

The Airbus safety magazine

#25

Safety first

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Safety first, #25 January, 2018. Safety first is published by Airbus S.A.S. - 1, rond point Maurice Bellonte - 31707 Blagnac Cedex/France. Publisher and Editor: Yannick Malinge, Chief Product Safety Officer. Concept Design by Airbus Multi Media Support 20172357. Reference: X00D16031905 Issue 25. Photos by Airbus, A. Tchaikovski, S. Ramadier, P. Masolet, Lindner Fotografie, P. Pigeyre, J.B. Accariez, A. Doumenjou. Computer renderings by Fixion.

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editorial



YANNICK MALINGE
SVP & Chief
Product Safety Officer

As we began the new year, Commercial Aviation Safety was already making headlines. Fortunately, this was for the exceptionally low number of fatal accidents which occurred in 2017. It is a fantastic achievement and shows hugely encouraging progress. Yet as I am fond of saying, we must never be complacent.

The industry continues strong growth in terms of the size of the world fleet and the volume of operations. We have to redouble our efforts if we want to keep the number of accidents at these all-time lows. There is no doubt in my mind that if we as an industry are to succeed in further enhancing Safety, we will need to further reinforce our efforts in sharing Safety information.

This magazine is a major contribution in Airbus' efforts to share Safety information with our operators and the industry. We first started publishing a dedicated Safety magazine in June 1995, with 'Hangar Flying'. The reaction to this magazine confirmed to us that the people using our products on a daily basis do indeed have a thirst for quality technical information that helps them carry out their duties more safely, and with a deeper appreciation.

In 2004, we decided to change the name of our magazine to 'Safety First', to better reflect its Safety objective, and so to boost its distribution and readership. The first issue came off the press in January 2005, and since that time we have established it as a bi-annual publication, built up a library of 25 issues, and created 120 individual articles.

But the world moves on, and we see that Safety First must move with it if we are to ensure our readership is not only maintained, but also continues to expand. This is why we recently sent out a short readers' survey, collecting feedback and inputs on what changes would be of value to you. I would personally like to thank those of you who answered this survey, your help is very much appreciated.

Here are some of the key changes we will make that have been supported by your answers:

Increased frequency: 86% of respondents confirmed that they would like to receive articles at a higher frequency, so that is exactly what we will do. We will start to publish individual articles every six weeks in various digital formats. The paper magazine will still be available every January and July.

Article search: An overwhelming 96% of respondents replied that an article search feature would be useful. A new app is available this month organized around articles instead of magazine issues, and including a search engine feature. Smartphones will get their own dedicated apps, and later in 2018 there will be a Safety First website too.

Article topics: Feedback on what articles the respondents would like more of clearly indicates a desire for more coverage of pilot knowledge & skills topics. Cabin safety is also requested by the Safety Officers who replied. We will take this into account in planning our stories, and you should expect to see some coming changes over the course of 2018.

So, having let you know how Safety First is moving forward, I leave you to move forward yourself, through the pages of edition #25!

A handwritten signature in black ink, appearing to read 'Y Malinge', with a long horizontal flourish underneath.



Vienna, Austria
19-22 March 2018

Airbus Flight Safety Conference

The Airbus' 24th annual flight safety conference is the forum for Airbus and our customers to share safety lessons learnt and best practices

It also provides a venue to establish networking opportunities between airline Safety Officers and Fleet Management Pilots in addition to interacting with Airbus Safety, Flight Test, Flight Ops, and Chief Engineering personnel.

SAFETY THEMES IN 2018:

- **Aircraft Energy Management**
- **Control Inputs in Manual Flight**

Both themes will be presented in their relevant phases of flight over the duration of the conference.

ATTENDANCE & INVITATIONS

The 24 Airbus Flight Safety Conference will be held at the hotel Hilton Vienna, Austria from 19 - 22 March 2018.

Invitations were sent to customers early January 2018.

To nominate an attendee, or to change contact information, please send an email to Mrs Nuria Soler at nuria.soler@airbus.com



NEWS

New “Cabin Operations” domain and merge of the “Engineering” and “Maintenance” domains

Because Cabin Crews play a key role in safety, we have created a new domain called “Cabin Operations” that will ease identification of the articles that are relevant for cabin crews.

To ease navigation and to limit the number of domains, we merged the Maintenance and Engineering domains into a single “Engineering & Maintenance” domain.



Flight operations



Cabin Operations



Ground Operations



Engineering & Maintenance



NEWS

Evolution of the Safety first app

A new version of the Safety first app is available with several improvements:

- Article based application
- Search engine for quick access to specific topics
- Independent article publications
- Now compatible with any screen size: available for both tablets and smartphones.

Download the Safety first app from your app store:





Safety first #25



Flight operations



Cabin Operations



Ground Operations





Engineering & Maintenance

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Protecting Aircraft and
Passengers from Cargo Fire



Are You Properly Seated?

The best position for a pilot to fly is not left to chance. It is the result of detailed analysis and design that provides the optimum seating position for both the Pilot Flying (PF) and the Pilot Monitoring (PM) to safely and comfortably operate their aircraft.

It may be surprising that something as simple as the pilot's seat positioning can play a key role in the safe flying of an aircraft. This is why it is important to pay close attention to the seat adjustment phase during the "Before pushback and start" part of the Standard Operating Procedures (SOP). This article will describe the principle of Eye Reference Point and how this is pivotal in the design of an Airbus aircraft's cockpit. It will also illustrate how a pilot seated in the correct position will avoid the potential consequences from operating the aircraft with a poorly adjusted seating position.

CERTIFICATION REQUIREMENTS

Regulations require that the aircraft manufacturer provides a means which will aid the pilots to position themselves with precision and allowing them to have the best point of view from their seat. This is defined by the EASA CS 25.773 and FAA FAR 25.773.

A pilot who is between 1.58 m (5ft 2 inches) to 1.91 m (6ft 3 inches) tall shall have easy access to all of the aircraft's controls in the cockpit and this is stipulated by EASA CS 25.777. This requirement ensures that the design fits to the vast majority of pilots.

These requirements are taken into account when a reference point is provided for the design of any cockpit. It is often referred to as the design eye position and also called eye reference point.

THE EYE REFERENCE POINT

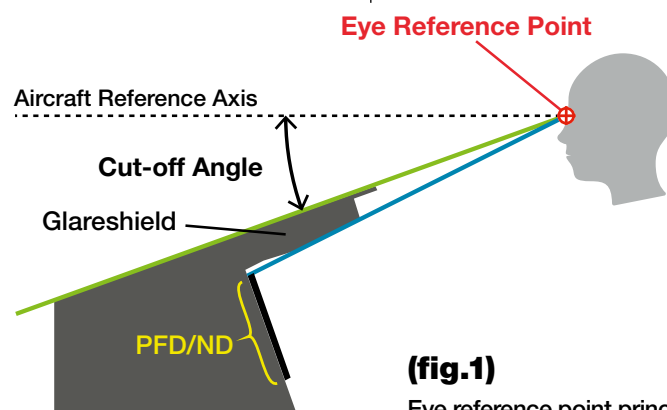
Modern aircraft cockpits are built around the eye reference point. It is used to size the cockpit windows and define the location of all the controls, displays and instruments.

When the pilots align themselves with the eye reference point, they will have adopted the optimum position to operate the aircraft.

An optimized field of view

The cockpit is designed so that when the pilot has aligned themselves to the eye reference point; all of the instruments and displays on the front panel are in their field of view (**fig.1**).

