2020 - SIRM

Special COVID-19 Bulletin

October 2020

SAFETY
ISSUE
REVIEW
BULLETIN

A message from IATA

Mark Searle, Director, Safety

Welcome to this Special COVID-19 edition of the Safety Issue Review Meeting Bulletin.

It was shortly after taking up my role, as Safety Director at IATA, that reports of a new virus had been identified in China. It's not the first time we've heard of or had to manage health epidemics, but the impact that COVID-19 has had on aviation is something few have seen before.

During this time, the entire aviation system has needed to adapt and adapt quickly, while maintaining the safety of operations. This has included the management of change at both organisational and operational levels, utilising entities' Safety Management System (SMS) to assess potential safety hazards and risks that have emerged from the multiple alleviations, exemptions and new business models observed over the past months.

I've been delighted at the engagement of the IATA Safety Group, and the technical groups* reporting to it, during these challenging times. Many of the issues airlines are facing at present have been raised in the months following the beginning of the pandemic, and IATA has sought to support the industry by delivering tangible outcomes.

Although this has not been possible through our traditional face-to-face meetings – and I've missed the opportunity to meet and thank dedicated safety professionals in person for the time and expertise shared with IATA – we've been able to continue the conversations in the virtual world and create material that may be shared to keep aviation safe and support the industry on its way to a gradual re-start.

This Special COVID-19 Bulletin is an example of such collaboration, and I thank all those who have contributed to it. Please take time to read the bulletin and take note of the lessons learnt from others. If there is anything that you or your organisation have observed, but is not included within, then please let us know at irm-safety@iata.org

** Accident Classification Technical Group, Hazard Identification Technical Group, Cabin Operations Safety Technical Group, Fatigue Management Technical Group*

A message from the IATA Safety Group (SG) Chair

Mark Burtonwood, Senior Vice President Group Safety, Emirates Airlines

Greetings from the United Arab Emirates, I hope that you are all safe and well at your various places across the globe.

It's fair to say that the start of the new decade has been an interesting one. 2020 has brought unprecedented challenges to the world and COVID-19 has touched all continents except Antarctica. Like many industries, the aviation sector has been hit hard by the pandemic and airlines and related stakeholders have had to think on their feet, and pivot numerous times over the past months. Colleagues have worked harder than ever to respond to the ever-changing dynamics when operating in new and unforeseen conditions.

During this time, I have seen people rise to the challenge in remarkable ways. Be it converting passenger jets into freighter aircraft, flying modified or changed flight plans, adapting uniforms for an added layer of protection, supporting colleagues who contract the virus, or taking on new roles to support rapidly diversifying operations. It is true when they say that a crisis can bring the best out of people.

Over the past months, I have been grateful for the ongoing and supportive communication between IATA Safety Group (SG) and SIRM members, and I have valued our virtual meetings and informal catch-ups. Now more than ever, talking to one and other, sharing experiences, and learning from safety events is crucial. These collective experiences, lessons learned and subsequent actions are key to the recovery of our sector. I truly believe that some of the hardships that we are experiencing today can be turned into opportunities for the future.

I wish you all the best for the remainder of the year and hope that 2021 brings a close to the current health pandemic for all, and that we get to see all of our airlines returning to the skies at pre-pandemic levels. Slowly but surely, we will get there.

A message from the IATA Hazard Identification Technical Group (HITG) Chair

Frank Hitzbleck, ASD Manager / Head of Flight Safety, Cargolux

Greetings from Cargolux Airlines. "The world has rarely experienced a simultaneous, global shock as complex as the COVID-19" (Statement by Michelle Bachelet, UN High Commissioner). There are hardly better words to describe the current situation; aviation is supposed to connect people around the globe, but it has turned to a near standstill. IATA and Safety Groups around the globe have worked together to find the best industry practices to overcome the challenges, with the overall silence of the sky affecting all areas of the industry.

Challenges are wide-ranging and sometimes contrary; while passenger operators have parked aircraft, the cargo section is operating day and night to overcome shortfalls of supplies amongst various industries.

We, the HITG and Safety Incident Review Meeting group, request that you support the industry by providing us with your experience.

We should all have met during the spring under normal circumstances. Instead, with your reports and participation, we have created this bulletin. It shows clearly with the number of issues we received that there is a need for the exchange of ideas and it supports the idea of the SIRM feeding the Hazard Identification Technical Group in IATA.

