The Airbus safety magazine

#32

Safety first

AIRBUS

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Safety first

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editorial

A Tribute to Bernard Ziegler

In each era of aviation, there are people who pioneer an idea with such conviction that the industry as a whole will benefit from it. Working for Bernard Ziegler (a.k.a "BZ" as he was called by all who knew him), I witnessed first-hand his passion for flight, his relentless innovative spirit, and the power of his convictions. The most visible legacy from BZ is certainly the benefits of flight envelope protection enabled by Fly-By-Wire (FBW) technology on commercial jet aircraft.

BZ believed that this step change would significantly reduce the risk of loss of control in-flight. The FBW technology was thus first introduced on the Airbus A320 and it is the baseline for every Airbus aircraft produced since. Beyond the Airbus fleet, it is the industry standard today for all new aircraft types.

The facts demonstrate BZ's vision was absolutely correct, that FBW would significantly reduce the accident rate . Indeed, aircraft with flight envelope protection enabled by FBW technology that belong to the current fourth generation of commercial jets have an impressive record. Today there are around 15,500 in operation, with 11,600 (or 75%) of which are Airbus FBW aircraft. Fourth-generation aircraft have completed more than 212 million flights and accumulated over 500 million flight hours (172 million flights and 375 million flight hours by Airbus aircraft) over the last 33 years.

This has resulted in a historically low rate of 0.04 fatal accidents per million flights (10-year moving average) compared with the rate of 0.15 for the previous third-generation aircraft without FBW. To follow on from BZ's focus on the reduction of accidents caused by loss of control in-flight (LOC-I), the current LOC-I accident rate 0.01 for fourth-generation jets is a seven-fold decrease when compared with the rate of 0.07 LOC-I accidents per million flights for third-generation jets.

More than thirty years on, we can reflect on the occasions when persistence over the resistance to change required the characteristic tenacity of someone like BZ, to win over the sceptics and gain support for his vision. The foundations for aviation to make a leap forward in safety are often laid by such visionaries. It is then our duty to constantly reinforce their legacy through collaboration across our industry, and through the implementation of incremental safety improvements on our aircraft and for how they are operated.

I join my Airbus colleagues, and together with so many across our industry, in paying tribute to Bernard Ziegler - a true pioneer and inspiration for aviation safety.

Chapeau bas Bernard

YANNICK MALINGE

SVP & Chief
Product Safety Officer

Bernard Ziegler joined Airbus as its chief test pilot in 1972 and he flew the first flight of the first A300. The programme later became an early testbed for FBW which transfers the pilot's commands to the aircraft via digital signals. FBW provides significant benefits through commonality, improved flight safety, reduced pilot workload, fewer mechanical parts, and real-time monitoring of all aircraft systems.

He also flew the A310, A320 and A340-200. In June 1993, Ziegler participated in the longest flight ever undertaken by a civil aircraft, when an A340-200, dubbed the "World Ranger", flew around the world from Paris with just one stop in Auckland in just over 48 hours. Up until his retirement in December 1997, Ziegler was Airbus Senior Vice President of Engineering.

Airbus Fly-By-Wire Visionary Bernard Ziegler Passes Away

(Airbus Press Release)

Safety first

The Airbus Safety magazine

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NEWS

Save the Date! The 26th Airbus Flight Safety Conference will be held 21-24 March, 2022

Save the date in your calendars for the next Airbus Flight Safety Conference to be held 21-24 March, 2022. It will be three years since our last conference as the Covid-19 crisis has prevented us from hosting this annual event. Safety collectively remains our top priority and let's not miss this opportunity in March 2022 to share the many safety lessons learned and experiences together.

Invitations for the event will be sent to all of our customers in January 2022.

NEWS

Visit us at accidentstats.airbus.com

The annual "Statistical Analysis of Commercial Aviation Accidents" is now available to view online and to download the brochure.

The website provides an analysis of commercial aviation accidents for jet aircraft from 1958 to 2020. It shows significant improvements of the safety record for our industry. This is also underlined by the contribution that technology has made in further enhancing the level of safety for commercial aircraft flights today.

Safety first #32

Flight Operations

Cabin Operations

Ground Operations

Maintenance

OPERATIONS

Unreliable Airspeed at Takeoff

Since the beginning of 2020, Airbus has received an increasing number of reports of unreliable airspeed events at takeoff due to Pitot probe obstruction. Despite the existing prevention means and the preflight exterior walkaround, takeoffs with obstructed air data probes may happen. This article highlights why it is so important for pilots to actively monitor the airspeed during the entire takeoff roll, to detect an airspeed discrepancy as early as possible, and safely reject the takeoff, if required to do so.

MULTIPLE UNRELIABLE AIRSPEED EVENTS AT TAKEOFF

"Preparing for a Safe Return to the Skies" is a Safety first article published in June 2020 that already highlighted the increased risk of unreliable airspeed events after aircraft parking or storage. The number of reported occurrences since this article was published is still a reason for concern.

Between January 2020 and March 2021, 55 events of unreliable airspeed indication during takeoff were reported to Airbus.

Majority of events linked to Pitot obstruction

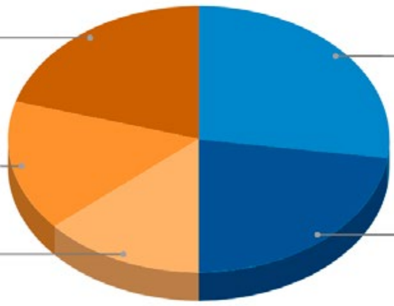
44 of the 55 reported cases of unreliable airspeed at takeoff were due to obstruction of the Pitot tube. Obstructions can be caused by the presence of insects, sand, dirt, dust or any other foreign materials that could enter the Pitot when protective covers are not fitted to the aircraft when on the ground. In one reported case, the obstruction was because the protective covers were not removed before the flight.

Pitot contamination occurring during various types of parking conditions

The chart below **(fig.1)** shows the duration of time an aircraft spent on the ground before the flight when the unreliable airspeed event occurred.

(fig.1)

Duration of time an aircraft spent on ground before reported unreliable airspeed event



Also beware during shorter ground stays

Contamination of Pitot probes by insects does not happen only during long periods of parking or storage. Half of all reported Pitot contamination related events occurs when the aircraft is parked for a time period of less than 48 hours. A significant number of reported occurrences of obstructed Pitots were on aircraft in transit and on the ground for less than two hours. Pitot probes are not always protected by covers during short duration transits.

Why Pitots are even more exposed to the risk of contamination during the pandemic

The COVID-19 pandemic had the effect of a significantly reduced number of flights, which means aircraft spent more time on the ground between flights. In cases where the air data probe protective covers are not fitted, the exposure to the risk of Pitot contamination is greatly increased.

INFORMATION

Prevention of air data probe obstruction

Airbus published several documents to provide recommendations for the prevention and detection of obstructed air data probes on ground:

- **ISI(*) 34.11.00026:** A320FAM and A330/A340 Pitot probes - Description, evolutions and maintenance recommendations
- **OIT(*) 999.0019/20** (May 2020) - ATA 10 – Parking and Storage: Exceptional Procedures and Recommendations Related to COVID-19 Massive Grounding Situation
- **OIT(*) 999.0048/20** (July 2020) - Increasing number of events related to adverse effects on air data probes following a parking/storage period
- **Parking and Storage / Return to Service Summary Letter**
- **Safety first articles:**
  - Pitot Probe Performance Covered On the Ground (July 2016)
  - Aircraft Parking and Storage (April 2020)
  - Preparing for a Safe Return to the Skies (June 2020)
  - News: Parking and Storage / Return to Service Summary Letter (December 2020)
- **WIN video:** What about the exterior walkaround? (September 2020)

(*) ISI articles, OITs, and the Parking and Storage / Return to Service Summary Letter are available on the AirbusWorld portal

Several cases of late detection

In 36 of the 55 reported cases, the flight crew detected the speed discrepancy and rejected the takeoff. For many of the reported rejected takeoffs, the speed discrepancy could have been detected earlier during the takeoff roll, which would have incited the flight crew to reject the takeoff at a lower speed. The following case studies of three events of unreliable airspeed at takeoff highlight the importance of speed monitoring during the takeoff roll.

CASE STUDY 1

Event description

Flagged speed indications detected during the takeoff roll

An A330 aircraft was lined up for takeoff in night conditions. The first officer was the Pilot Flying (PF). The weather was clear with no wind. The recomputed takeoff decision speed was 150 kt and the rotation speed was 159 kt.

During aircraft acceleration, the speed indications were flagged on both PFDs.

A 100 kt callout and a rotation based on ground speed indication

The Pilot Monitoring (PM) made the 100 kt callout when the ground speed reached 100 kt. The PF then initiated the rotation at 159 kt of ground speed.

Unreliable airspeed indication procedure application

The flight crew applied the FCOM unreliable airspeed procedure when airborne and switched all three ADRs to OFF when the aircraft reached FL 110, activating the BackUp Speed Scale (BUSS) indication (as requested by the procedure when all ADRs are affected below FL 250).

In-flight turnback and overweight landing

The flight crew decided to return to the departure airport and performed an overweight landing.

When the aircraft finally returned to the gate, it was noticed that the protective covers were not removed before the flight and they were still fitted on all three Pitot probes.

Event Analysis

Analysis of the recorder data confirmed that the Pitot covers, which were not removed before the flight, were the cause of the unreliable airspeed indication.

Three missed opportunities of detecting the covers

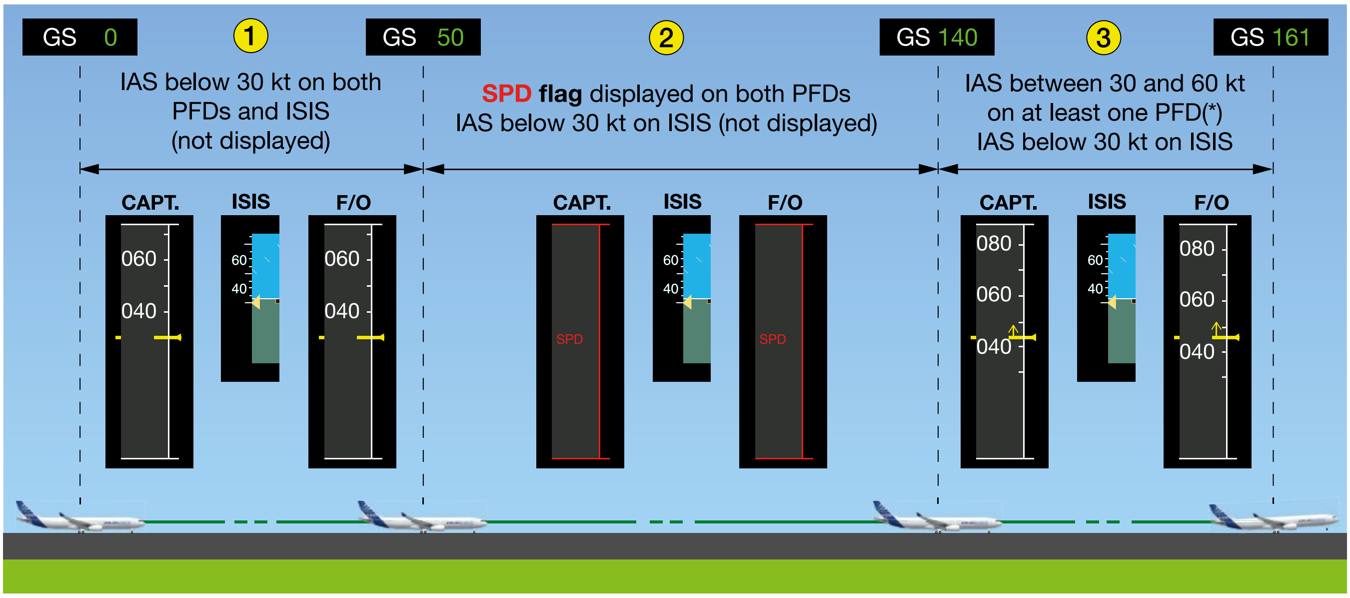
Post event analysis shows that the Pitot protective covers were not seen by the maintenance engineer during the external aircraft inspection, and neither by the captain during the preflight exterior walkaround nor by ground personnel during pushback, as recorded on the airport surveillance videos.