“ When the pilots align themselves with the eye reference point, they will have adopted the optimum position to operate the aircraft. ”



(fig.1)

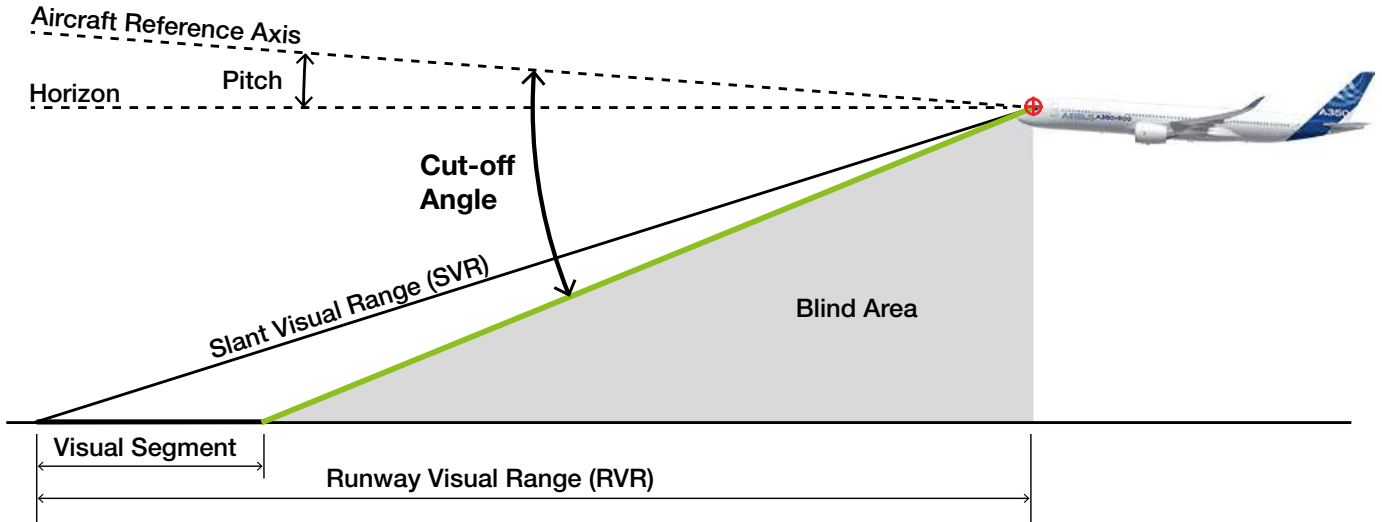
Eye reference point principle

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Are You Properly Seated?

A pilot needs to have good situational awareness during a flight. Alignment using the eye reference point enables the pilots to have an optimal field of view through the cockpit's windows to see what is around them outside the aircraft. The eye reference point position ensures the pilot can maintain the best cut-off angle that will provide the longest visual segment **(fig.2)**. This is especially important to get visual references during Low Visibility Operations (LVO).

(fig.2)
Cut-off angle



A consistent viewpoint

Having a consistent viewpoint gives several operational advantages such as easing the handling of the aircraft by providing pilots with a consistent visual reference, repeatable at every flight. This is especially useful during final approach to be familiarized with the final approach path angle and also for the flare phase.

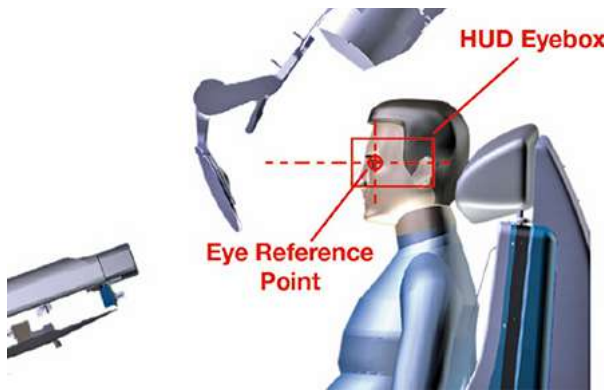
Since the A300 Airbus has provided an eye reference indicator on the centre structure of the windshield in all Airbus aircraft **(fig.3)**. It enables flight crew to adjust their seat position so that their eyes position matches the eye reference point. The indicator is a device that is fitted with 3 balls painted red or white. To achieve a correct seating position, pilots must align the red and white ball meaning that the white ball is hidden when in the correct position.

(fig.3)
Example of the eye reference indicator in the A350



» Using Head Up Display (HUD)

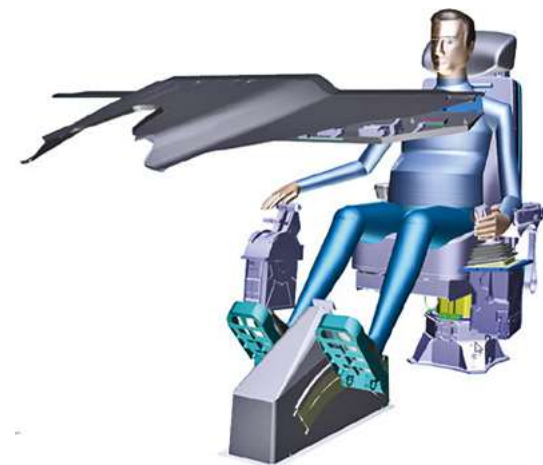
HUD symbols are fully visible when the pilot's eyes are closest to the eye reference point. An "eye box" is defined as an area around the eye reference point that gives a position tolerance range **(fig.4)**. Hence the pilot correctly sees indications on the HUD when their eyes are positioned inside this virtual box. The HUD eye box area extends further aft than forward to allow HUD readability when seated in a more reclined position for comfort.



(fig.4)
HUD eyebox principle

An optimized access to aircraft controls

A pilot properly seated with their seat harness fastened is able to reach and operate all of the aircraft's controls through their full range of motion or deflection as it is defined by the design certification requirements **(fig.5)**.



(fig.5)
3D model to visualize the access to flight controls

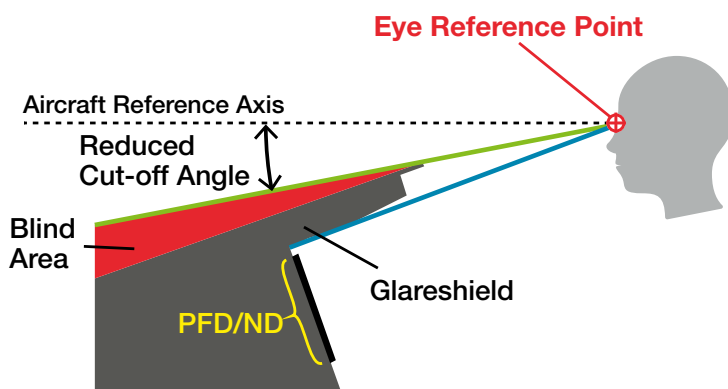
What if seated too low?

A pilot seated in a position that is too low may have difficulties to reach all of the system controls located on overhead panel.

On ground, if seated too low while taxiing the aircraft, the pilots' situational awareness can be impaired to an extent where it may increase the risk of collision with airbridges, buildings, ground support vehicles or other aircraft on the ramp.

In flight, if pilots position themselves too low, during final approach their perception of the flight path angle may be inaccurate.

“ In flight, if pilots position themselves too low, during final approach their perception of the flight path angle may be inaccurate. ”

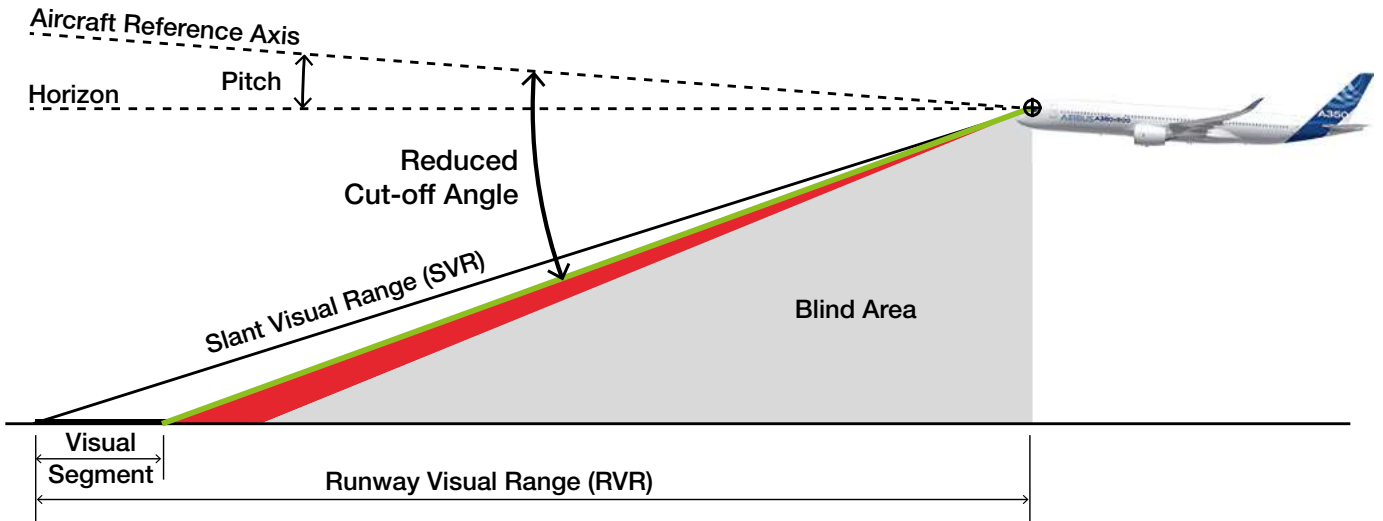


(fig.6)
Impact of a too low seating position

OPERATIONS

Are You Properly Seated?