In addition, you will find a compiled list of references with links to best practices and industry recommendations to help guide you through these difficult times. I would like to take the opportunity to thank all of you for your continued participation and enthusiasm and I wish all of you to stay healthy and dedicated. Continue to care, so the airline industry continues the safe path of the past.

Contents

1. Update from The IATA Accident Classification Technical Group (ACTG)

The ACTG is a sub-group to the Safety Group (SG) and is comprised of safety experts from airlines and manufacturers. The ACTG met virtually in July to review, validate and classify accidents that occurred in the first six months of 2020. Please note that due to the latency time between an accident occurrence and its reporting, this update may not contain all accidents that occurred in the first half of 2020.

The IATA ACTG recorded 20 accidents worldwide in the first half of 2020. Although the accident rate remained low, the first half of 2020 had a slightly higher accident rate of 1.15 vs. 1.14 accidents per million sectors compared to 2019 due to the reduced number of flights caused by COVID-19.

Runway/Taxiway Excursion was still the most common accident category including both lateral excursion and overrun excursions. The details are reported in our Mid-Year Accident Update.

One of the top contributing factors for Runway/Taxiway Excursion has been Manual Handling/Flight Controls errors by the flight crew for quite some time, and the ACTG has added a section "Synthetic Training Devices" in our annual Safety Report 2019 where we recommend the industry to "Explore new approaches to refine simulator fidelity (e.g., by integrating emerging technologies like Artificial Intelligence with FDM), and to explore the possibility of using safety data (e.g., FDM, ASR) to design simulator sessions so that the pilots will be trained using realistic scenarios".

This year's Mid-Year Accident Update is an Interactive Report for the first time, which enables the readers to customize their reports. We hope the readers make full use of this report to fulfil your needs.

Mid-year analysis

The Mid-year interactive analysis report can be accessed **here**.

Tips: *download and save a copy of the report before opening with Adobe Acrobat and follow the steps on slide 3. The embedded MS Excel graphs are compatible with Microsoft Office 2013, 2016 and Office 365. Close any opened excel files after viewing to maintain optimum performance.*

Safety report

The ACTG analyses accidents, identifies contributing factors, determines trends and areas of concern relating to operational safety and develops prevention strategies. The group uses the IATA Accident Database, which covers all commercial aviation accidents worldwide since 2005 that meet IATA accident criteria and creates the annual IATA Safety Report. The report contains essential insight into global and regional accident rates and contributing factors, key trends and statistics on accidents by category and region, prevention strategies as applicable to major accidents contributing factors, and It is made available to the industry for free distribution.

The 56th Edition of the IATA Safety Report (2019) can be downloaded **here**.

2. Short-term stored aircraft returning to operational service

Challenge

Submitting airline reactivated about 100 stored aircraft in a three-day period during the first week of this past July. As part of the SMS process, a Risk Management Worksheet was created to document potential hazards with this aircraft reactivation. One risk mitigation was a collaboration with the labor association representing the pilots of this particular airline.

Risk mitigation

The airline's TechOps team provided the tail numbers for all the aircraft that were planned to be reactivated to the pilot's labor association. The labor association matched the names of the Captains to these aircraft tail numbers and then texted the Captains of these Ferry Flights and/or first revenue flights, to notify them that these particular aircraft had been in short term storage, and to call if there were any questions. Captains were asked to review the important information that was on their iPads to assist with the pre-flight activities, to pass on guidance to flight attendants (if applicable), and to also provide feedback after the flight on any maintenance anomalies.

Fleet reactivation process

Extra attention suggested on the pre-flight inspection

- Gear pins removed
- Landing gear struts not fully compressed
- Tires in satisfactory condition and free from obvious irregularities
- Engine inlets and tailpipes are clear, the access panels are secured, the fan cowls are latched, the exterior, including the bottom of the nacelles, is not damaged, and the reversers are stowed
- Probes, sensors, ports, vents, and drains - plugs and covers removed
- Pack inlet and outlet ducts clear
- Outflow valve outlets clear
- Fuel tank vents (typically lower side of wings at tips) uncovered
- Doors and access panels not in use closed and latched
- Verify cargo compartments are empty
- Inspect for the presence of any leaks of fuel, oil, hydraulic, water, lavatory fluid
- No unusual tape or plastic of varying color on the aircraft
- Evidence of insects or birds nesting in/on the aircraft
- Check navigation database currency

Extra attention suggested on the pre-flight inspection for cabin

Check the general condition of the cabin, equipment, carts, PA system, and lavatories.
Suggest turning on the ovens and coffee makers.