Speed display during takeoff roll

Recorder data also showed that the display of the **SPD** red flag on both PFDs from 50 kt of ground speed should have made the flight crew aware of the airspeed issue which would have enabled them to reject the takeoff.

- (1) **From 0 kt to 50 kt of ground speed:** The Indicated Air Speed (IAS) was at the bottom of the speed scale on both PFDs and on the speed scale of the Integrated Standby Instrument System (ISIS). This was because the measured airspeed from all 3 ADRs was below 30 kt.
- (2) **From 50 kt to approximately 140 kt of ground speed:** The **SPD** red flag was displayed on the speed scale of both PFDs and the IAS on the ISIS was still at the bottom of the speed scale.
- (3) **From 140 kt of ground speed until rotation and liftoff:** The IAS was between 30 kt and 50 kt on at least one of the PFDs. The IAS of the ISIS remained at the bottom of the speed scale.

(fig.2)
PFD airspeed indication during the takeoff roll of the event



(*) This type of flight data recorder records only the airspeed value of the captain's side, provided it is valid information. Otherwise, it will record the first officer's IAS. The IAS may have been displayed on both PFDs at this stage. If it was only displayed on one PFD, the other PFD would still have displayed the SPD red flag.

This sequence is in accordance with the display logic of the IAS on the PFD:

- If the measured airspeed is below 30 kt and ground speed is below 50 kt, then the IAS remains at the bottom of the speed scale
- If the measured airspeed is below 30 kt and the ground speed is above 50 kt, the **SPD** red flag is displayed on the speed scale
- When the measured airspeed is above 30 kt, it will be displayed on the PFD.

CASE STUDY 2

Event Description

A speed discrepancy at the 100 kt callout

An A330 aircraft was ready for takeoff. The captain, who was the PF, applied takeoff power and the aircraft started to accelerate. The flight crew noticed a discrepancy between the PFD airspeeds at the 100 kt crosscheck. The flight crew continued the takeoff and performed the rotation at 133 kt.

ECAM cautions and level off for troubleshooting

The NAV IAS DISCREPANCY ECAM caution triggered shortly after liftoff, followed by the NAV ADR1 FAULT. The flight crew levelled off the aircraft at 3000 ft to perform ECAM actions and troubleshooting. The flight crew set the

AIR DATA rotary selector to “CAPT ON 3” and resumed the climb to cruise FL 340.

Overspeed warning while approaching cruise FL

An overspeed warning triggered while the aircraft was passing FL 334. The autopilot remained engaged and the aircraft leveled off at FL 340. The overspeed warning stopped a few seconds later.

In-flight turn back

The flight crew performed an in-flight turnback and landed safely. Maintenance personnel inspected the Pitot on the captain’s side and found that it was obstructed by dust.

Event Analysis

Flight data recorder analysis confirmed the effects caused by the obstruction of the captain’s Pitot probe.

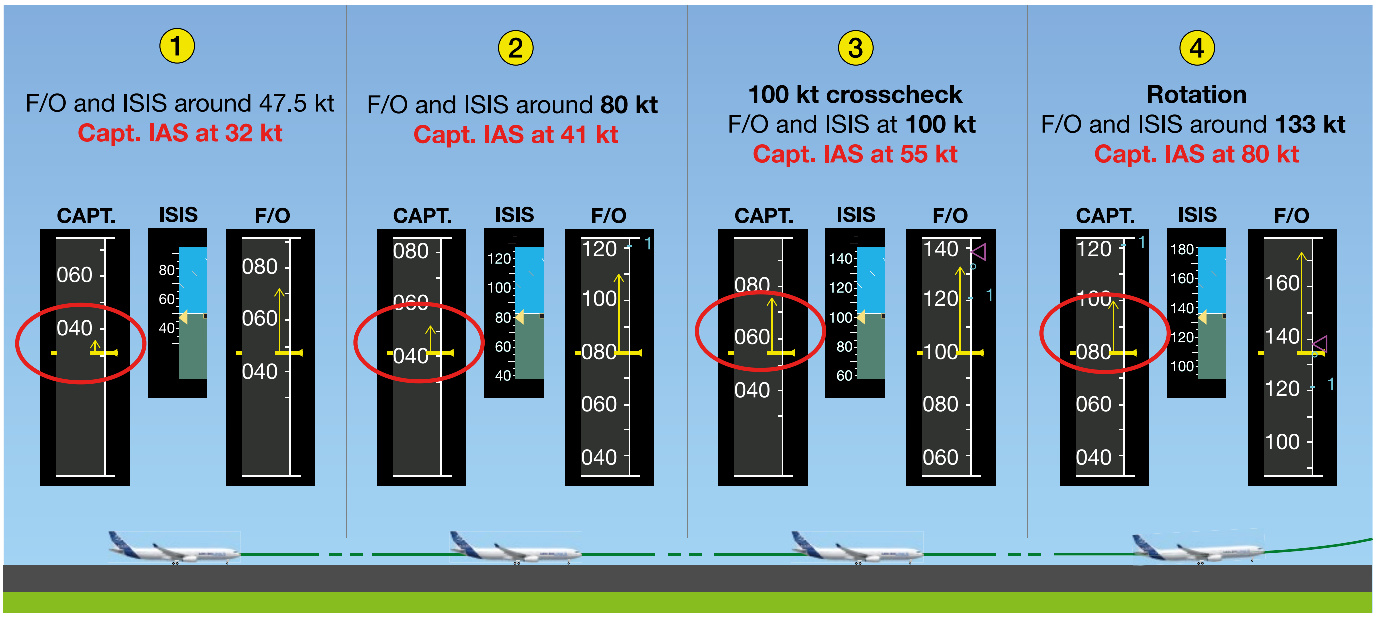
A missed opportunity to reject the takeoff

If the airspeed was monitored even more closely by the flight crew during the takeoff roll, they may have identified the speed discrepancy sooner, allowing them to reject the takeoff and bring the aircraft safely to a stop.

Airspeed display during the takeoff roll

- 1 The IAS remained at the bottom of the PFD speed scale on both PFDs, and on the ISIS, at the start of the takeoff roll until the measured speed reached 30 kt (which is its normal behavior). The captain’s IAS went above 30 kt when the first officer and ISIS IAS both indicated approximately 47 kt.
- 2 When the first officer and ISIS IAS indicated approximately 80 kt, the captain’s IAS was only displaying 41 kt.
- 3 When the first officer and ISIS IAS indicated 100 kt, the captain’s IAS was only displaying approximately 55 kt.
- 4 The captain rotated the aircraft when 133 kt was indicated on the first officer’s PFD and ISIS, but the captain’s IAS was only displaying 80 kt.

(fig.3)
PFD airspeed indication during the takeoff roll of the event



CASE STUDY 3

Event Description

Rolling takeoff

An A320 was cleared for takeoff and the PF, who was the captain, performed a rolling takeoff. The captain performed the 1.05 EPR stabilization step and then applied takeoff thrust.

Rejected takeoff following an airspeed discrepancy at the 100 kt crosscheck

The aircraft accelerated nominally, but the captain identified a speed discrepancy when the PM did the 100 kt callout, and immediately rejected the takeoff.

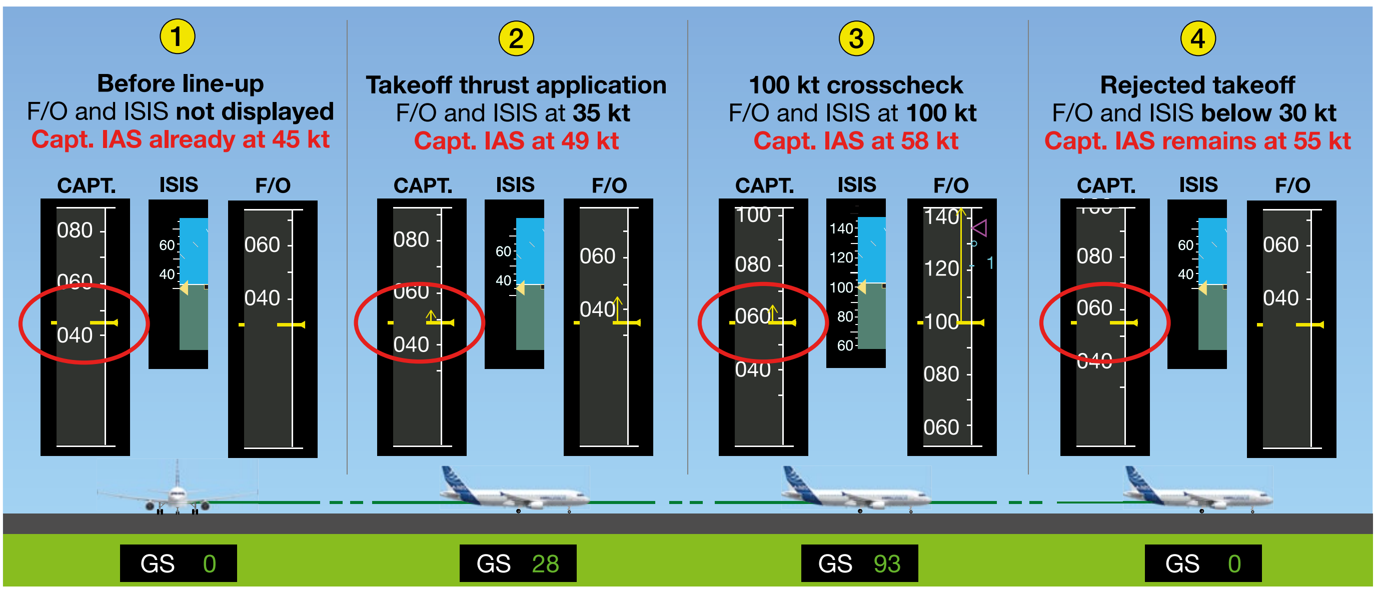
Maintenance personnel performed troubleshooting when the aircraft returned to the gate and they found small pieces of leaves in the captain's Pitot probe and its pressure line.

Event Analysis

An early speed discrepancy on the captain's side

- 1 Recorder data showed that obstruction of the captain's Pitot probe was providing an initial IAS of approximately 45 kt while the aircraft Ground Speed (GS) was 0 kt prior to the aircraft lining up on the runway.
- 2 At the application of takeoff thrust, the first officer and ISIS IAS indicated 35 kt with nominal acceleration shown by the speed trend arrow on the first officer's PFD. However, the IAS on the captain's PFD was 49 kt with a very small speed trend arrow.
- 3 When 100 kt was reached on the first officer's PFD and ISIS, the captain's IAS was only 58 kt.
- 4 When the aircraft safely came to a complete stop after the RTO, the captain's IAS was still at 55 kt.

(fig.4)
PFD airspeed indication during the takeoff roll of the event



A useful 100 kt crosscheck!

During the entire takeoff roll, the captain's IAS increased slightly but remained below 64 kt. The 100 kt crosscheck enabled the captain to identify the discrepancy and immediately reject the takeoff.

A possible earlier RTO

The Standard Operating Procedure requests monitoring of the PFD speed scale during the entire takeoff roll. Following this recommendation may have made the flight crew aware of the airspeed discrepancy earlier than the 100 kt callout and enabled them to reject the takeoff at lower speed. The first opportunity to detect the speed discrepancy was before lining up for takeoff, when the captain's airspeed indicated 45 kt while the aircraft was stationary with ground speed at 0 kt. The second opportunity was at the application of takeoff thrust when the IAS on the captain's PFD was almost steady speed with a very small speed trend arrow. ■

MONITORING OF THE AIRSPEED DURING THE TAKEOFF ROLL

The three events described above illustrate the importance of closely monitoring the airspeed throughout the takeoff roll. Both the Pilot Flying (PF) and the Pilot Monitoring (PM) have a role to play.

While the PF maintains the aircraft on the centerline using external references, the PM must actively monitor the airspeeds from the start of the takeoff roll. This will allow for the PM to detect any inconsistent airspeed indications between instruments, an abnormal airspeed trend or absence of airspeed indications as early as possible.

The *"Role of the Pilot Monitoring during Takeoff"* video on the Airbus Worldwide Instructors News (WIN) website illustrates each of the various steps for the PM to perform during the takeoff.