(fig.7)
Cut-off angle when seated too low



Being seated too low can also create a blind area due to the glareshield, reducing the cut-off angle and thus limiting the visual segment **(fig.6 and 7)**. Such reduced visual segment during approaches with poor visibility conditions, including Low Visibility Operations (LVO), impairs the ability of the flight crew to obtain the proper visual references for landing, increasing the likelihood of a go-around.



BEST PRACTICE

Towards the end of a flight, especially for long sectors, the pilot's position may change due to muscle fatigue often causing them to adopt a position that is lower than at the beginning of the flight. Before commencing the approach, it is recommended to re-adjust the seating position to make to reconfirm that their visual reference is aligned with eye reference point and their position is adjusted accordingly.

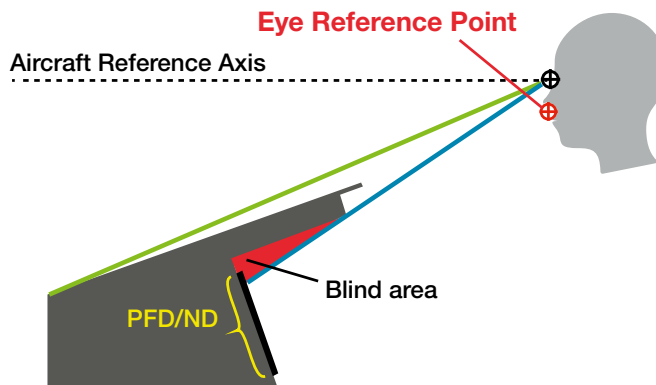
What if seated too high?

If the pilot has adjusted their seat to a position that is too high, then the same effect can be experienced as for a pilot who has positioned themselves too low. During final approach, the perception of the flight path angle may also be inaccurate.

If the pilots' eye level is above the eye reference point, then the glareshield impairs their view of the instrument panel and in some cases, hides the upper PFD and ND from view **(fig.8)**.

Additionally, operating the rudder pedals through their full range would be more difficult.

(fig.8)
Impaired view on the instrument panel when seated too high





BEST PRACTICE

During the cruise flight phase where the pilots' eye level alignment is not as critical, for increased comfort, it is common practice for the pilots to adjust their seat to be out of the eye reference point position. However, and to be prompt to face any unexpected situation, the pilots should still ensure that they can reach all of the flight controls and their view of the control panels is not impaired.

ADJUSTMENT PROCEDURE

The flight crew must adjust their seating position before the aircraft moves, typically before the pushback or engine start according to the FCOM SOP.

How does a pilot adjust their seat to position themselves correctly?

Step 1: Adjust the seat longitudinal and vertical position to align your eye-level with the eye reference indicator and also check that the glareshield does not obstruct the view the upper PFD and ND (**fig.9**).



(fig.9)

Correct seat adjustment

Step 2: Adjust the armrest to a position where your hand can grip the sidestick naturally without stretching the forearm and with a straight wrist. If the armrest is correctly adjusted, your forearm should rest comfortably on the armrest and you will only need to move your hand and fingers to give the appropriate inputs to the sidestick (**fig. 10**).



(fig.10)

Correct armrest adjustment

OPERATIONS

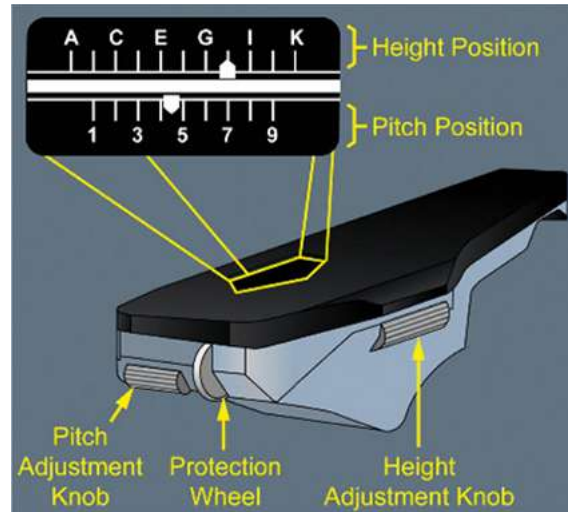
Are You Properly Seated?

Step 3: Adjust the Pedals position using the adjustment lever. Ensure the pedals can be moved through their full range of motion with your feet they can be fully deflected and that full manual braking can be applied.

Tip: Take a note of the positions of both the armrest and pedals on their associated position indicators when your adjustment settings are correct and comfortable to save time when making seat adjustments for your next flights **(fig. 11)**.

(fig.11)

Armrest position indicator



“ An armrest that is not properly adjusted makes it more difficult to make the appropriate inputs during manual flying. ”

“ The ability to move the rudder pedal through their full range of motion is crucial. ”

The importance of armrest and pedals adjustment

» A correct armrest adjustment for a comfortable and precise manual flying

The hand is the most dexterous part of the body that is most capable to perform the movements of the sidestick with the most precision. When the pilot's armrest is adjusted correctly, their hand is in a comfortable position without any strain on the wrist, allowing for accurate inputs on the sidestick. An armrest that is not properly adjusted makes it more difficult to make the appropriate inputs during manual flying and a pilot can be more prone to overreaction and make excessive command inputs on the sidestick.

In addition, in turbulent conditions, the armrest stabilizes the pilot's arm to avoid involuntary sidestick inputs due to vibrations.

» An incorrect rudder pedals adjustment can have strong impact in some phases of flight

The ability to move the rudder pedal through their full range of motion is especially crucial during the takeoff roll and initial climb after lift-off in the case of an engine failure or strong crosswinds. It is also a critical control input that is necessary during the flare and roll out in engine out or in crosswind landing conditions.

When on the ground, the pilots' seat and pedals positions must enable the pilot to apply maximum manual braking if it is required following a rejected takeoff roll or should it be required after landing.

**CONTRIBUTORS:****Maurice GARNIER**

Displays/Warning/
HUD Systems
Engineering

Gilles MARQUET

Cockpit Design
Engineering

Vincent SIBELLE

Expert Pilot
Flight Operations Support

Adjusting the seat position may be sometimes seen as an inconsequential step in the SOP. However, a poorly adjusted seating position can have significant effect on the pilot's capability to make appropriate control inputs when flying or taxiing the aircraft.

Adjusting the seat to be correctly positioned with the pilots' eyes level aligned with the Eye Reference Point ensures that all of the aircraft flight controls and systems control panels can be reached and operated properly. It is also crucial to ensure full visibility of all the instruments or displays in the cockpit. Finally, it provides the optimum position for the pilot's field of view from the aircraft to enhance their situational awareness and have a correct perception of the flight path angle during approach.

Flight crew should keep in mind that a seating adjustment done at the right time ensures comfort and accurate aircraft handling in the critical phases of flight.



A Recall on the Correct Use of the MEL

The dispatch under a Minimum Equipment List (MEL) item allows to dispatch an aircraft in a safe and airworthy condition when certain system functions or equipment are temporarily unavailable or inoperative, enabling the aircraft to continue earning revenue without compromising the safety of the flight.

But, what are the MEL principles and are there good practices to think about when dispatching an aircraft with an MEL item in the tech log?

In the daily operations of an aircraft, failures that have an impact the flight dispatch can happen. A lack of spare parts or other constraints may make it unfeasible to fix the issue before the next scheduled flight. Using the MEL to dispatch an aircraft with a system function or equipment which is inoperative can avoid costly operation disruptions and ensures that the safety of the aircraft is not impaired. The operator can then schedule the necessary maintenance action at the next most suitable opportunity such as a return to a main base or a station when spares parts are available. This article recalls the principles of the Master Minimum Equipment List (MMEL) which is the baseline for the establishment of the Operator's Minimum Equipment List (MEL). It also provides an overview of the best practices for using the MEL.

THE MMEL AND THE MEL

Definitions

» MMEL

The Airbus MMEL is a dispatch document that is produced by the aircraft manufacturer and approved by the certification authorities.

The MMEL is used as a reference by the Operators to create their own MEL, which will permit the dispatch and operation of an aircraft with one or more inoperative equipment or unavailable system function while maintaining an acceptable level of safety.

» MEL

The MEL is a dispatch document developed by the Operator based on the aircraft manufacturer's MMEL. The MEL must be as restrictive as or more restrictive than the MMEL and must be approved by the Operator's national airworthiness authorities.