Crew Feedback concerning maintenance issues

Feedback received from flight crews to the labor association and the submitting airline TechOps concerning reactivated aircraft mechanical anomalies included the following:

- Exterior NAV lights burnt out
- Bird nest found
- Flight control unit lights too dim
- Hydraulic system failure
- Rejected takeoff for delayed engine spool up
- Auto pilot disconnected at cruise
- Outdated emergency quick reference cards (QRC) for the pilots
- Three aborted takeoffs due to unreliable airspeed issues

Lessons learned

- The pilot's labor association, as well as the Flight and Safety Departments from the submitting airline, received overwhelming positive feedback by all the Captains that were contacted before they flew aircraft that had been stored. Text messaging was very effective, and this resulted in quick communication with the pilots.

- The submitting airline's suggested guidance for extra attention to certain areas, which was listed in the pilot's iPad, was updated based on feedback from crew members.

- The submitting airline's TechOps modified the return to service work cards based on feedback from crew members.

- As a safeguard for the future, the submitting airline's Flight Ops Department will document this SMS and communication process in several locations for future use.

Comments

Labor associations and airline corporations, working together for safety, will pave a road to success.

3. Fifth (5th) stage check valve seizure

A Boeing 737-800 was descending towards its destination, and shortly after the throttle pullback, the crew felt an airframe vibration with no abnormal engine indications on the Display Unit. The parameters of the engine #1 did not stabilize on normal idle values and continued to decrease, until the crew received the ENG FAILURE indication, followed by an EGT increase. The crew was unable to correctly recognize the malfunction due to its uncommon nature.

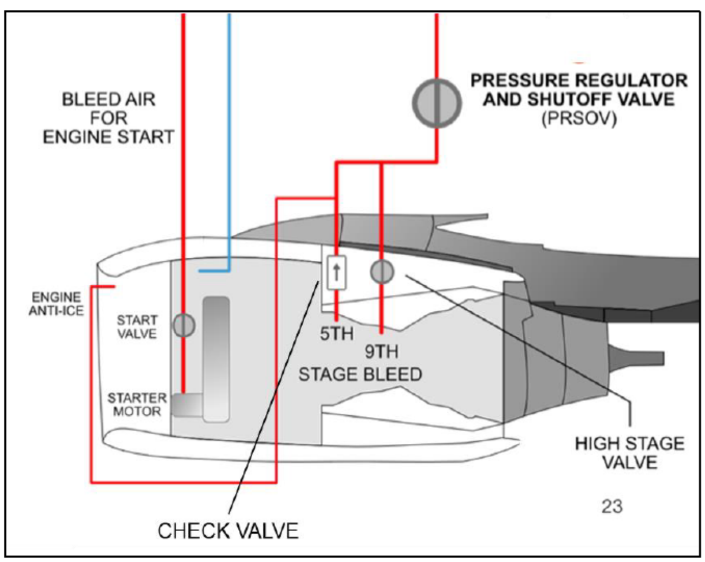
An engine restart was later attempted, with no success. The 737 landed with a single engine at its original destination, without further issues. During the post flight maintenance inspection in engine #1, it was found that the bleed air 5th stage check valve was seized in the open position.

Aircraft information

Due to the COVID-19 crisis, the aircraft was stored for 60 days at a coastal airport. Two days prior to the flight, the return to service procedures were carried out and an 18-minute ferry flight was made to the airport from which the incident flight departed. The return to service task did not include a 5th stage check valve inspection, so the seized valve was not found.

The excerpt from the Flight Crew Operations Manual (FCOM) below explains the operation of the bleed air valves:

Engine bleed air is obtained from the 5th and 9th stages of the compressor section. When 5th stage low pressure bleed air is insufficient for the bleed air system requirements, the high stage valve [9th stage] modulates open to maintain adequate bleed air pressure. During takeoff, climb, and most cruise conditions, low pressure bleed air from the 5th stage is adequate and the high stage valve remains closed.