The 100 kt crosscheck: the last line of defense

Case study 3 shows us the importance of the 100 kt crosscheck, which is requested in the Standard Operating Procedure. It is the last line of defense in preventing a takeoff with an unreliable airspeed indication. The flight crew should be prepared to reject the takeoff at the time of the 100 kt crosscheck if an airspeed discrepancy is observed.

Monitoring that must be done for every takeoff

Takeoff with obstructed Pitot probes can happen for any flight as highlighted by the reported events described in this article. It is evidence of why it is essential to carefully monitor airspeed during every takeoff. ■

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Obstructed Pitots are the main cause of the reported unreliable airspeed events at takeoff. Contamination of aircraft Pitot probes can happen in less than two hours on the ground in certain cases. The risk of Pitot contamination has increased since the beginning of the COVID-19 pandemic because there are fewer flights and aircraft spend more time on the ground between flights.

Airbus has published several documents to provide recommendations for the prevention of obstructed air data probes on the ground.

During transits or upon the return to service of a parked aircraft, it is important to pay particular attention to the Pitot probes during the maintenance external aircraft inspection and the pilot's preflight exterior walkaround. This will confirm that all protective covers are removed before flight.

Early detection of an unreliable airspeed event will enable the flight crew to reject the takeoff at a lower speed. From the start of the takeoff roll, the pilot monitoring must check for inconsistent airspeed indications, abnormal airspeed trends, or the absence of airspeed indications, and alert the pilot flying as early as possible if an issue is detected.

The 100 kt crosscheck is the last line of defense to prevent taking off with an unreliable airspeed indication. The flight crew should be prepared to reject the takeoff at the time of the 100 kt crosscheck if an airspeed discrepancy is observed.

It is essential that flight crews carefully monitor the airspeed indications during every takeoff. Obstruction or contamination of the Pitot can occur before any flight.

Take Care of the Wheel Tie Bolts

A significant number of missing wheel tie bolts have been reported to Airbus over the last 5 years. A few of these reports have described significant damage to the wheel or brakes.

Carefully checking the condition of the wheel tie bolts during aircraft walkarounds can allow detection of missing or damaged bolts and help to prevent serious incidents in service or during maintenance. Strictly observing the preventive maintenance practices, including planned inspection intervals, ensure that any damaged wheel tie bolts are replaced before they are at risk of failing.

ANALYSIS OF AN EVENT

Event Description

An A321 was in cruise when the HYD G ENG 1 PUMP LO PR and HYD G RSVR LO LVL ECAM alerts were triggered. The flight crew applied the FCOM procedures and switched off the PTU and green hydraulic pump on engine 1.

During the approach, the flight crew switched the green hydraulic pump on again (not requested by the FCOM procedure). The landing gear was extended. Landing and rollout were uneventful and performed with the green hydraulic system selected ON.

The flight crew stopped the aircraft before commencing the taxi-in to switch the green hydraulic system to OFF once again. They resumed the taxi, and finally parked the aircraft at the gate. The engines were selected to OFF and the parking brake was set to ON. The yellow hydraulic pressure started to decrease toward 0 PSI, which was indicating an issue with the yellow hydraulic circuit.

In the meantime, the ground personnel observed that the right main landing gear wheel was on fire and extinguished it using a fire extinguisher at the gate.

Event Analysis

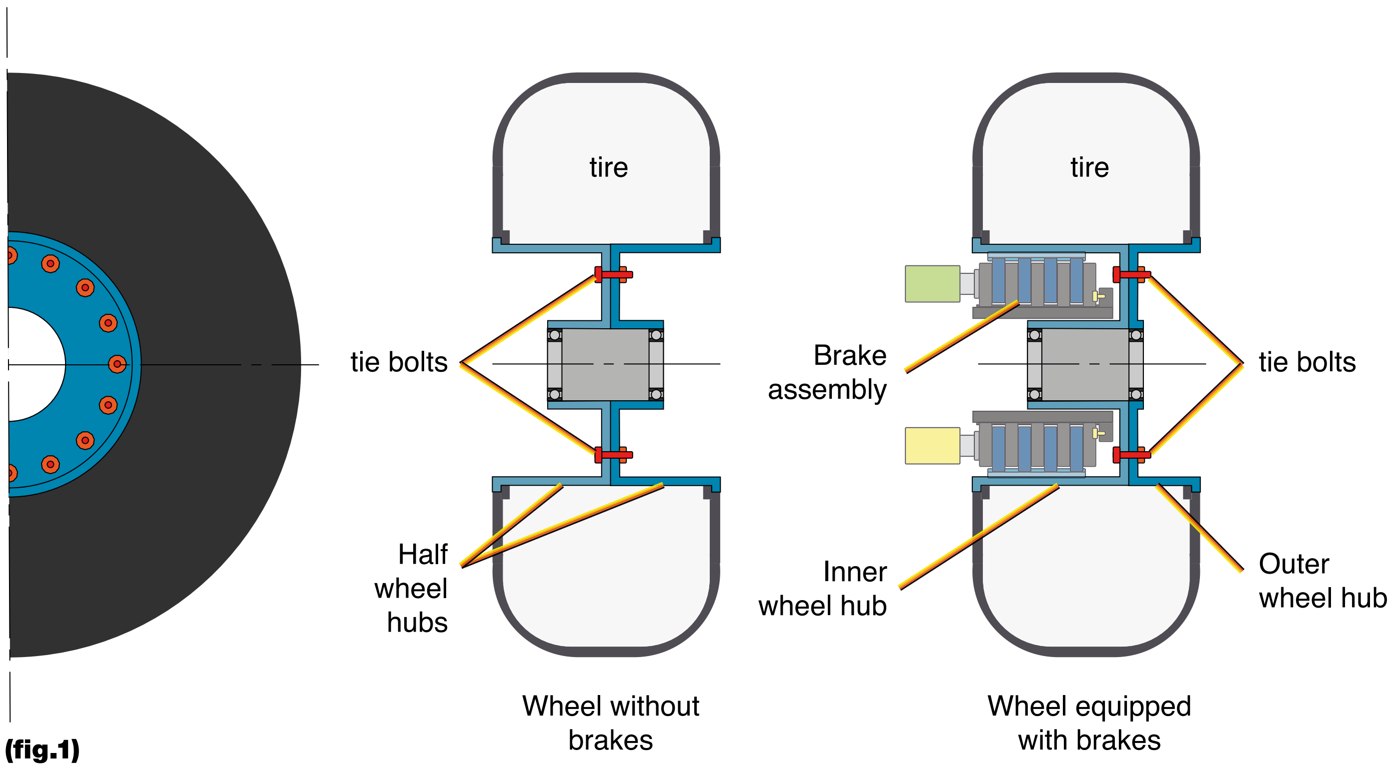
The investigation showed that the head of one of the tie bolts of wheel n°3 had sheared off and progressively migrated toward the brake, causing damage to the brake assembly during the previous flights. This damage eventually caused a leak from the green hydraulic system, which triggered the ECAM messages that indicated low hydraulic system pressure and low fluid levels during the flight. The leak from the yellow hydraulic system happened when the parking brake was set to ON at the gate, causing hydraulic fluid to be in contact with the hot brakes and resulting in the wheel fire. ■

THE CRITICALITY OF WHEEL TIE BOLTS

Ensuring the structural integrity of the wheel

Aircraft landing gear wheels (nose, main, body or wing landing gear) have a similar basic structure, regardless of the wheel manufacturer. Each wheel assembly consists of a tire fitted over two half hubs, which are fastened together by tie bolts. **(fig.1)**. For wheels fitted over brake assemblies, the inner hub of the wheel is designed to house the brake.

The tie bolts ensure the structural integrity of the wheel by sustaining the loads from the tire pressure, the aircraft weight, and the dynamic loads due to the impact of the landing gear during landing. Therefore, **wheel tie bolts should be considered as one of the critical components of the landing gear assembly.**



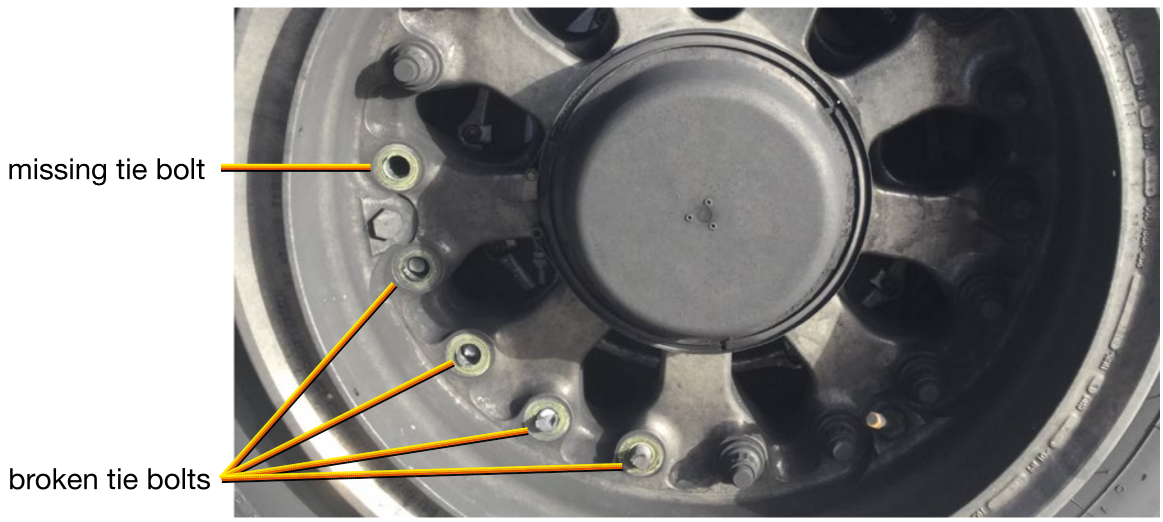
(fig.1)
Typical aircraft wheel structure

Consequences of a damaged tie bolt

A tie bolt may be damaged and its screw or nut may migrate from its location, potentially causing damage and safety risks.

A reduced structural resistance of the wheel

Any missing tie bolt will result in an increase in the loads on the remaining tie bolts. This can adversely affect their condition and it may reduce the structural integrity of the wheel if it is not replaced **(fig.2)**. Damage to the wheel and the aircraft can occur with the associated risk of injury to ground personnel during ground operations.



(fig.2)
Example of tie bolts rupture leading to wheel deflation (picture send by an operator)

A risk of Parts Departing the Aircraft (PDA)

A damaged tie bolt that falls from a wheel can cause damage to the aircraft or injury to people on the ground. If the damaged tie bolt falls on the runway, there is a risk of damage to subsequent aircraft taking off or landing, and especially a risk of engine ingestion.

A risk of damage to the brakes and the aircraft

When a tie bolt is missing from a wheel that houses brakes, the tie bolt can migrate toward the brake, causing extensive damage and a risk of brake jamming. If the pistons of the brake are damaged, there is a risk of hydraulic fluid leak that may trigger a brake fire, as in the example described above.

A significant number of events related to damaged tie bolts

Airbus identified a significant number of reported events related to tie bolt loss in the last five years, although only a few of these events resulted in significant damage. Prevention is key to reducing this trend by early detection of any missing tie bolts in line operations or even by anticipating a tie bolt failure through regular wheel tie bolt inspections that are requested by the maintenance planning.

DETECTION OF MISSING/ DAMAGED TIE BOLTS IN LINE OPERATIONS

There are numerous opportunities in the line of operations where maintenance personnel and flight crews can detect a missing or damaged tie bolt and prevent potential damage.

Inspection by maintenance personnel

A missing or damaged tie bolt or may be detected during the daily check or preflight walkaround **(fig.3)**. If the tie bolt damage is located on the inner hub side of a wheel equipped with brakes, or if the wheel has a brake cooling fan assembly fitted to it, it is more difficult to see if the tie bolts are damaged.

(fig.3)
Example of missing tie bolt detected during a preflight walkaround (picture sent by an operator)

Inspection by flight crews

As an additional safety net, the flight crew should check for the presence of all the tie bolts when checking the condition of the wheels and tires during the exterior walkaround.

Check of the wheel and brake condition if one bolt is found missing

As per the AMM/AMP/MP procedure, if one of the tie bolts is found missing, the wheel must be removed and visually inspected for damage as well as the brake assembly.