The MEL permits the Operator to assess the impact on their operations (flight schedule, route, environmental conditions,...) while operating an aircraft with systems, functions or components inoperative, thus to optimize aircraft dispatch reliability and profitability without impairing safety.

How is the MMEL developed?

The MMEL provides a list of items with associated conditions for dispatch. For every item, Airbus must demonstrate that the associated dispatch conditions are compliant with the certification requirements as specified by EASA. The major steps of this demonstration are the following:

Step 1: Assessment of the MMEL item to identify any operational impact or impact on other system functions, and check if there is any influence on the safety level of the aircraft.

“ The MMEL is used as a reference by the Operators to create their own MEL ”

“ The MEL must be as restrictive as or more restrictive than the MMEL and must be approved by the Operator's national airworthiness authorities. ”

OPERATIONS

A Recall on the Correct Use of the MEL

Step 2: Identification and assessment of the operational and safety impact of the next critical aircraft system failure which may occur during subsequent flights.

Step 3: Definition of any maintenance actions or operational procedures that may be necessary as a means of mitigation for the assessed impacts of the MMEL item.

Based on the above assessments, a dispatch status is defined for each MMEL item as either:

- “GO” when the dispatch is permitted for a limited period of time without specific dispatch condition, or
- “GO IF” when the dispatch is permitted for a limited period of time with specific dispatch conditions, or
- “NO GO” when the dispatch is not permitted and corrective maintenance action must be undertaken before the aircraft can continue operations.

How is the MEL developed?

The Operator’s MEL is a dispatch document which should be tailored according to the Operator’s routes, procedures and applicable local regulations, and within the constraints defined by the aircraft manufacturer’s MMEL.

“ The Operator’s MEL is a dispatch document which should be tailored according to the Operator’s routes, procedures and applicable local regulations, and within the constraints defined by the aircraft manufacturer’s MMEL. ”



When does the MEL apply?

As per regulations, when there are failures or defects that cannot be rectified, and which are covered by an MEL item, the MEL must be applied prior to departure and accepted the Captain.

The “departure” corresponds to the “commencement of the flight”. “The commencement of the flight” is defined as the moment when the aircraft starts to move under its own power for the purpose of takeoff (i.e. the taxi phase).

EASA and FAA require Operators to define procedures in their MEL for the management of any failure that occurs during the taxi-out phase.

EASA regulations

The EASA regulations require that Operators define an appropriate guidance for flight crew for the management of failures if they occur between the start of taxi and commencement of take-off roll.

The EASA regulations also state that the captain may decide to continue with the flight based on their “good judgment and airmanship”. Additionally, their regulations allow flight crew to consult the MEL if it will help them to make a decision. Communication with dispatch, or the Operator’s maintenance control centre, may assist the flight crew in their assessment of the MEL item and aid the Captain to decide if they will continue with the flight or not.

The final decision to continue with the flight is the responsibility of the Captain. This decision should be based on any operational considerations that could impair the current flight and also consider any impact on the subsequent missions of the aircraft.

FAA regulations

The FAA regulations require that Operators establish a procedure for the Pilot In Command (PIC) to communicate with the aircraft dispatch and maintenance organizations when a failure occurs after an aircraft departs the gate or ramp area, during pushback, taxi or prior to take-off.

This procedure permits the flight crew to review the situation and determine if the aircraft can be either dispatched with the failure under the MEL item, or if the failure must be rectified before take-off. If a dispatch with the failure under the relevant MEL item is advised, the return to the gate to accomplish the appropriate maintenance or operational procedure must be considered. In coordination with the Operator’s dispatch and maintenance organization, certain MEL procedures may be accomplished by the flight crew without returning to the gate, provided these procedures are approved by the FAA’s Principal Operations Inspector (POI).

Other Local regulations

Other National Aviation Authorities (NAA) may have regulations that differ from the regulations defined by the EASA or by the FAA. It is the responsibility of each Operator to check the applicable regulations with their relevant NAA.

MEL consultation in flight

The MEL is defined as a dispatch document and therefore the MEL is not applicable in flight. However, if a system or equipment defect is detected during flight, the MEL information may be useful to assess the likely dispatch condition for the next flight. A detailed description of the defect detected should be entered in the tech log, and Operator’s dispatch or Maintenance Control Centre notified so they can consult MEL when the aircraft arrives.

What about multiple failures?

If several aircraft system functions or equipment are inoperative, operators should consult the MEL for each individual item to check if there are any incompatibilities for each of the associated dispatch conditions. If there is no MEL restriction, it is the flight crew’s responsibility to assess the situation and to decide whether or not to dispatch the aircraft with multiple inoperative items.

“ if a system or equipment defect is detected during flight, the MEL information may be useful to assess the likely dispatch condition for the next flight. ”

“ Any aircraft system function unavailability or equipment failure has to be reported in the technical logbook by the flight crew ”

RULES AND RECOMMENDATIONS ON HOW TO USE THE MEL

From the moment of the failure has occurred until the dispatch of the aircraft, the following steps should be followed to ensure that the aircraft can be dispatched in an airworthy condition.

Step 1: Detection of the failure

A failure is detected:

- Through an ECAM alert or an indication on the Master Warning Panel (A300 B2/B4 only) or a failure indication on the Maintenance Panel (A300/A310 only)
- Through an observation of the flight crew by:
 - A flight deck effect (missing indication, amber indication on a System Display (SD) page, inoperative button or display, etc...)
 - A defective component detected during the external walkaround (e.g. external light not illuminating)
- Through an observation of the maintenance personnel.

Step 2: Reporting the failure

Any aircraft system function unavailability or equipment failure has to be reported in the technical logbook by the flight crew.

This technical logbook entry is the starting point for assessing any defect using the MEL. The flight crew should write any additional information associated to the defect that will help identify the cause of the defect such as the ECAM alert title, time of occurrence, SD page indication and flight phase.

Line Maintenance personnel can also make an entry in the aircraft's technical logbook to report any system function defect or inoperative equipment detected during ground operations.



NOTE

Aircraft system defects detected in the passenger cabin may be reported by the cabin crew in the cabin logbook. Should the defect have an impact on dispatch, these entries must be transferred to the aircraft's technical logbook before assessing the relevant MEL item applicability.

Step 3: Identification of the correct dispatch condition or MEL item associated to the failure

The identification of the failure is usually based on the ECAM alert's title and the dispatch assessment is provided in the MEL Entries section under the "CONDITION OF DISPATCH" header **(fig.1)**.

VENT EXTRACT FAULT	
AIRCRAFT STATUS	CONDITION OF DISPATCH
NIL	Refer to Item 21-26-01 Avionics Extract Fan

(fig.1)
Example of a MEL entry with an associated MEL item



KEYPOINT

If a failure is classified as "NO DISPATCH" **(fig.2)**, the aircraft must not be dispatched until the equipment or function is rectified.

BRAKES ANTI SKID FAULT	
AIRCRAFT STATUS	CONDITION OF DISPATCH
NIL	NO DISPATCH

(fig.2)
Example of a MEL entry with a "NO DISPATCH" condition

In some cases, MEL Entries section may require additional action by the flight crew or the maintenance crew in order to assess the dispatch conditions, particularly when:

- One ECAM alert refers to several MMEL items **(fig.3)**

ANTI ICE L(R) WINDSHIELD	
AIRCRAFT STATUS	CONDITION OF DISPATCH
If the Window Heat Computer is affected	Refer to Item 30-42-01 Window Heat Computer
NIL	Refer to Item 30-42-03 Windshield Heating

(fig.3)
Example of a MEL entry with several associated MEL items

- The dispatch condition assessment depends whether the ECAM alert is actual or false (spurious) **(fig.4)**

BRAKES BRK Y ACCU LO PR	
AIRCRAFT STATUS	CONDITION OF DISPATCH
Actual alert	NO DISPATCH
False alert	Refer to Item 32-44-02 ACCU PRESS Indicator
// END	

(fig.4)
Example of a MEL with dispatch condition depending whether the alert is actual or false

OPERATIONS

A Recall on the Correct Use of the MEL

- The dispatch condition assessment requires additional information such as ECAM indication on the SD page **(fig.5)**

(fig.5)

Example of a MEL entry with the dispatch condition depending on indications on the associated SD page

VENT SKIN VALVE FAULT	
AIRCRAFT STATUS	CONDITION OF DISPATCH
Outlet valve determined faulty on the CAB PRESS SD page	Refer to Item 21-26-04 Avionics Skin Air Outlet Valve
Inlet valve determined faulty on the CAB PRESS SD page	Refer to Item 21-26-05 Avionics Skin Air Inlet Valve

On A350, the ECAM Dispatch Messages are a straight forward help for dispatch. The flight crew finds the Dispatch Message in the MEL entries section to get the condition of dispatch or identify the applicable MEL item **(fig.6)**

(fig.6)

Example of a Dispatch Message on A350

L/G CTL 1(2)	
AIRCRAFT STATUS	CONDITION OF DISPATCH
The landing gear control 1(2) is failed.	Refer to Item 32-31-01 Landing Gear Control

The A380 and A350 MEL also show a “Crew Observations” section in the MEL entries **(fig.7)** covering failures of monitored systems that are indicated with flight deck effects that don’t have an associated ECAM alert or Dispatch Message, for example, an amber indication on system display (SD) page or when the FAULT light of a pushbutton switch illuminates. The “Crew Observations” section also covers malfunctions that can be visually detected by the flight crew or the maintenance personnel, for example during the external walk around.