Adapted from: The 737 Technical Handbook

In the incident flight, as the descent started and the 9th stage valve modulated open, the 5th stage check valve remained seized in the open position. That caused 9th stage compressor air to be re-ingested to the 5th stage of the compressor, resulting in engine stall.

When an engine stall occurs, usually there are visible flames from both ends of the engine, accompanied with one or more very loud bangs and fluctuating engine parameters. However, that was not the case and the crew got confused as to what the actual malfunction was. The ENG FAIL alert accompanied with an unusual airframe vibration led them to consider the Engine Failure or Shutdown and the Engine Severe Damage non-normal checklists. The crew failed to associate the EGT increase to the Engine Limit or Surge or Stall non-normal checklist. The investigation later found that the first officer had a history of simulator performance deficiencies, including poor systems knowledge.

An engine restart was attempted and a shortly successful relight was conducted, followed by another non-recoverable stall. The crew then decided to perform a single engine landing.

Corrosion was later found on the seized valve. It is highly probable that the environmental and humidity conditions at the storage airport contributed to the development of corrosion on the component.

Actions taken by the company

- As soon as the 5th stage check valve was found seized, the Engineering and Safety teams issued an order to inspect all engine check valves that had just returned to service after prolonged storage.

- A Safety Recommendation issued by the Investigation Committee determined the design of a new pilot's record database, to improve monitoring of flight crew performance during simulator training and check rides.

Actions taken by the industry

- Boeing updated the Aircraft Maintenance Manual (AMM) procedures for return to service from active storage and prolonged parking to include inspection of the 5th stage bleed air check valve.

- The Federal Aviation Administration (FAA) issued an Emergency Airworthiness Directive (EAD) for all stored Boeing 737 Classic and Next Generation. The EAD covers the engine bleed 5th stage check valve on aircraft that were stored for seven or more consecutive days. The FAA issued the EAD following four separate incidents caused by 5th stage check valve seizure.

4. ILS signal interference in Hong Kong and erroneous AFDS guidance when ILS signal interference occurs on Boeing models 777, 787, 744, 748, 757 and 767

In recent months, a series of incidents related to ILS signal interference have occurred in Hong Kong, leading to unstable approaches, go-arounds and loss of terrain separation, attracting public and media interest. The possibility of ILS signal interference when approaching to Hong Kong (HKG) airport, especially on runways 07R and 25L, is a known issue due to the location of the ILS antennas and terrain features.