Depending on the wheel type and manufacturer, the MEL may permit dispatch with one tie bolt missing on a wheel for a limited number of flights. In this case, the condition of the wheel and brake must also be checked before dispatch as per MEL maintenance procedure.

DETECTION OF DAMAGED TIE BOLTS DURING WHEEL SHOP MAINTENANCE

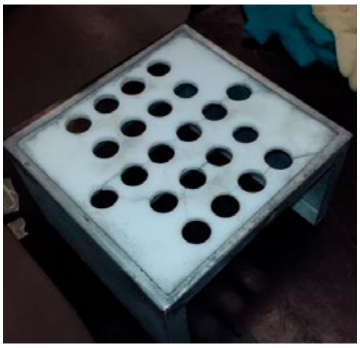
Many tie bolt ruptures and losses can be avoided if the damaged tie bolt is detected during planned shop maintenance inspections.

Regular visual inspections

At each tire replacement, the tie bolts must be removed and visually inspected for any damage (refer to the CMM of the wheel manufacturer for the complete procedure).

KEYPOINT

Storage of the tie bolts after removal



The removed wheel tie bolts must not be put together in a box without suitable separation and protection before inspection and reinstallation.

When the bolts are removed from the wheel, they should be handled with care and placed into a box with dedicated compartments for each bolt to ensure that they are not in contact with each other. This prevents contact damage to the bolts.

Regular Non-Destructive Testing (NDT) inspections

Regular NDT inspections are planned to detect any structural damage on the bolt or any indications of fatigue or cracks and ensure that any damaged bolt is replaced before it fails. Inspection intervals vary for each wheel manufacturer and must be observed. These intervals may consider a maximum number of tire replacements on the wheel, or the number of flight cycles, or the maximum number of calendar days since the previous inspection. Often it is a combination of these and whichever occurs first. Refer to each wheel manufacturer CMM to determine the inspection intervals. In the case of an overload (e.g. Hard landing), some additional specific checks might be requested (refer to the CMM).

KEYPOINT

Traceability is key

Traceability is key to ensure that the wheel tie bolts are inspected at the required intervals using NDT inspection methods.

Tie bolts do not have a serial number. Therefore, it is the wheel serial number that must be used to ensure there is a record of the number of tire replacements, flight cycles, and the last recorded NDT inspection date.

The good practices listed below should be followed to ensure that the bolts are inspected at the required intervals:

- After a tire replacement, the same set of tie bolts removed from a wheel assembly should be reinstalled on the same wheel to ease traceability, and the number of tire replacements since the last NDT inspection should be recorded
- When reinstalling the same set of wheel tie bolts onto a wheel assembly it is important to make sure that the tie bolts have not exceeded the number of allowable flight cycles, tire replacements, or calendar days passed since the last NDT inspection date, in accordance with the wheel assembly CMM
- If a wheel tie bolt is removed from a set, the replacement bolt must be a new bolt or a substitute bolt, but only if this bolt was inspected using NDT as per the CMM
- If a new set of tie bolts is installed on a wheel, the maintenance record of the wheel must be updated to indicate this accordingly
- Any tie bolt installed on the wheel must be the same part number specified by the wheel assembly CMM.

Observe the correct torque value

Correctly torquing and greasing the wheel tie bolts is important to ensure the overall structural integrity of the wheel assembly and to prevent damaging the bolts. The correct tightening torque value to apply for the wheel tie bolts is specified in the CMM and must be observed when assembling the wheel.

NOTE

To improve the protection of wheels and brakes during parking and storage of aircraft, the recommendations provided in the AMM/MP/AMP procedure for parking/storage of aircraft should be applied.

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Wheel tie bolts should be considered as a key component of the aircraft landing gear because they ensure the structural integrity of the wheels. The wheel assembly must sustain significant loads and any damaged bolt could shear under stress and reduce the capability of the wheel to resist these loads. This could have the potential to cause injury to personnel on the ground or be a risk of wheel failure on taxi, take off or most likely upon landing. A sheared wheel tie can migrate toward the brake assembly and cause damage that may lead to hydraulic system leak, resulting in loss of brake pressure, and possibly brake fire.

Early detection by maintenance and flight crew who can check for any damaged or missing tie bolts during the preflight exterior walkaround can help to prevent this.

Preventive maintenance allows for early detection of any damaged bolt by regular visual and NDT inspection. Careful traceability of the bolts installed on each wheel assembly will help to ensure that the required NDT inspection intervals are observed. This will enable an early detection of any indication of structural fatigue on the wheel tie bolts so that they may be replaced before there is a risk that they shear in service.


REMOVE BEFO

Ensuring a Correct Aircraft Technical Configuration

Flying on an aircraft with an incorrect aircraft technical configuration can cause unexpected system behaviors that could lead to an accident or a serious incident. This can occur when an aircraft is dispatched with a computer standard that is not authorized to be installed on that aircraft. Incorrect technical configuration or documentation can also create inconsistency between the documentation and the actual aircraft technical configuration.

This article recalls the key aspects of technical configuration management. It highlights the importance of checking the Part Number (P/N) of the software installed on data loadable computers and describes the tools that Airbus has developed to help Operators make sure that they install the appropriate P/N on their aircraft.

SEVERAL REPORTED INCORRECT AIRCRAFT TECHNICAL CONFIGURATIONS

More than 30 cases of incorrect aircraft technical configuration were reported to Airbus over the last two years. In all cases, the aircraft was dispatched with a computer standard that was not authorized to be installed on the aircraft.

Consequences of an Incorrect Aircraft Technical Configuration

A risk of incorrect behavior of some aircraft systems

Incorrect aircraft technical configuration can lead to unexpected system behaviors, which could affect the safety of a flight, especially if the incorrect configuration has an effect on flight control or flight guidance computers, or causes certain system functions to become unavailable.

A risk of documentation providing inappropriate information or procedures

A mismatch in the aircraft technical configuration can also cause the aircraft documentation (e.g AMM, IPC, FCOM, QRH, MMEL) to not reflect the actual technical configuration of the aircraft. This may result in documentation that provides inappropriate information or procedures to the flight crew or the maintenance personnel.

> “Incorrect aircraft technical configuration can lead to unexpected system behaviors, which could affect the safety of a flight”

HOW AIRCRAFT TECHNICAL CONFIGURATION EVOLVES

The “As Delivered” Configuration

Every new aircraft delivered to an Operator is equipped with the latest computer standards and full compatibility with all of its systems is ensured. This is called the “**As delivered**” initial certified configuration of the aircraft.

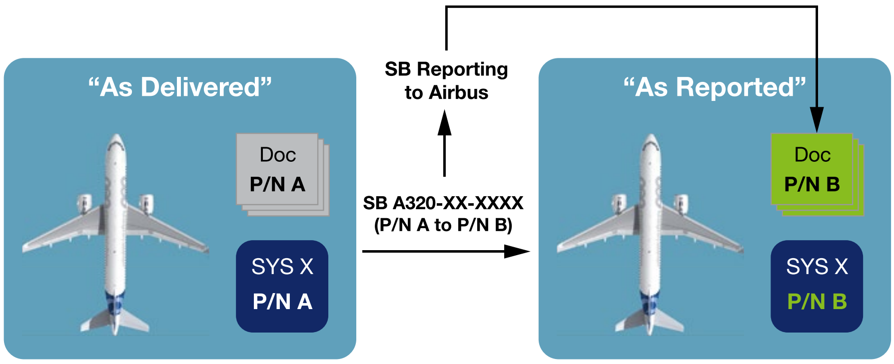
The “As Reported” Configuration

Operators can implement system improvements, corrections or add new functions, through modifications accomplished by Service Bulletins (SBs) during the entire service life of their aircraft. A SB replaces the original component with an updated component. The new component has a new Part Number (P/N) corresponding to the new standard. The Operator must report the embodiment of the service bulletin to Airbus, because Airbus uses this “**As Reported**” configuration of the aircraft to customize the content of the aircraft maintenance and operational documentation **(fig.1)**.

> “Airbus uses the “As Reported” configuration of the aircraft to customize the content of the aircraft maintenance and operational documentation”

KEYPOINT

Reporting SB embodiment to Airbus is essential to have up-to-date maintenance and operational documentation.



(fig.1)
Reporting SB embodiment ensures that aircraft documentation is updated to match with the actual technical configuration of the aircraft

INFORMATION

For more information on service bulletin configuration management, refer to the **"SB Configuration Management"** article published in Airbus FAST magazine #57 in 2016.

IPC Spare Parts

The Illustrated Parts Catalog (IPC) enables Operators to use a compatible P/N instead of the original P/N of a component if it is not available. This prevents unnecessary grounding of an aircraft in the case of a component failure.

Only P/Ns that are listed in the IPC as spares can be used to replace the installed P/N. This reinforces the need to report the embodiment of service bulletins to Airbus to ensure that the IPC provides the correct spare P/Ns.

Operators should be aware that if they use an IPC spare part, the aircraft documentation remains customized to the "**As reported**" configuration **(fig.2)**.

KEYPOINT

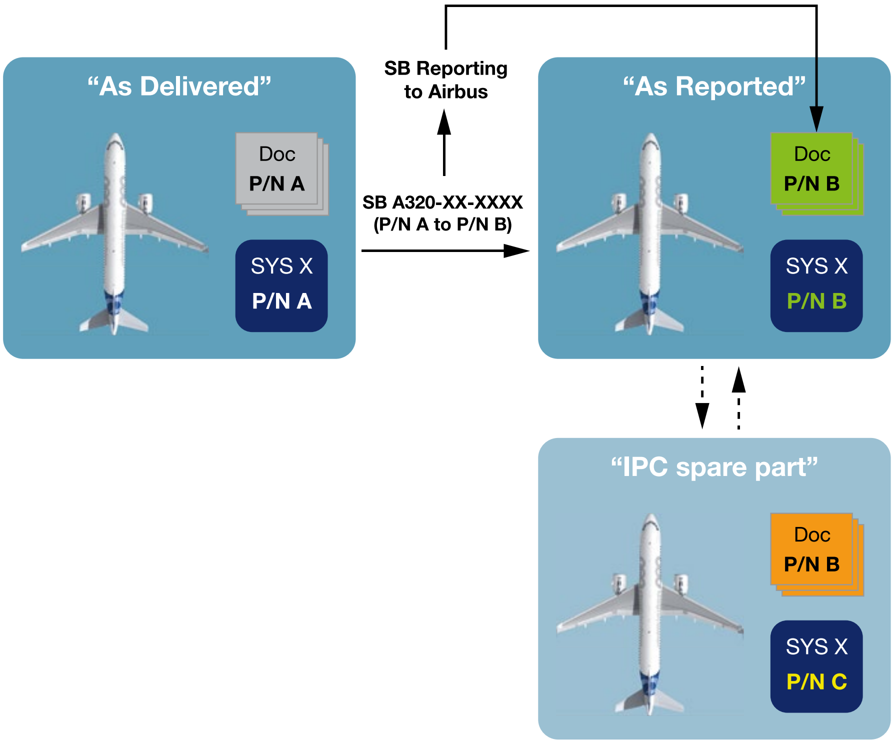
If the IPC does not list spare P/Ns, the replacement component must have the same P/N.

If the IPC provides a spare P/N, it may be used to avoid unnecessary grounding of the aircraft.

If a spare P/N from the IPC is used, the aircraft documentation remains customized to the "As reported" configuration.

Check with Maintenance

Ground technicians should contact their maintenance engineering department if they have any doubt about the "**As Reported**" configuration versus the actual aircraft technical configuration.



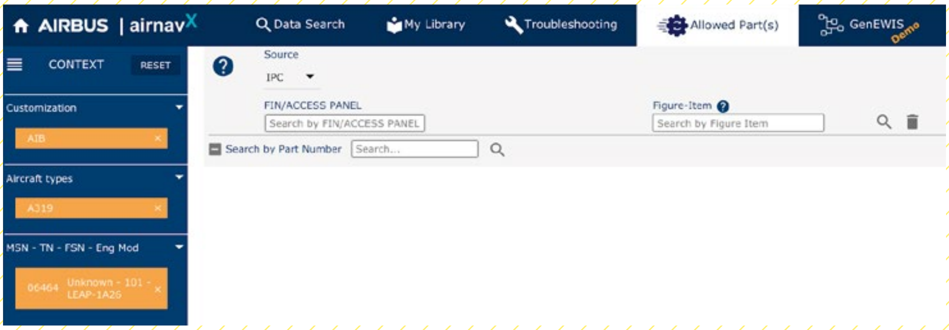
(fig.2)
When an IPC spare P/N is used, the documentation remains customized to the original P/N

INFORMATION

For more information on interchangeability and mixability rules, refer to the "Interchangeability/IPC spares PN" documentation available in the **airnav**X help center.