(fig.7)

Example of a Crew Observation in the MEL Entries section on A380

MANUAL HORIZONTAL ADJUSTMENT INOPERATIVE ON COCKPIT SEAT	
AIRCRAFT STATUS	CONDITION OF DISPATCH
The manual horizontal adjustment is inoperative on the CAPT seat or on the F/O seat.	NO DISPATCH
The manual horizontal adjustment is inoperative on the third occupant seat.	Refer to Item 25-12-02 Third Occupant Seat Horizontal Adjustment

If the failure is not linked to an ECAM alert or to a failure reflected in the Crew Observation section (A380 & A350), the correct MEL item should be identified directly into the MEL items section.



KEYPOINT

It is important to identify the MEL item correctly. The application of a MEL item that does not correspond to the inoperative equipment or unavailable system function may have unintended consequences for the safety of the flight.

Step 4: Review of the dispatch conditions

When the MEL item is correctly identified, the flight crew should carefully review the dispatch condition.

If there are several dispatch conditions, the title of the associated dispatch condition helps to identify which one is applicable (fig.8).

36-12-02 **APU Bleed Valve**

■ **36-12-02A Inoperative in the closed position**

Repair Interval	Nbr Installed	Nbr Required
C	1	0

May be inoperative provided that:

- 1) ETOPS beyond 180 min is not conducted, and
- 2) The APU bleed valve is deactivated in the closed position, and
- 3) The APU BLEED pb-sw is set to Off.

■ **36-12-02B Inoperative in the open position**

Repair Interval	Nbr Installed	Nbr Required
C	1	0

May be inoperative in the open position provided that:

- 1) ETOPS beyond 180 min is not conducted, and
- 2) The APU is not used in flight.

“ The application of a MEL item that is not corresponding with the inoperative equipment or unavailable system function may have unintended consequences for the safety of the flight. ”

(fig.8)

Example of a MEL item with two dispatch conditions: 36-12-02A and 36-12-02B

Step 5: Decision for dispatch

Maintenance personnel may propose to dispatch the aircraft under MEL item provided that all of the associated dispatch conditions are fulfilled.

It is the Captain’s responsibility to accept the aircraft dispatch under the MEL item for the flight; taking into account not only the MEL dispatch condition but also the applicable operator’s policy and the operational constraints.



“ It is the Captain’s responsibility to accept the aircraft dispatch under the MEL item for the flight ”

OPERATIONS

A Recall on the Correct Use of the MEL

“ Inoperative items should be repaired as soon as possible and at least within the period of time defined by the repair interval ”

Step 6: Log of the MEL item

The maintenance personnel must make an entry into the logbook for the MEL item and determine the deadline for rectification based on the MEL repair interval.

Inoperative items should be repaired as soon as possible and at least within the period of time defined by the repair interval **(fig.9)**.



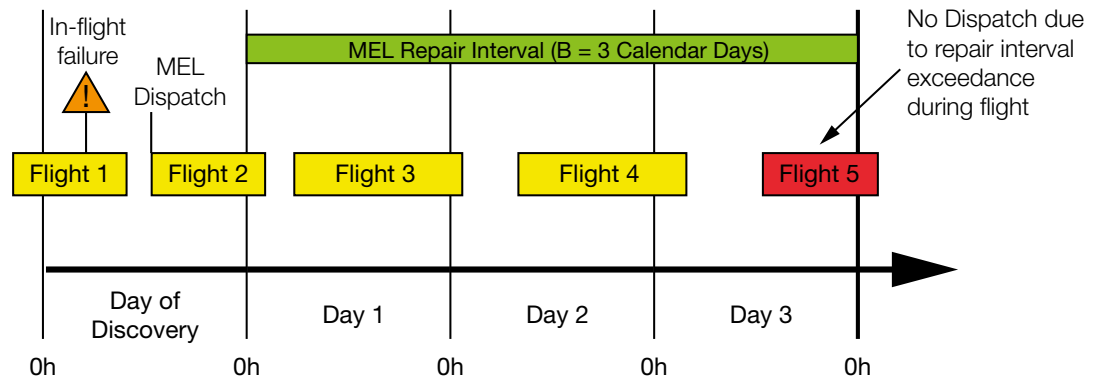
BEST PRACTICE

Plan the repair as soon as possible to avoid operational disruption should additional failure occur that may make the dispatch impossible.

» The allowable intervals for rectification are classified as the following:

Interval	A	B	C	D
Calendar Days	Refer to interval provided in MMEL item	3*	10*	120*

*Excluding the day the defect was first detected



(fig.9)
Principle of the repair interval

» Specificity of Category “A” repair intervals

MEL with category “A” repair intervals can use different references, e.g. calendar days, flight cycles...

Step 7: Initial dispatch

For the first dispatch after applying the MEL item, all dispatch conditions and associated limitations must be accounted for and any relevant maintenance (m) and operational (o) procedures must be applied to maintain an acceptable level of safety for the operation of the aircraft, even with the inoperative equipment or unavailable system function.



BEST PRACTICE

For a complete awareness of aircraft dispatch condition, maintenance personnel should also consult the operational procedure (when applicable).



KEYPOINT

An incorrect or incomplete application of the maintenance or operational procedure may impair the safety of the flight.

Step 8: Subsequent flights dispatched under MEL item

For the subsequent flights, the flight crew must check that any open MEL item in the logbook is within the window of the repair interval and that this time limit won't be exceeded during the next flight mission.

When the dispatch conditions are accepted by the captain (as described in step 5), all necessary operational procedures must also be applied.

In the case when a new MEL item is recorded in the technical logbook, the maintenance personnel must also review all of the pre-existing MEL items to ensure that all of the dispatch conditions for each item are fulfilled.

“ An incorrect or incomplete application of the maintenance or operational procedure may impair the safety of the aircraft. ”



KEYPOINT

In the case of a multiple MEL items logged, flight crew and maintenance personnel must check before each flight that dispatch conditions of all MEL items are fulfilled.

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The MEL is a commonly used tool allowing for the safe and continuous operation of the aircraft until rectification of certain inoperative equipment or unavailable system functions that are not adversely affecting the airworthiness of the aircraft. But incorrectly using the MEL could lead to dispatching an aircraft in a configuration that is not airworthy and with potential consequences that could impair the safety of the flight.

Understanding the principles and rules for correctly applying MEL items is crucial for both maintenance personnel and flight crews.

When dispatching under a MEL item, the conditions of dispatch and the rectification interval must be taken into account and the associated maintenance and operational procedures must be accurately applied.

It is ultimately the Captain's responsibility to decide to dispatch the aircraft for flight under the MEL conditions.



Protecting Aircraft and Passengers from Cargo Fires

Cargo compartment linings are designed to provide an air-tight space, and are essential in protecting the aircraft and its occupants from fire and smoke.

This article looks at how these composite components have come to play such an important role in Safety, and what can be done to make sure they stay in good condition.

Aircraft certification requirements for cargo compartment fire protection have evolved in response to a number of tragic events. Today's design standard for lower deck cargo holds relies on the flame-proof and air-tight properties of the compartment liner. Inspecting the liner and making repairs when needed is important to keep it in good condition.

CARGO COMPARTMENT FIRES & THE EVOLUTION OF DESIGN STANDARDS

Origins of the fire containment principle

Regulations providing design criteria for cargo compartments in commercial aircraft were introduced in 1946, prior to the introduction of the first jet aircraft into commercial aviation. At this time, the criteria considered that cargo compartments would either be accessible to the crew and a fire would be manually extinguished, or inaccessible and equipped with fire detection and extinguishing systems.

