Flight Safety Advisors to Chief Engineers



Michel PALOMEQUE
 Flight Safety Advisor
 To Single Aisle Chief Engineer
 Phone : + 33 (0)5 62 11 02 85
 Fax : + 33 (0)5 61 93 44 29
 E-Mail : michel.palomeque@airbus.com
 Mobile : +33(0)6 23 08 06 38



Jacques KUHL
 Flight Safety Advisor
 To Wide Body Chief Engineer
 Phone : + 33 (0)5 62 11 03 90
 Fax : + 33 (0)5 61 93 48 28
 E-mail : jacques.kuhl@airbus.com
 Mobile : +33(0)6 20 61 35 21



Per-Oliver GUENZEL
 Flight Safety Advisor
 To Long Range Chief Engineer
 Phone : + 33 (0)5 61 93 22 56
 Fax : + 33 (0)5 67 19 15 21
 E-mail : per-oliver.guenzel@airbus.com
 Mobile : +33(0)6 84 78 70 52

Airbus Overseas safety Representatives



William G. BOZIN
 Vice-President Safety
 and Technical Affairs
 Airbus North America
 Phone : + 1 202 331 2239
 Fax : + 1 202 467 5492
 E-mail : bill.bozin@airbus.com
 Mobile : +1 703 474 0892



André POUTREL
 Safety Operations Director
 For China
 Phone : + 86 10 80 48 61 61 (5072)
 Fax : + 86 10 80 48 61 62
 E-mail : andre.poutrel@airbus.com
 Mobile : + 86 13 70 13 15 413

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