A useful tool: The Allowed Part(s) search function in airnavX

The **airnav**X tool, enabling operators to access the technical documentation for their aircraft, was updated in early 2021 to introduce the Allowed Part(s) search function. This function enables the Operator to quickly find a spare P/N if the original P/N is not available as a spare. The search can be made using the Functional Item Number (FIN), Access panel, IPC figure item reference, or directly using the P/N.



(fig.3)
Interface of the Allowed Part(s) search function

HANDLING DATA LOADABLE COMPUTERS

How Technology Evolved to Ease Computer Updates

Line Replaceable Units (LRUs) and On Board Replaceable Module (OBRM)

To update a computer to a new standard on A300, A310, A320 family, A330, and A340 aircraft, a Line Replaceable Unit (LRU) can be replaced with an LRU at a new standard. For some computers on A320 family, A330, and A340 aircraft, the update can also be done by changing only a part of the computer hardware called On Board Replaceable Module (OBRM).

Data Loading Units (DLUs)

A more recent generation of computers known as **Data Loadable Units (DLUs)** are now used for the majority of computers. Operators can update DLUs by directly loading updated software onto the units, also known as the **Field Loadable Software (FLS)**, using an interface in the cockpit or a portable data loader. Operators do not need to remove DLUs from the aircraft to perform their update. DLUs ease computer upgrades, simplify management of spare parts, and as a result, save time and cost.

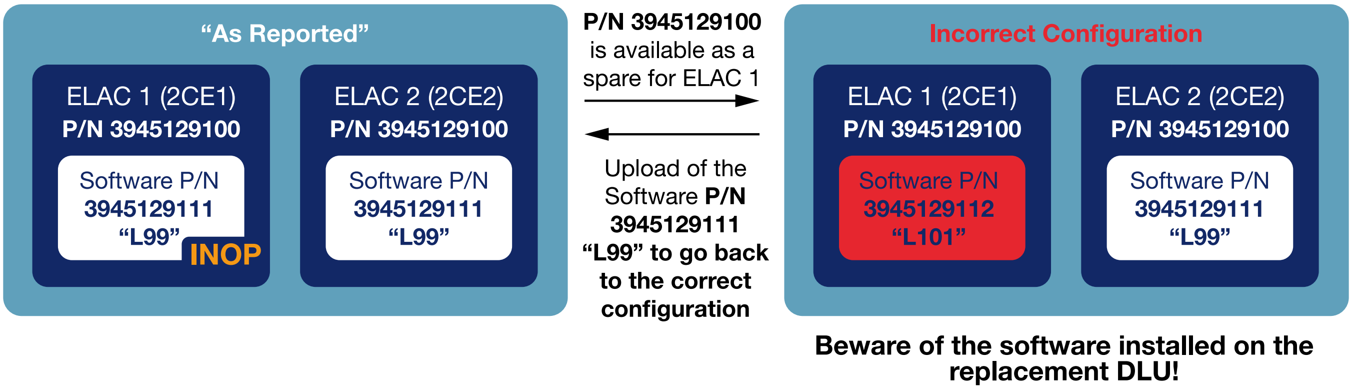
Most of the computers installed on A220, A350 and A380 aircraft are DLUs. DLUs have been progressively introduced on A320 family, A330, and A340 aircraft since 2009. All currently delivered A320 family and A330 aircraft are equipped with several DLUs. Some computers on older A320 family, A330 and A340 aircraft are also being progressively replaced with newer DLUs. When installed with the relevant software standard, a DLU has the equivalent behavior of the older LRU that is not data loadable.

Ensuring the Correct Software is Installed

Maintenance technicians must check the P/N of the software installed on a DLU to identify the actual computer standard. Checking the P/N of the DLU hardware alone is no longer sufficient. The software P/N must also be checked and treated like any other aircraft component, and its configuration should be managed in the same way.

Cases of Incorrect Software Installed

Failing to check the software P/N installed on a DLU caused many of the reported cases of incorrect aircraft technical configuration. As a typical example, when a DLU fails and is replaced with a DLU that has the same hardware P/N, the P/N of the software preinstalled on the new unit may not be correct **(fig.4)**.



(fig.4)
Example of incorrect technical configuration of Elevator & Aileron Computers (ELAC) on A320 family aircraft due to non-compatible software preinstalled on the replacement computer

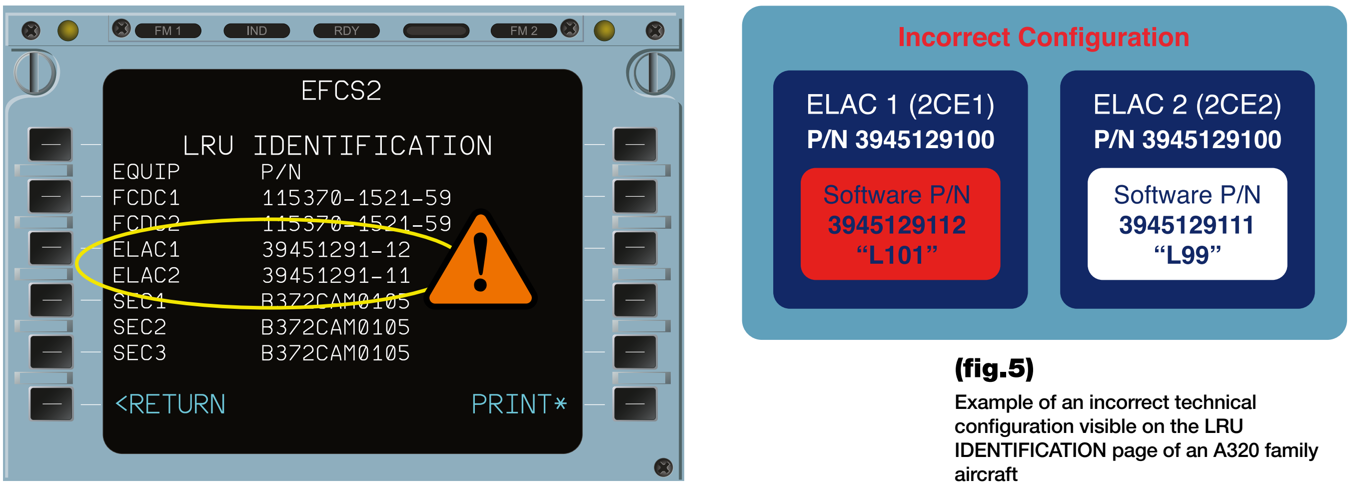
The LRU Identification Steps in the AMM/MP/AMP

The ground technicians must perform all of the steps in the AMM/MP/AMP tasks for computer removal and installation. This includes the LRU IDENTIFICATION steps that enable them to check that both the P/N of the hardware and the P/N of the software of a computer are correct.

The LRU identification page can be accessed via the **SYSTEM REPORT / TEST** page on the MCDU (A320 family, A330, A340 aircraft) or via the OMS (A220, A350 and A380 aircraft).

KEYPOINT

The LRU IDENTIFICATION step of the AMM/MP/AMP task for computer installation is the last opportunity to check via the MCDU/OMS that the correct software P/N is installed on a computer.



(fig.5)
Example of an incorrect technical configuration visible on the LRU IDENTIFICATION page of an A320 family aircraft

Managing Software on A220, A350 and A380 Aircraft

The A220, A350 & A380 aircraft introduced new challenges in configuration management for airlines due to the high number of software to manage and the increased possibility of customization compared with A320 family or A330/A340 aircraft.

To ensure smooth FLS operations, A350 and A380 Operators should have specific processes and roles dedicated to software configuration management within their organization. **ISI 00.00.00095** and **00.00.00188** articles are available on the AirbusWorld portal and provide generic FLS management recommendations in line with ARINC 667.

INFORMATION

Airbus Customer Support has published the ISI articles listed below on the AirbusWorld portal as well as an A220 Service Letter to help Operators and MROs to manage FLS.

ISI 00.00.00095: Field Loadable Software Management - FLS Applicable Standards and Classifications

ISI 00.00.00188: Field Loadable Software Management - FLS Applicable Recommendations

ISI 00.00.00189: Field Loadable Software Management - FLS List. This article provides Operators with the way to extract the SW configuration of the aircraft and the list of FLS FIN that can be installed on A320 family and A330/A340 aircraft)

ISI 00.00.00240: FLS Media Digitalization - PDL adaptation

ISI 00.00.00317: How to manage FLS with LSBM

ISI 00.00.00329: FLS electronic Delivery

ISI 00.00.00333: How to rebuild a FLS Media from a digitalized FLS

ISI 00.00.00334: Correspondence matrix between Media PNR and FLS PNR

ISI 00.00.00337: 1st Webinar A320-A330/A340 families - FLS Media Digitalization

ISI 00.00.00384: 2nd Webinar A320-A330/A340 families - FLS Media Digitalization

A220 Service Letter CS-SL-46-00-0003: Field Loadable Software List

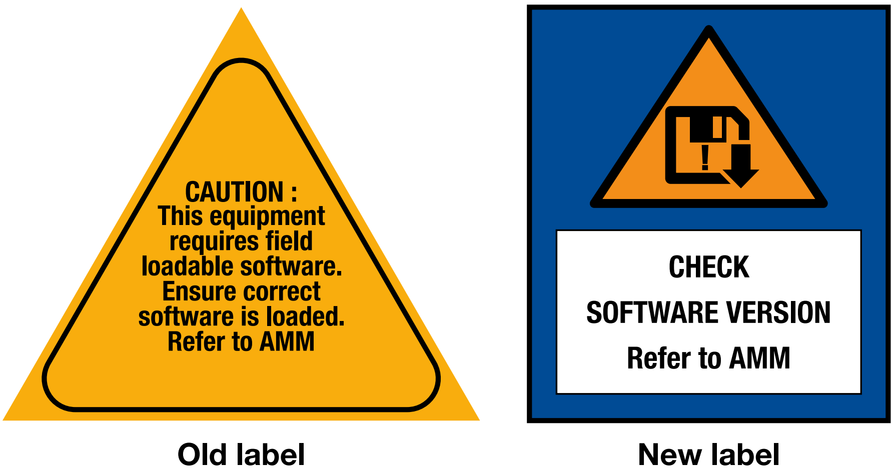
Mixing DLU with non-DLU on A320/A330/A340 Aircraft

A mix of DLU and non-DLU computers is possible on A320 family, A330, and A340 aircraft. It requires clear identification of the computers that are DLUs and a strict adherence to the interchangeability and mixability rules defined in the IPC.

DLU identification:

A placard located on the computer hardware enables ground technicians to identify any computer that is a DLU **(fig. 6)**.

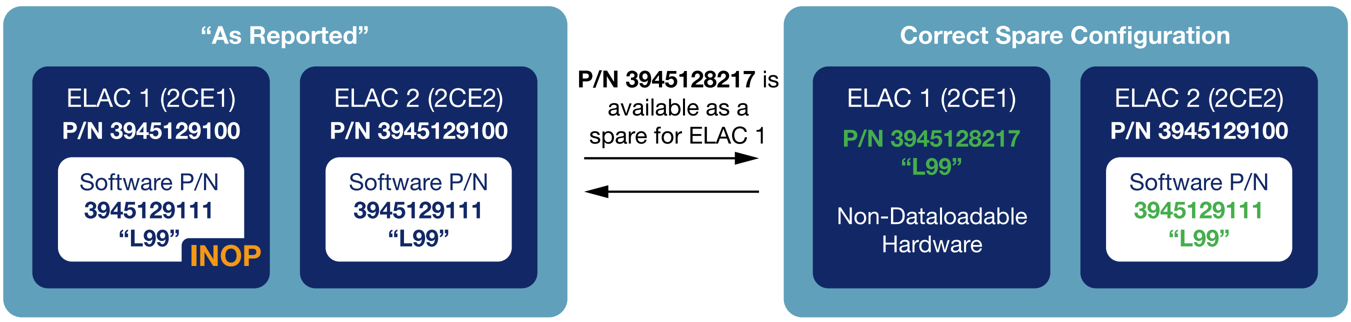
(fig.6)
Examples of DLU identification placard



Mixability of DLU and Non-DLU Computers

For some computer standards, both a DLU and a non-DLU version are available and are two-way interchangeable units. The IPC usually enables the DLU and non-DLU versions to be interchanged provided that the software of the DLU version is also loaded with the correct software P/N.