Changes to regulations introduced in 1952 allowed for new types of inaccessible cargo holds called 'Class D' compartments. Designs were permitted to rely purely on fire containment principles, by having linings designed to be capable of restricting the supply of oxygen into the compartment, without needing any fire detection and suppression systems.

With the introduction of larger passenger jets, the size of Class D compartments grew beyond that for which the 1952 regulations had originally been intended. Larger compartments introduced new risks, including larger quantities of combustible material, and the presence of a larger volume of oxygen.

The combination of these two factors created the possibility that a fire starting in such a hold could burn for sufficient time or with sufficient strength that it would penetrate the cargo hold linings. Penetration of the linings would of course lead to availability of an increased oxygen supply, and an uncontrollable fire.

In-service events

A number of uncontrolled fires have occurred in cargo compartments, which contributed to an evolution of airworthiness regulations. The FAA's 'Lessons Learnt from Civil Aviation' website identifies two tragic fatal accidents which were pivotal in driving this evolution.

In 1980 in Riyadh, shortly after take-off of a second generation wide-body aircraft, an uncontrollable fire occurred in the rear cargo hold. Tragically, all 301 passengers and crew died in the event.

The accident report of the Saudi Presidency of Civil Aviation included the conclusion that "Investigative evidence and testing indicates that the C-3, Class D compartment of the L-1011 did not meet the intent of the FAR 25.857 (d) and that the FAR is inadequate for purpose".

“ In 1952 fire containment designs relying on restricting oxygen supply became permitted ”

“ In 1980 an uncontrollable fire occurred in the rear cargo hold of a second generation widebody aircraft ”

OPERATIONS

Protecting Aircraft and Passengers from Cargo Fires

“ In 1996, a second generation single-aisle crashed after takeoff with the death of 110 passengers & crew ”

“ New legislation established more stringent flame resistance standards for liner materials ”

“ Fire detection and suppression systems became mandatory ”

In 1996 in the Everglades near Miami, a second generation single-aisle aircraft experienced an uncontrolled fire in its forward cargo compartment shortly after takeoff, leading to the death of all 110 passengers and crew.

The accident investigation report written by the US NTSB identified the following findings related to the design standard of the aircraft type:

“[...] a smoke/fire warning device would have more quickly alerted the pilots to the fire and would have allowed the more time to land the airplane”

“If the plane had been equipped with a fire suppression system, it might have suppressed the spread of the fire [...] and it would have delayed the spread of the fire, and in conjunction with an early warning, it would likely have provided time to land the airplane safely.”

Hence, these and similar accidents highlighted the need to update Part 25 airworthiness regulations regarding the means of fire protection in cargo holds, including through design of the compartment lining as well as by detection and suppression systems.

Changes to regulations

Following the accident in Riyadh, amendment 25-60 to Part 25 airworthiness regulations was made effective in 1986 by the FAA. This amendment established more stringent flame resistance standards for compartment linings, to take account of the findings of a series of full-scale tests by the FAA to investigate the capability of different liner materials.

A retrofit activity was mandated to some of the existing fleets of the time in order to ensure cargo compartment panel linings were upgraded. This completion date of this retrofit was established by the legislation as March 1991.

It was subsequent to the Everglades accident in 1996 that the limitations of the principle of relying purely on containment by oxygen starvation were acknowledged. In particular it was recognised that new risks needed to be considered, including potential explosions of consumer aerosol products which could damage the integrity of cargo compartment linings.

Recognising that under such circumstances, the only way to contain a fire would be through active fire detection and suppression, in 1998 the FAA introduced new legislation through Amendment 25-93 to 14 CFR 25.855, which removed the Class D cargo compartment category.

This meant that all new designs of aircraft, as well as existing aircraft in-service, were to be equipped to the standards of Class C compartments, or Class E compartments for freighter aircraft. In particular, fire detection system capable of alerting the flight crew within 1 minute of the fire starting became necessary, together with Halon gas fire suppression systems. The limit date for retrofits of existing fleets was set at March 2001.

Type	Crew Access	Fire Detection	Extinguishing or Suppression	Ventilation	Flames, Smoke & Fumes
A	Possible	By crew at workstation	By crew with extinguisher		
B	Possible	By detection system	By crew with extinguisher		Means to exclude from cabin
C	Not possible	By detection system	By dedicated system	Means to control to enable extinguishing	Means to exclude from cabin
D	Not possible	None required	None required	No ventilation into compartment	Means to exclude from cabin
E		By detection system		Means to shut off to enable extinguishing	Means to exclude from cabin

Table 1
Cargo Compartment Types

Post 25-93, types A, B, C & E remain in use in commercial aircraft

Post 25-93, type D compartments no longer exist in 25.855

CURRENT DESIGNS OF LOWER DECK CARGO COMPARTMENTS

Following the tragic events described earlier in this article, the design standard of lower deck cargo compartments was revised across the air transport industry, with Class C type compartments and cargo compartment panel fireproofing improvements being mandated.

This industry wide action significantly improved the fire protection level of commercial aircraft through the equipping of the commercial fleet with key features:

- Air-tight & fire-proof cargo holds
- Cargo fire detection systems
- Cargo fire suppression systems

These three features are all necessary and must all work together in order to ensure that the aircraft and its occupants is protected from a cargo fire.

Making the cargo hold air-tight

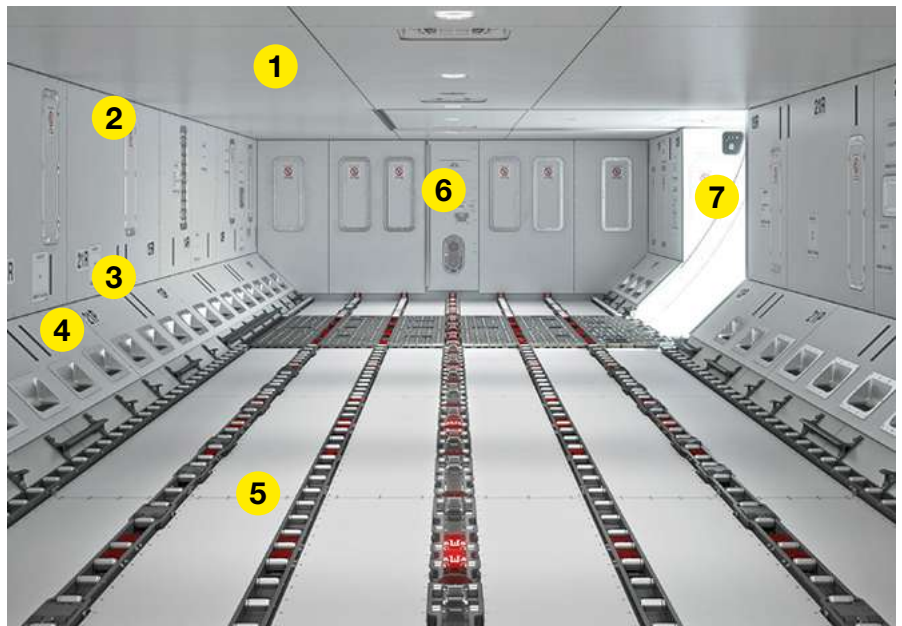
The volume of lower deck cargo holds on Airbus aircraft varies significantly depending upon the aircraft type and hold, but can range from as low as 7.0m³ (250ft³) on an A318 to 143m³ (5050ft³) on an A340-600. Enclosing such voluminous spaces obviously requires the use of many components.

“ Cargo compartments must be air-tight and resistant to burning ”

OPERATIONS

Protecting Aircraft and Passengers from Cargo Fires

- 1 Ceiling panels
- 2 Decompression panels
- 3 Vertical sidewall panels
- 4 Sloping sidewall panels
- 5 Floor panels
- 6 Partition
- 7 Door



“ The air-tight lining of the cargo compartment is created by composite panels together with their fasteners, secondary structure and the cargo door. ”

Lower deck cargo holds are constructed out of their doors, and many composite panels attached to the aircraft's primary and secondary structure. Various categories of panels are used, including ceiling, sidewall, sloped and floor panels, as illustrated in Figure 1. Even if we just consider the sidewalls and ceilings, a shipset of these different panels for a specific hold can include anything from 42 on an A320 up to 188 on the A380.

Together with their fasteners, secondary structure, and the cargo door, these panels create the liner of the cargo hold lining. This liner is required to provide the two fire protection functions of air-tightness and fire-proofing.

Air-tightness limits the available oxygen to any fire occurring within the cargo hold compartment. It is a key safety measure which allows to suffocate a fire, as well as to ensure that fire suppression systems have the required effect by creating an enclosed space within which the Halon gas can act.

Air-tight seals between the panels and the structure are achieved by the use of self-adhesive elastomer foam tapes applied to the rear of the panels. The seal is made when these tapes are compressed during tightening of the fasteners.

Fire-proofing the cargo hold

The second fire protection function of the liners and panels is to withstand burning. This function ensures that the passenger cabin is kept free of fire, as well as any hazardous smoke and gases. Clearly, in the case of any fire, flame resistance of the linings is essential to maintaining air-tightness.

Panels and all materials used in construction of the cargo compartment liner are required by aircraft certification regulations CS-25.855 to meet flame resistance properties are defined by airworthiness regulations.

The process to demonstrate compliance with this regulation is detailed and rigorous, involving specific test equipment and the exposure of sets of production standard panels to flames at a temperature of 927°C / 1700°F.

Detecting & suppressing a fire

Fire detection systems are designed to alert flight crew on the cockpit within 1 minute of a fire starting. Based on the information provided by the detection warnings, flight crew initiate the suppression of any fire by discharge of Halon gas into the affected cargo compartments.

Halon is a very effective suppression agent which operates by chemically reacting with the radicals generated by a fire, to inhibit the reaction.

To achieve the extinguishing effect, sufficient Halon needs to be released to achieve a volumetric concentration of 5% of the compartment air as a first shot, for a fire knock-down effect. Following this, a concentration of 3% must be continuously maintained for the rest of flight. With this approach, lower deck cargo compartment fires can be suppressed for up to 360 minutes on wide-body aircraft.

Nevertheless, maintaining the concentration of Halon is crucial to the effectiveness of the system, and therefore it is essential that the cargo compartment remains air-tight. Any damage or mis-installation of the cargo compartment lining can degrade the performance of the fire suppression system, and therefore has the potential to make a key defence against on-board fires ineffective.

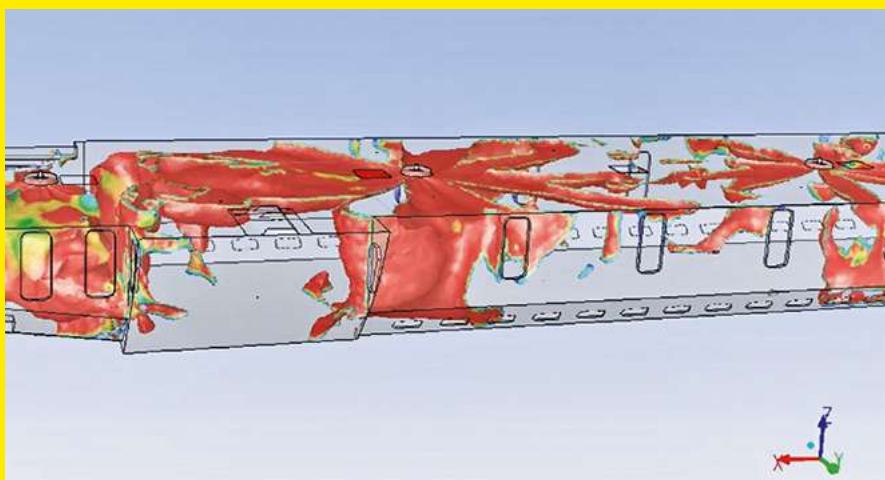
“ Any damage or mis-installation of the cargo compartment lining can degrade the performance of the fire suppression system ”

Certification of the A350-1000 fire suppression system

To comply with the airworthiness authorities' certification requirements, aircraft manufacturers must prove that a new aircraft type's fire suppression system can maintain the required amount of Halon present in a cargo compartment over time. Traditionally, this activity has only been possible by flight test, usually requiring five individual flights.

For the certification of the A350-1000, Airbus has taken advantage of the successful flight test campaign performed for the A350-900 and developed a Computational Fluid Dynamic (CFD) model of the cargo hold together with its Halon release system. Both EASA and the FAA have accepted this model as an acceptable means of compliance. This significant advancement will enable Airbus to perform more complex analyses in the support of Safety objectives.

CFD simulation of halon discharge into the aft cargo hold of the A350-1000



MAKING SURE THE CARGO COMPARTMENT IS IN GOOD CONDITION

Cargo unloading and loading operations are a crucial part of the often time constrained ground handling operations, so it hardly needs to be mentioned that the cargo compartment can experience rough treatment. Whilst cargo compartment liners are designed to be tolerant of such an environment, damages do occur.

To make sure that the crucial fire protection function of the cargo compartment lining is assured, regular maintenance inspections are required by the Maintenance Planning Document. Additionally, the IATA Ground Operations Manual specifies that a cargo hold inspection should be completed after each unloading operation.

Scheduled inspections

The Maintenance Planning Document (MPD) of all Airbus aircraft specifies a regular visual inspection of each cargo hold. The maintenance procedures associated with the MPD tasks specify a general visual inspection of the entire compartment, including all types of panels identified in figure 1, to identify any damage or deformation, or any panels which are in the wrong position.

Other elements which must be inspected include panel seals, fastener assemblies, and the position of decompression panels.

Program	MPD Revision	MPD Task Number	Interval
A350	Rev.03 Issue Jul 2015/16	501300-00001-01M	8 days
		01300-00004-01M	200 FH
A380	Rev. 13 Issue Feb 01/17	501000-00101-01	16 days
		501300-00001-01	750 FH
		501400-00001-01	750 FH
		501500-00001-01	750 FH
A330/A340	Rev.22 Issue 14 Sep 2017	255200-00001-01	8 days
		255300-00001-01	8 days
		255400-00001-01	8 days
A320 Family	Rev.44 Issue Sep.2017	2550000-01-1	8 days
A300/A310	Rev.31 Jul 01/17	255100-01-1	8 days
		255610-02-1	8 days

Inspections during cargo loading operations

On a daily basis, it is clear that the people who will have the most opportunity to identify any damages or other issues with the cargo hold linings are ground operatives.

There are no mandatory inspection requirements for ground operatives to complete during cargo loading. However, ground operations procedures such as those defined by IATA in the Ground Operations Manual (IGOM) provide a reference for recommended safe practices during cargo loading operations, and in practice also inform the expectations of local authorities.



KEYPOINT

The IATA Ground Operations Manual (GOM) states that ground crew must complete a final check of all holds to inspect for damage

IATA IGOM section 4.11 'Aircraft Loading' contains a dedicated section 4.11.5 'Cargo Hold Inspections', with the following key recommendations in relation to damage to the cargo holds:

- When an offload is completed, a final check of ALL cargo holds must be conducted to inspect each cargo hold for damage to the compartment [...]
- If any damage is found to the compartment [...] it must be immediately reported to a supervisor, the flight crew, and/or a company representative as required by the operating airline
- Any damage to the structure or linings of containerised or bulk holds may lead to specific loading limitations. Therefore, any damage must be reported. The load controller shall be informed accordingly.

In addition to section 4.11.5, cargo hold inspections are also specified in section 6 'Airsides Safety Operational Oversight'. This section of the GOM deals with the activities which are expected to be performed by trained and qualified supervision personnel of airlines and their subcontractors.

Turnaround Coordination/Supervision Requirements are defined in section 6.3 by the use of a checklist table, the primary purpose of which is to prevent unsafe acts. Checklist item 11 states 'Ensure all cargo holds offloaded according to LIR (Load Inspection Report) and inspected for damage'.

TYPICAL REPORTS OF CARGO COMPARTMENT DAMAGE AND THEIR CAUSES

Typical abnormalities found during cargo compartment inspections are identifiable from reports sent to Airbus by operator airlines. A study of reports over the period 2015-2017 reveals that types of abnormalities are generally quite consistent according to their source.

Damage to sidewall panels, ceiling panels or cargo doors from cargo operations

The majority of damage to cargo compartments are caused during cargo loading or unloading operations. Reports of such damage total around 65% of reports to Airbus, and include cases of damage to vertical or sloping sidewall panels, ceiling panels or doors.

Typical damage identified on widebody aircraft types are related to out of contour cargo containers or pallets impacting and/or scratching the sidewalls, with ceilings being damaged less frequently. Damage to the cargo door linings are also typically caused by impact with out-of-contour containers, and often result in cracking of the panel around fixation holes upon door closure.

Additionally, poor maintenance of containers can make them more susceptible to warping of the contour when under flight loads, leading to damage of sidewalls and doors.

On A320 Family aircraft, both ceilings and sidewalls can be damaged during bulk loading operations. This damage is usually due to abnormal impacts from bags and suitcases under manual handling, and typically results in delamination or puncturing of the top layer of the panels, or crushing of the honeycomb core.