(fig.7)
Example of mixability for DLU and non-DLU ELAC computers on A320 family aircraft



IPC Qualified condition:
IF **3945129100**, SEE **3945128217**: NON-DATALOADABLE **ELAC L99 P/N 3945128217** IS TWO WAYS INTERCHANGEABLE AND MIXABLE WITH DATALOADABLE **ELAC L99 P/N 3945129100** WITH OPERATIONAL SOFTWARE **P/N 3945129111** LOADED.

Awareness & Training for Maintenance

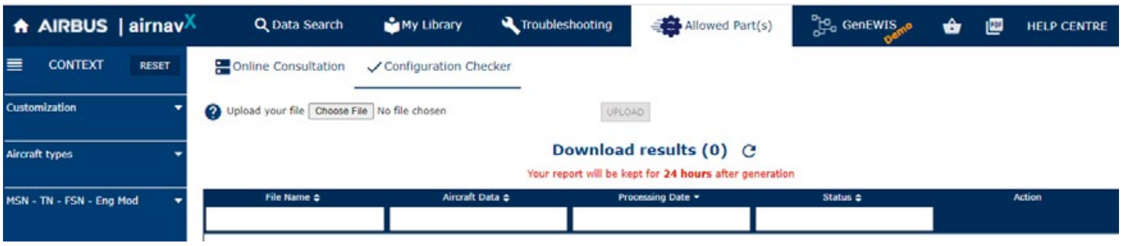
Operators should ensure that maintenance technicians who work on A320 family, A330, and A340 aircraft are aware of the presence of DLUs on their aircraft and perform the necessary training to manage DLUs correctly.

CONFIGURATION CHECKER TOOL

Available since June 2021 (A320 family, A330, A340, A350 & A380 aircraft)

Airbus developed a tool called the Configuration Checker to further assist Operators in the management of their aircraft technical configuration: this tool is available in the Allowed Part(s) menu of **airnav**X since June 2021 for A320 family, A330, A340, A350, and A380 aircraft.

(fig.8)
View of the interface of the Configuration Checker tool in the Allowed Part(s) menu of airnavX



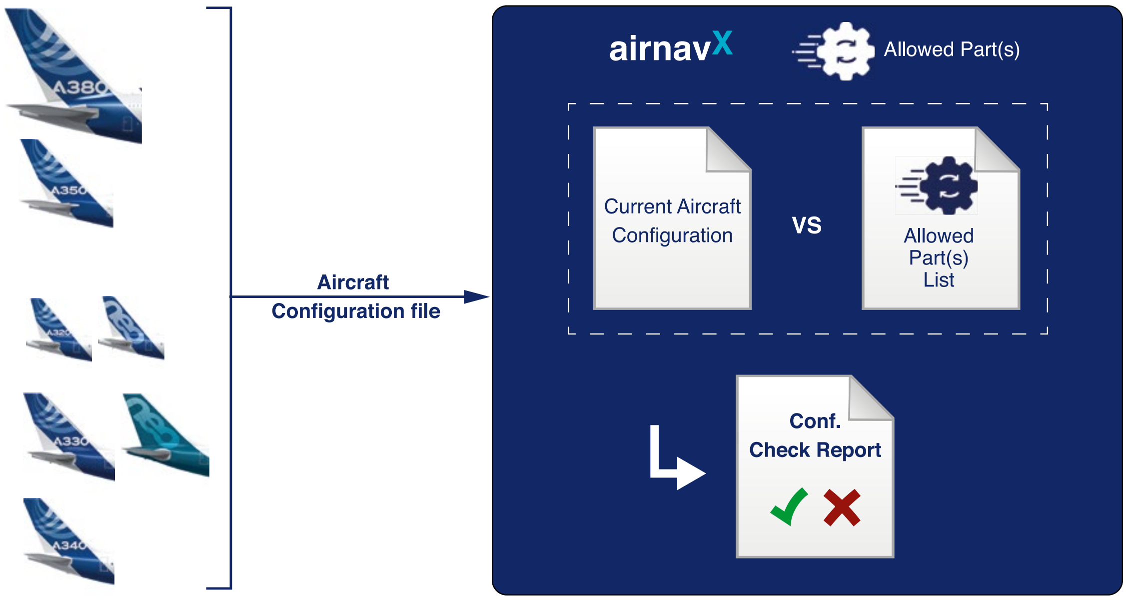
A Comparison Between the P/N Installed on the Aircraft and the List of Allowed P/Ns

Operators can upload the aircraft configuration file that contains the P/Ns installed on an aircraft into the Configuration Checker. The tool then compares the installed P/Ns with the list of allowed P/Ns per position and provides a report that highlights the configuration mismatches, if any.

The Configuration Checker tool brings an additional safety check on top of the LRU IDENTIFICATION step against any configuration mismatch.

Note that the uploaded data is not archived and the report is only visible to the Operator.

(fig.9)
Concept of the Configuration Checker tool



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With thanks to Jason BURGE, Jean-Philippe JACQ and Alexandre LAGU from Customer Support and Francis Péloquin from Airbus Canada

Proper aircraft configuration management and consistent aircraft documentation are key elements to flight safety:

- Operators must ensure correct aircraft technical configuration management and inform Airbus when they have embodied service bulletins on their aircraft so that their documentation reflects the actual aircraft technical configuration. This will ensure that the maintenance technicians and flight crew have the appropriate information and procedures to safely maintain and operate the aircraft.
- Operators must only use a spare part that is listed in the IPC to prevent the grounding of an aircraft if the original P/N is not available.
- Maintenance technicians must check the software P/N installed on Data Loadable Units to ensure that the correct software standards are installed on the computers. The LRU identification step of the AMM/MP/AMP procedure for installation of a computer is the last opportunity to check that the software installed on a computer is correct. This step must not be skipped, even if the technicians are under operational pressure.Communication between the flight crew and the cabin crew enables safe and efficient management of the cabin before and during turbulence events.

Since June 2021, the Configuration Checker tool is available to Operators in the Allowed Parts menu of **airnav**X. This provides an additional safety net to check that the aircraft current technical configuration is in line with the list of allowed parts.

System Reset: Use with Caution

A system reset is not always the quick fix that it may seem. Performing an inappropriate manual system reset in flight can seriously impair the safety of the flight. Multiple system resets on the ground without performing the necessary troubleshooting actions can also have serious consequences.

This article addresses when system resets are applicable and how to perform them correctly.

CASE STUDY

Event Description

AUTO BRK FAULT at engine start

At engine start of an A320, the BRAKES AUTO BRK FAULT ECAM alert triggered. The flight crew set the A/SKID & N/W STRG switch to OFF and then back to ON **(fig.1)**. This action cleared the alert.

First A/SKID N/WS FAULT during the takeoff roll

The BRAKES A/SKID N/WS FAULT ECAM alert triggered during the takeoff roll prior to the inhibition phase. After the aircraft became airborne, the flight crew cleared the alert by setting the A/SKID & N/W STRG switch to OFF then ON.

Second A/SKID N/WS FAULT during approach

The BRAKES A/SKID N/WS FAULT ECAM alert triggered again on approach. The flight crew set the A/SKID & N/W STRG switch to OFF and ON for a third time and this action cleared the alert.

Main landing gear tires burst at landing

The flight crew noticed unusual braking behavior immediately after touchdown. They applied full reverse thrust and manual braking. The aircraft came to a stop, but the flight crew was unable to begin taxiing. The four main landing gear tires had burst during landing.

(fig.1)
A/SKID & N/W STRG switch

Event Analysis

Similar faults were observed during the previous flights

There were seven occurrences of BRAKES AUTO BRK FAULT and two occurrences of BRAKES A/SKID N/WS FAULT recorded on this aircraft over the two months prior to the event. System resets and testing the BSCU were the only maintenance actions carried out each time.

Unauthorized resets of the braking and steering functions hid the deteriorating condition of the braking system

There is no reset procedure associated with BRAKES AUTO BRK FAULT and BRAKES A/SKID N/WS FAULT ECAM alerts in the A320 QRH. The use of the A/SKID & N/W STRG switch to reset the braking and steering functions in flight is mentioned in the System Reset table of the QRH, but it is only authorized with the BRAKES SYS 1(2) FAULT and BRAKES BSCU CH 1(2) FAULT ECAM alerts. The unauthorized resets that the flight crew performed during the flight hid the deteriorating condition of the braking system.

Dual tachometer failure

A dual tachometer failure was at the origin of the delay in the braking system activation. The unauthorized in-flight reset prevented the BSCU from detecting the failure of the tachometers and this led to the BSCU considering that 0 kt was the actual wheel speed. After 15 seconds, the braking function was recovered with a default deceleration speed. At the same time, the BSCU was unable to compute the anti-skid order and sent full hydraulic pressure to the brakes and caused the four tires to burst.

WHAT IS A SYSTEM RESET?

A system reset is the action of switching off a system and then switching it back on again with the objective to retrieve normal system behavior or recover a previously lost function. It is different from re-engaging a tripped Circuit Breaker (C/B).

Tripped Circuit Breaker

A C/B will trip when there is an overload of electrical current detected in the circuit. This is to protect from overheating or a short-circuit condition in the wiring that could lead to further damage or fire. Management of tripped C/Bs is not covered by this article. In this article, the term "reset" describes the action of switching off a system and switching it back on again. This action can also be called a "cycle".

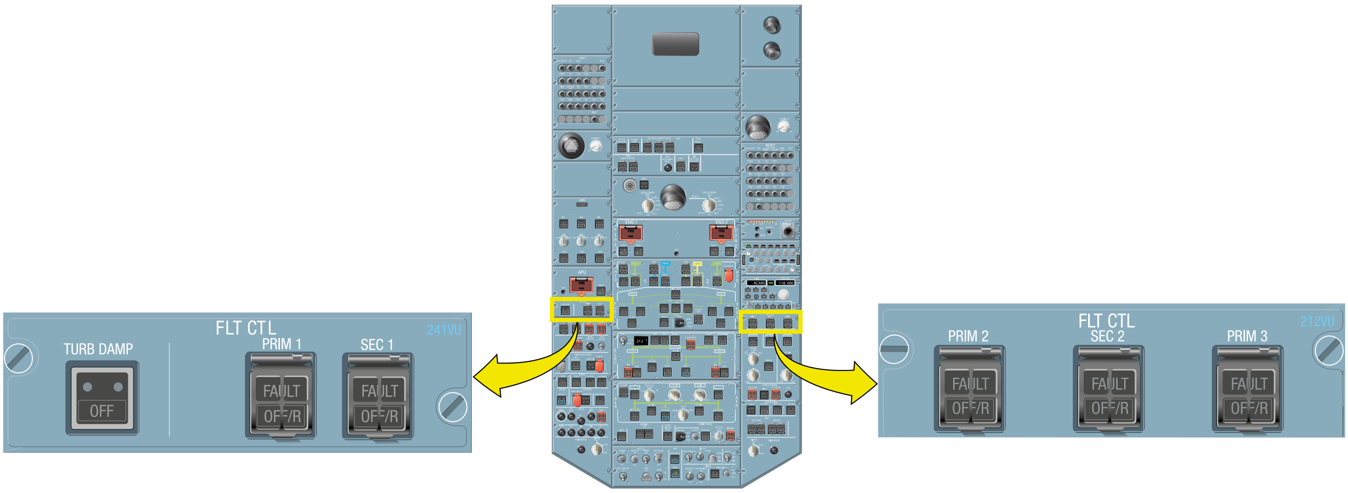
Automatic Reset vs. Manual Reset

Certain avionic systems, such as the Flight Management System (FMS), have an automatic reset function. The reset action is completely managed by the system that has an automatic failure detection mode. Maintenance or flight crews perform a manual reset by using the cockpit control for the system, a circuit breaker, or a dedicated reset button (also called a reset switch). This article focuses only on these types of manual resets.