KEYPOINT

The IGOM includes a checklist item for turnaround supervision staff, to 'Ensure all cargo holds offloaded according to LIR (Load Instruction report) and inspected for damage'.

“ About 65% of damages identified on widebody aircraft are related to the use of out of contour cargo containers. ”

CARGO LININGS PROTECT AGAINST FIRE

Keeping aircraft cargo linings in good condition is key to ensuring aircraft are protected from cargo hold fires



Don't load out of contour ULDs (containers or pallets)



Report any damage to the lining



Check decompression panels and catches are in the correct position



Ensure fasteners are present, tightened, and flat on the panel

Damage to decompression panels when incorrectly used as access panels

Damage to decompression panels comprise about 25% of reports to Airbus about damage to the cargo compartment. Whilst some of these reports are attributed to damage caused during cargo loading operations, the majority are attributed to the use of decompression panels as access panels during aircraft maintenance.

Typical damage is found around at the edge of the cut-out for the decompression panel (e.g. on the upper assembly, where the decompression panels attaches to the vertical sidewall). These reports are often due to a removal and installation of the decompression panel by pushing on it, without properly unlocking the catch. Other findings include missing or dislodged panels, or incorrectly latched panels.

“ About 25% of reports to Airbus of lining damage are due to incorrect use of decompression panels as access panels ”

Correct

Access by removal of sidewall panel assembly to perform maintenance



Incorrect

Access by removal decompression panel to perform maintenance



Decompression panels are clearly identified with placards mentioning 'DO NOT PUSH' and 'DO NOT REMOVE'. In case any panel is found partially or totally dislodged, it must be reinstalled as per AMM procedures in order to avoid additional damage. These require removal of the sidewall panel upper assembly for proper completion.

Loose or missing panel fasteners

All lower deck cargo compartment lining panels are attached to the structure and/or systems by a quick release fastening system (fasteners). About 10% of reports of damages to the cargo hold are related to either missing, or incorrectly installed fasteners. The reports principally impact the ceiling panels.

Investigations into these reports allowed Airbus to identify clear recommendations for fastener tightening and cargo lining installation. The appropriate torque value to be applied when tightening a fastener is between 0.055 and 0.060 m.daN (4.87 and 5.31 lbf.in).

“ About 10% of reports of damage to the cargo hold are about missing or incorrectly installed fasteners ”



KEYPOINT

The correct torque to be applied when tightening a fastener is between 0.055 and 0.060 m.daN (4.87 and 5.31 lbf.in)

OPERATIONS

Protecting Aircraft and Passengers from Cargo Fires

Cargo Hold Visual Inspection tasks

The number and location of missing fasteners which are permitted is contained within the relevant Cargo Hold Visual Inspection tasks of the maintenance documentation.

A300/A310:

AMM 25-50-00 PB 601

A320 Family:

AMM 25-50-00-200-002-A

A330/A340 (fwd):

AMM 25-52-00-210-801-A

A330/A340 (aft):

AMM 25-53-00-210-801-A

A330/A340 (bulk):

AMM 25-54-00-210-801-A

A350 XWB:

MP 50-13-XX-00001-310A-A

A380 (fwd):

AMM 50-13-00-210-801-A

A380 (aft):

AMM 50-14-00-210-801-A

A380 (bulk):

AMM 50-15-00-210-801-A

ACTIONS TO TAKE WHEN ANY LINING DAMAGE IS FOUND

Regulations for flight with damaged cargo hold linings are stringent, since any failure of the air-tight and/or flame-proof features of the cargo lining can lead to an uncontrolled fire on board.

For this reason, operational constraints can be triggered when any damages are found to the cargo lining, particularly flying with the cargo hold empty under MMEL.

Once any damage has been identified and alerted to the operator, it is the responsibility of maintenance staff to classify the damage and initiate the appropriate corrective actions. The maintenance manuals contain the appropriate procedures for visual inspection, damage classification, and general repair of panels.

Abnormalities which are not considered as damage

Small dents to the skin of the lining panels are not considered as damage as long as the upper skin is not damaged, and there is no visual debonding of the upper skin from the panel core.

Additionally, a small number of missing fasteners for ceiling, sidewall and partition linings (but not decompression panels) are often considered temporarily acceptable, as per limits defined in the Cargo Hold Visual Inspection tasks. Pending replacement of the fastener within the specified time period, the holes left by the missing fasteners must be sealed in line with the maintenance procedures.



Damages for which repairs can be scheduled

On A320, A330/A340, and A380 Families, when damage to ceiling, sidewall or partition linings are within the damage limits defined in the AMM Repair/Protection tasks, a limited number of small damage affecting the upper skin only, can be scheduled to be completed rather than be completed immediately. The dimensional and time limits of these small 'not-through' damages are also listed in the AMM Repair/Protection tasks.

Similar repair scheduling allowances exist for door linings, as long as the damage is to edge of the lining only, and within dimensional and time limits specified in the Cargo Door Lining General Repair tasks.

Damages requiring immediate repairs

Protection of the aircraft and its passengers from fire means maintaining in good condition, the components which assure the air-tight and fire-proof properties required by aircraft certification. When these components are damaged, immediate repairs are therefore often required.

Damages to ceiling, sidewall or partition linings in the following categories must be rectified before flight, either with a panel repair or with a replacement panel:

- Damage to the edge of panel
- Damage which goes through both faces of a panel
- Not-through damage, larger than the limited allowances defined in AMM Repair/Protection tasks for repairs which can be scheduled (see previous section)

Since door linings are not made of honeycomb composite materials, the conditions for immediate repair or replacement are different than those above. The relevant assessment conditions can be found in the Cargo Door Lining General Repair tasks.

If repairs cannot be made immediately

If panel repair or replacement cannot be completed immediately, the aircraft can be dispatched under MMEL with the relevant cargo hold empty, or not containing flammable or combustible materials. If a fly-away kit box is present, the operator must ensure that it doesn't contain flammable or combustible materials.

Repair/ Protection tasks

Ceiling, sidewall linings

The dimensional limits which apply for assessment of repairs to damage of ceiling and sidewall linings can be found in the procedures listed below

A300/A310:

AMM 25-00-00 PB 801

A320 Family:

AMM 25-50-00 PB 801

A330/A340:

AMM 25-50-00 PB 801

A350:

MP 50-13-XX-0M001-685A-A

A380:

AMM 50-10-00 PB 801

Repair/ Protection tasks

Cargo door linings

The dimensional limits which apply for assessment of repairs to damage of cargo door linings can be found in the procedures listed below

A300/A310:

AMM 52-30-13 PB 801

A320 Family:

AMM 52-31-13 PB 801

A330/A340 (fwd):

AMM 52-31-15-300 PB 801

A330/A340 (aft):

AMM 52-32-15-300 PB 801

A330/A340 (bulk):

AMM 52-33-15-300 PB 801

A350:

MP 50-13-XX-0M001-685A-A

A380 (fwd):

AMM 52-31-15 PB 801

A380 (aft):

AMM 52-32-15 PB 801

A380 (bulk):

AMM 52-33-15 PB 801

OPERATIONS

Protecting Aircraft and Passengers from Cargo Fires

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Today's design standard for cargo compartment fire protection is encoded in airworthiness regulations, having evolved to take into account Safety lessons learnt following a number of tragic events.

The key features of cargo hold design that today protect passengers and aircraft from a cargo hold fire are fire detection and suppression systems, combined with an air-tight and fire-proof cargo compartment lining. A cargo compartment lining comprises not only the various composite panels of the ceiling, sidewall, floor, and partition, but the panel fasteners, and the cargo door lining.

Keeping the cargo compartment lining in good condition is an important activity for safety. In addition to regular scheduled checks of the lining, checks should also be made at each aircraft turnaround by ground operatives.

The largest cause of damage to the lining is the use of out-of-contour or poorly maintained cargo containers. Damage on decompression panels is also reported from the incorrect use of these panels as access panels during aircraft maintenance activities.

Any failure of the air-tight and fire-proof features of the cargo lining can lead to an uncontrolled fire on-board. For this reason, operational restrictions can be triggered when any damages to the cargo lining are identified, including flying with the cargo hold empty, or not containing flammable or combustible materials, under MMEL.



ARTICLES PUBLISHED IN PREVIOUS 'SAFETY FIRST' ISSUES

Issue 24

July 2017

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- Troubleshooting Airframe Vibrations
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January 2005

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- **A320:** In-flight Thrust Reverser Deployment
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