Manual Reset Using System Controls

For specific systems, such as the flight control system, the maintenance or flight crews can perform a system reset from the cockpit using pushbutton-switches available on the overhead panel **(fig.2)**.

(fig.2)
Example of pushbutton-switches on the overhead panel of an A330 aircraft



Manual Reset Using a Circuit Breaker

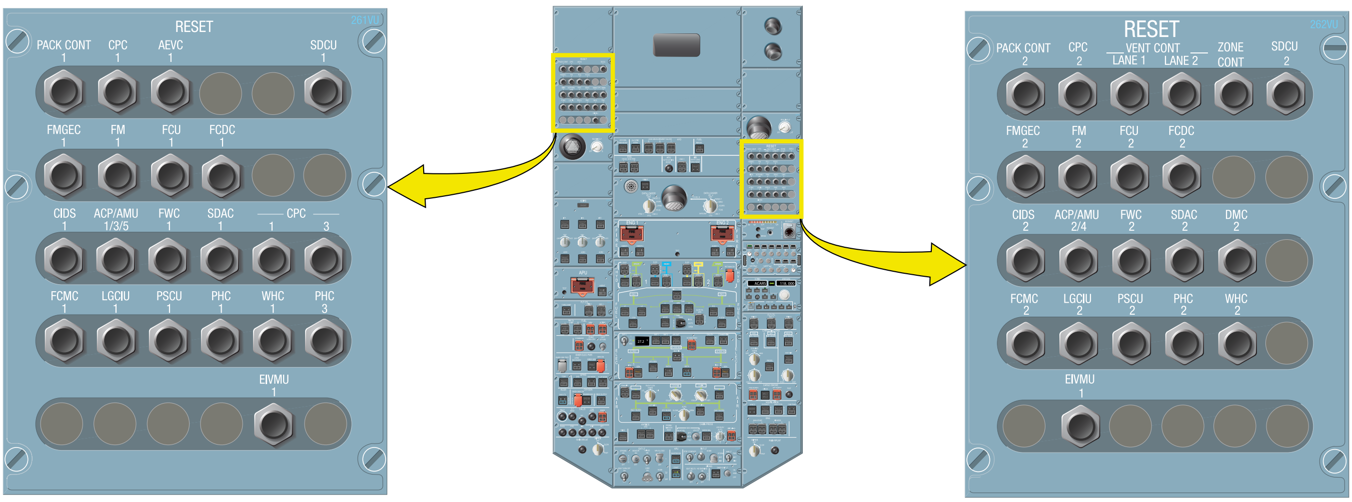
Pulling a system C/B and then pushing it back in will trigger a system reset because this will isolate and then restore the power supply to all parts of the system. It will also cause the software of the system to reload. This is considered as a “hard system reset”.
There are two types of C/Bs: traditional C/Bs and electronic C/Bs. The traditional C/B is manually opened and closed. The electronic C/B, also called Solid State Power Controller (SSPC), is controlled by a remote interface (on A220/A380/A350). Various system C/Bs are located in the cockpit of Airbus A220/A300/A310/A320 aircraft, the avionics bay, the cabin, and the cargo compartments. There are no C/Bs in the cockpit of Airbus A330/A340/A350/A380 aircraft. They are replaced by system reset buttons on the overhead panel.

Manual Reset Using a Reset Button

Pulling a system reset button **(fig.3)** then pushing it back in the cockpit will only reset the system software part (only available on Airbus A330/A340/A350/A380 aircraft). This is known as a “soft reset” because the system will remain powered.

(fig.3)

Reset buttons available on the top part of the overhead panel of an A330 aircraft



Inappropriate system resets can have serious consequences

Past events have highlighted how some system resets can have irreversible consequences. One example is where a system cannot be recovered after an inappropriate system reset in flight. Another example is where a reset of flight control computers is unduly performed. Depending on the system malfunction encountered, this can cause unexpected movements of the flight control surfaces, which may lead to serious consequences if performed in flight.

Avionics systems are interconnected systems, therefore, a system reset of one system can have significant consequences for the other systems that rely on its data. Inappropriate system resets can have unexpected side effects and hide deteriorating conditions of the system. In combination with a failure of another system, the safety of the flight can be impaired. Therefore, it is important that maintenance personnel and flight crews only perform system resets in accordance with the guidance in the relevant procedures, as for the cases described in this article.

A220 reset philosophy

For A220 aircraft, the flight crew can perform system resets only if specifically requested in an EICAS*/FCOM/QRH procedure. There is no system reset table published for the A220, contrary to all other Airbus aircraft, except for the A300B2/B4.

Maintenance resets must only be performed when requested by a specific task in the A220 Fault Isolation Manual or in the Aircraft Maintenance Publication (AMP).

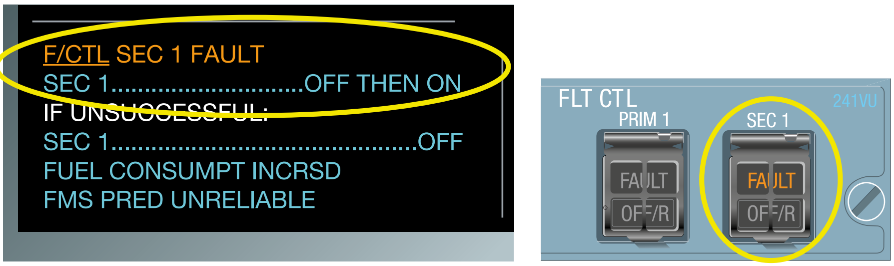
*EICAS: Engine-Indication and Crew-Alerting System on A220 is the equivalent of the ECAM on other Airbus aircraft.

SYSTEM RESETS BY THE FLIGHT CREW

The flight crew can perform system resets only in the three cases listed below.

CASE 1: A Dedicated Step in the ECAM/OEB/FCOM/QRH Procedure

A system reset can be specifically requested in an ECAM/OEB/FCOM/QRH procedure **(fig.4)**.



(fig.4)
Example of a SEC 1 FAULT ECAM alert on A330 aircraft

CASE 2: As an Option After ECAM Procedure (except A300B2/B4)

ECAM procedures do not necessarily request a system reset. In this case, as per the "Airbus Operational Philosophy" section of the FCTM, the PF should call out "STOP ECAM" after they perform the ECAM actions.

Before the review of the status of the aircraft on the STATUS page, if the PF considers that it is necessary to perform a system reset to recover the operation of the affected system, it is the responsibility of the flight crew to first check if such reset is authorized in the System Reset table of the FCOM/QRH.

KEYPOINT

If there is no reset procedure available in the System Reset table of the FCOM/QRH associated with the malfunction or ECAM alert encountered, the flight crew must not attempt a reset.

For A320 family aircraft, **on the ground only**, the flight crew can still perform a reset that is not listed in the A320 System Reset table as described in Case 3 below.

The System Reset table lists the specific conditions necessary for the reset procedure

The reset procedures are the result of in-depth analysis to define the authorized resets and their associated conditions, such as the maximum number of resets possible, if they are authorized on the ground only, or also in flight. These conditions must be respected.

KEYPOINT

Resets that are only authorized on the ground can have dramatic consequences if performed in flight.

System resets can trigger functional tests that may lead to movement of the flight control surfaces, which is why they must not be performed in flight. This can also cause reversion of the flight control laws with associated loss of flight envelope protection.

Read and do the procedure

A reset procedure must be performed in “read and do” mode. The flight crew must not apply the system reset procedure from memory and they must always follow the relevant procedure (ECAM/OEB/QRH/FCOM), or refer to the System Reset table in the QRH/FCOM.

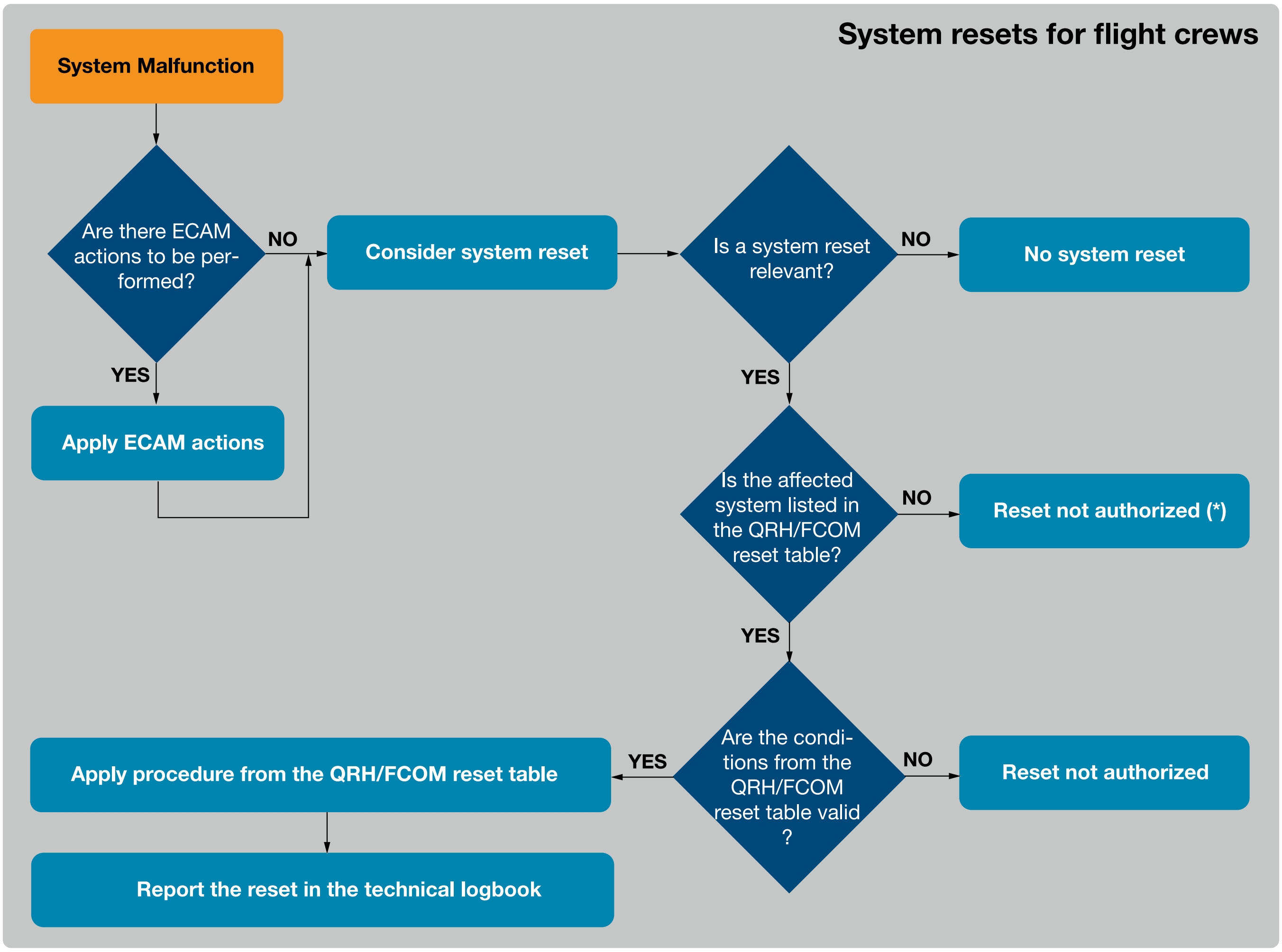
The need for crosscheck

Performing a system reset is an action that can have irreversible consequences. A crosscheck action is necessary before resetting a system when using a guarded cockpit control, a C/B, or a reset button.

Report any reset to maintenance

Any manual system reset that the flight crew does on the ground or in flight must be reported to maintenance and recorded in the aircraft logbook regardless of it being successful (i.e. system recovered) or not. The number of attempted resets should also be specified to help maintenance monitor the resets as an indication of the system condition.

(fig.5)
Flow diagram for flight crew system resets



(*) For A320 family aircraft, some resets may be authorized on ground (See Case 3 below)

CASE 3: System Resets for Electrical Transient Faults for A320 Family Aircraft on the Ground Only

Electrical transients may lead to intermittent system failures

A320 family aircraft systems can be affected by electrical transients during power-up, APU, or engine start, or any electrical transfer.

To manage the side-effects of these transients, depending on the affected system, it is possible to perform system resets from the A320 QRH System Reset table and also system resets that are not specifically listed in the System Reset table.

The affected system is listed in the QRH System Reset table

If the affected system is listed in the QRH System Reset table, the associated reset procedure and conditions must be applied, but only for the corresponding ECAM alerts or system malfunctions listed in the reset table. For other ECAM alerts or malfunctions of the affected system not specifically listed in the System Reset table, a system reset is not authorized.

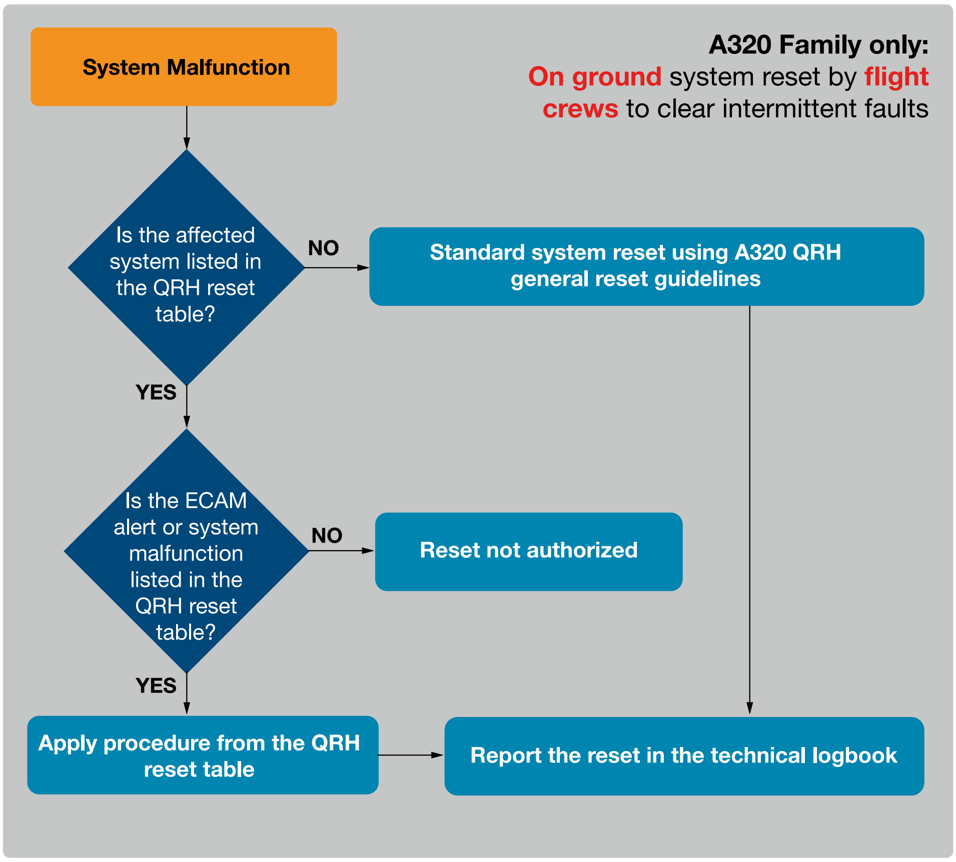
The affected system is not listed in the QRH System Reset table

If the affected system is not listed in the QRH System Reset table, the system can be reset on the ground only by applying the general guidelines provided in the General part of the System Reset section of the A320 QRH.

Crosscheck and report

As for any reset, a crosscheck must be done when using a guarded cockpit control, a C/B, or a reset button and the reset must be reported in the aircraft technical logbook.

(fig.6)
Flow diagram for flight crew system resets on A320 family aircraft on the ground



SYSTEM RESETS BY MAINTENANCE PERSONNEL

Caution for System Resets on Ground

System resets can cause system components to move or operate, which is a risk of serious or fatal injury to people in close proximity to the aircraft. This can also cause damage to the aircraft if in contact with ground equipment. Specific precautions must be taken when performing tasks on or near flight controls, flight control surfaces, around landing gears and landing gear doors, or any other moving parts or components.

Maintenance personnel can perform system resets only in the two cases listed below.

CASE 1: Resets Requested in a Maintenance Procedure

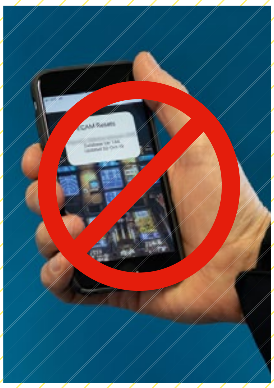
Resets may be required when applying a troubleshooting procedure from the Troubleshooting Manual (TSM) for A300/A310/A320/A330/A340/A380 or the Aircraft Fault Isolation document (AFI) for A350.

KEYPOINT

Performing a system reset on the ground must always be part of a troubleshooting procedure.

Performing unauthorized "quick fix" resets on the ground to dispatch an aircraft can affect the conditions of the next flights. The ECAM alert may be cleared for dispatch, but the underlying issue is not fixed and this can hide a deteriorating condition in the system.

Use of third party smartphone or tablet applications is not authorized by Airbus



There is a growing number of unauthorized applications that present a list of system resets for Airbus aircraft. These applications are not validated by Airbus. The specific conditions for each system reset are not described by these applications and the information can be inaccurate and out of date. Therefore, **these applications must not be used**, because they can represent a safety risk. An OIT about this topic is available on the AirbusWorld portal: **OIT 999.0042/19 "Un-approved maintenance instructions available on the internet or as applications".**

CASE 2: Specific Condition for A320 Aircraft

Electrical Transients

As already described in Case 3 for flight crew resets, A320 family aircraft operations can be affected by electrical transients at power-on. That is why it is allowable to perform resets on A320 family aircraft that are not part of a dedicated TSM task.

TSM System Reset Table

The A320 TSM contains a list of authorized resets with their associated conditions in the “System Reset Guidelines” task of the ATA 24 chapter. These authorized resets are the same as the authorized resets on the ground in the System Reset table of the A320 QRH.

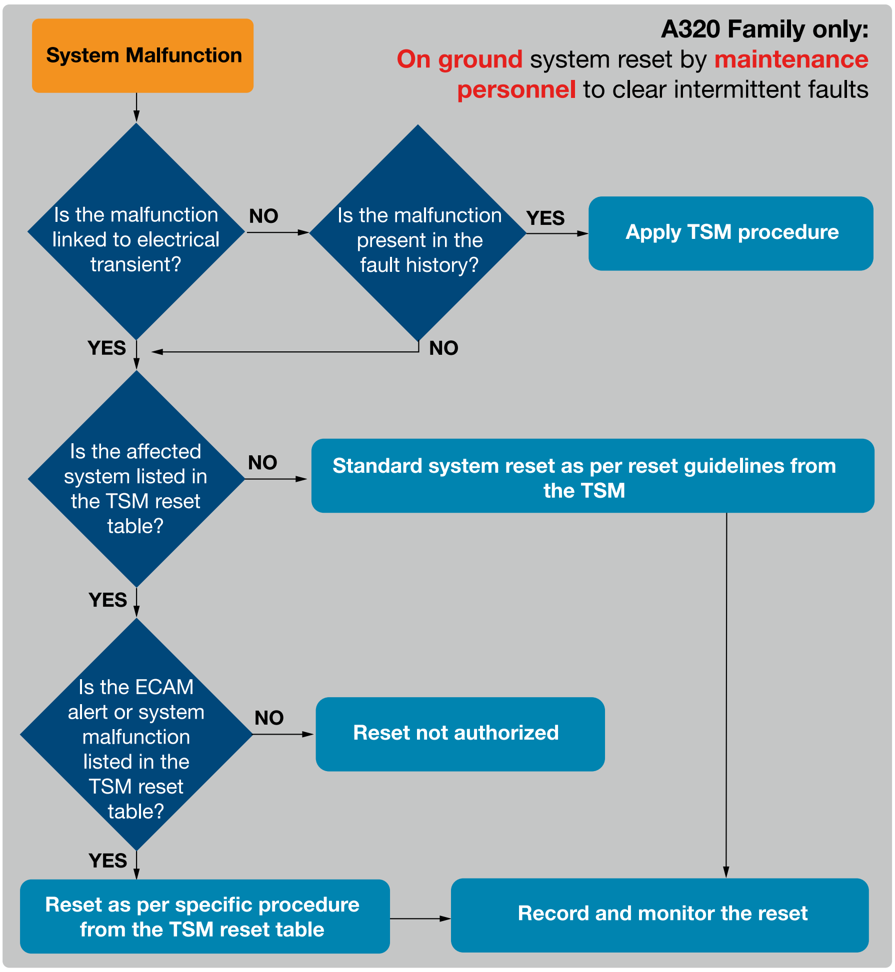
Fault due to Electrical Transient or Without Previous Record

When it is obvious that a fault is due to electrical transients, or is not present in the fault history, the affected system can be reset under certain conditions. If the affected system is listed in the System Reset table of the ATA 24 TSM task, a system reset is authorized, but only for the ECAM alerts or system malfunctions specifically listed in the table. For other ECAM alerts or system malfunctions not listed in the System Reset table, a reset is not authorized, despite the system itself being listed in the reset table. If the affected system is not listed in the System Reset table, a reset is authorized with no specific restrictions.

Fault not Obviously due to Electrical Transient With Previous Record

If the fault is not obviously due to electrical transients and is present in the fault history (repeated intermittent failure), then the application of the appropriate TSM procedure(s) is required.

(fig.7)
Flow diagram for maintenance personnel system resets on A320 family aircraft on the ground



Monitoring System Resets

Always Record System Resets

An efficient method to record and monitor system resets must be implemented. Any attempted reset must be recorded whether a maintenance reset requested during the fault confirmation part of a TSM/AFI task is successful (intermittent failure, no further action required) or not successful (permanent failure, fault isolation actions to perform).

A Management System for System Resets

Repetitive failures can occur despite maintenance actions, but they may not necessarily reappear over consecutive flights. Operators shall have a dedicated management system for repetitive failures to comply with continued airworthiness regulations.

Repetitive Failure Management

Repetitive resets of the same system could indicate a permanent failure. Appropriate troubleshooting actions must be initiated to mitigate the risk of latent failures on the ground with multiple resets, which could reappear later in flight.

It is important to properly track repetitive occurrences of system malfunctions over several flights. This is usually an indication that the fault condition still exists and deeper troubleshooting is required.

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Unauthorized resets of an aircraft system can hide a deteriorating condition of the system. What may seem to be a "quick-fix" on the ground to dispatch the aircraft can lead to a system fault reappearing in flight that may even affect the safety of the flight.

If not specifically requested in an ECAM/OEB/FCOM/QRH procedure, the flight crew can only consider attempting a reset to recover the operation of an affected system if it is listed in the System Reset table of the FCOM/QRH. If there is no reset procedure available in the System Reset table of the FCOM/QRH, which is associated with the malfunction or ECAM alert encountered, then the flight crew must NOT attempt to reset the system. Any system reset performed by the flight crew needs to be reported to maintenance personnel and must be recorded in the aircraft technical logbook, including the number of attempts and outcomes.

For A320 aircraft only, due to possible electrical transients, the flight crew can perform on ground resets that are not listed in the reset table.

Maintenance system resets are only performed in accordance with specific TSM/AFI tasks. Troubleshooting can start with resets but should not end there. The appropriate troubleshooting actions or at least recording actions should always follow.

For A320 aircraft only, the same on-ground resets from the System Reset table of the QRH are available in the A320 TSM and can be used to manage intermittent faults and ease the aircraft dispatch. In this case, it is possible to perform system resets that are not specifically listed in the TSM.

Manual system resets performed by flight crew or maintenance personnel are not a way to fix repetitive faults. Multiple and unreported resets can hide degraded system conditions. The fault could reappear later and have significant consequences during a flight. An efficient system for reporting and managing system resets is crucial for monitoring the health of all aircraft systems, which is key to maintaining safe aircraft operations.

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