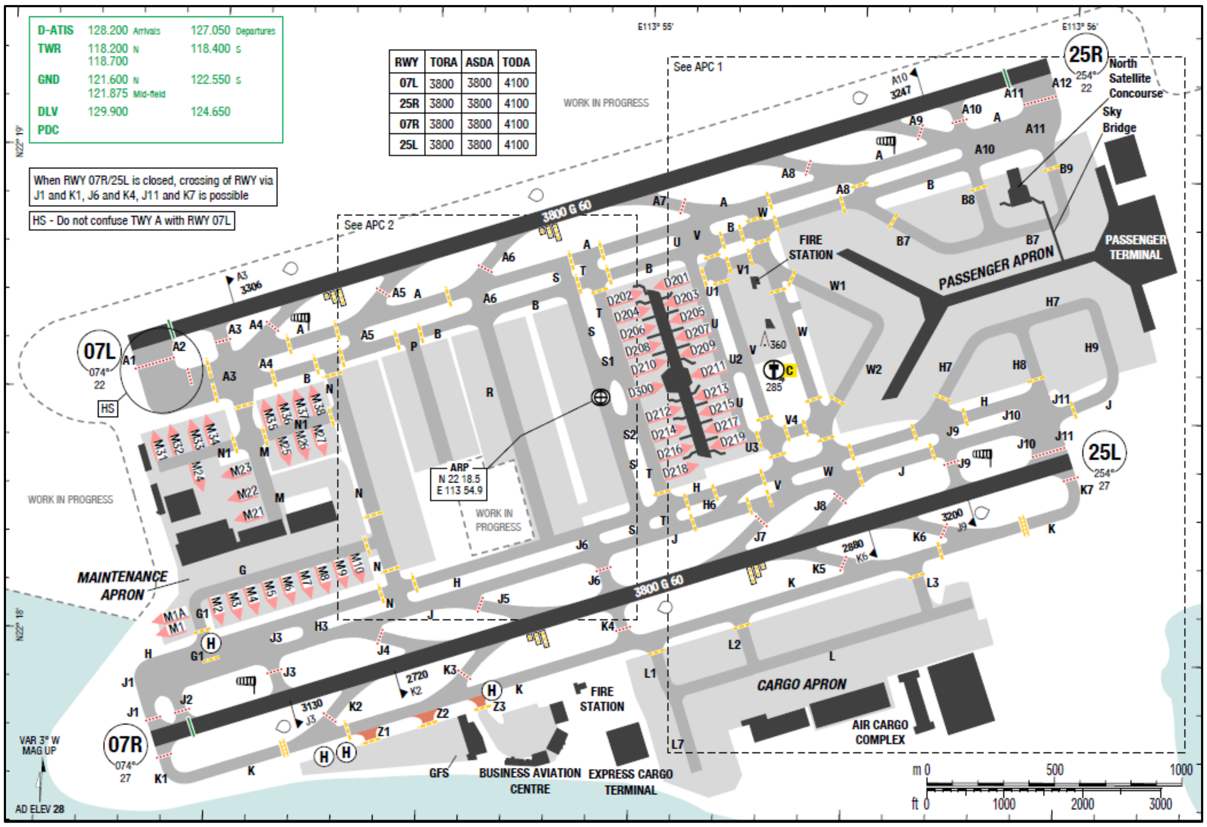


__Figure 1__ above shows HKG LIDO Airport Ground Chart (AGC). ILS antennas are indicated by this symbol

In a number of those events, Boeing aircraft models were involved, including a Boeing 787, which descended to 200 feet aal 2.6nm short of runway 07R.

The threats from an ILS signal interference are increased in certain Boeing models due to the possibility of an undesirable behavior of the AFDS system. In December 2019, Boeing issued a Flight Crew Operations Manual Bulletin (FCOM) highlighting the threats of erroneous Autopilot Flight Director System (AFDS) guidance when ILS signal interference occurs. The Boeing bulletin describes the AFDS operation during periods of localizer or glideslope signal degradation or signal instability, and the possible flight deck effects during such an event. The AFDS may initially attempt to track the degraded or unstable radio signal which may lead to large changes in pitch, high descent rates, or a pitch angle lower than required to normally track the glideslope.

BOEING

Flight Crew Operations Manual Bulletin

The Boeing Company
Seattle, Washington 98124-2207

777

Number: EAD-124
Issue Date: December 05, 2019

Airplane Effectivity: All 777 Airplanes

Subject: Erroneous Autopilot Flight Director System (AFDS) Guidance when Instrument Landing System (ILS) Signal Interference Occurs

Reason: To inform flight crews about erroneous AFDS guidance during ILS approaches

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

__Figure 2__ above shows the Boeing Flight Crew Operations Manual (FCOM) Bulletin

Event 1 summary - ILS signal interference runway 25L.

During descent, the flight requested ATC for the RNP Z approach to runway 25L in order to mitigate the possibility of an ILS interference. However, ATC could not accommodate the request and the flight was cleared for the ILS approach. During the ILS approach to runway 25L, a glideslope interference occurred prior to the FAP, between 4,000 feet aal and 3,500 feet aal, resulting in an increase in the aircraft pitch down attitude. The PF disengaged the autopilot and the approach momentarily destabilized above the vertical profile. Since the RNP approach had been previously briefed and validated, it was activated in the FMC and the approach continued in VNAV PATH mode with reference to the RNP approach. Stabilization criteria was achieved at 2,500 feet aal. The approach was conducted in day VMC weather conditions.

The flight crew were well aware of the hazards and possible threats and prepared their arrival accordingly. The Pilot Flying (PF) planned to conduct an RNP approach to runway 25L in order to avoid the ILS issues. However, ATC could not initially accept the request since it required coordination with the next ATC sector due to a mismatch between the initially cleared STAR and the RNP approach. The flight then accepted the ILS approach with a plan to mitigate any ILS interference issues by following the Boeing Bulletin guidance and if possible, activate and continue on the RNP approach or continue visually to the runway.

The possible root cause for the ILS signal interference was a Boeing 767 that was lining up for take-off on runway 25L via taxiway K7.

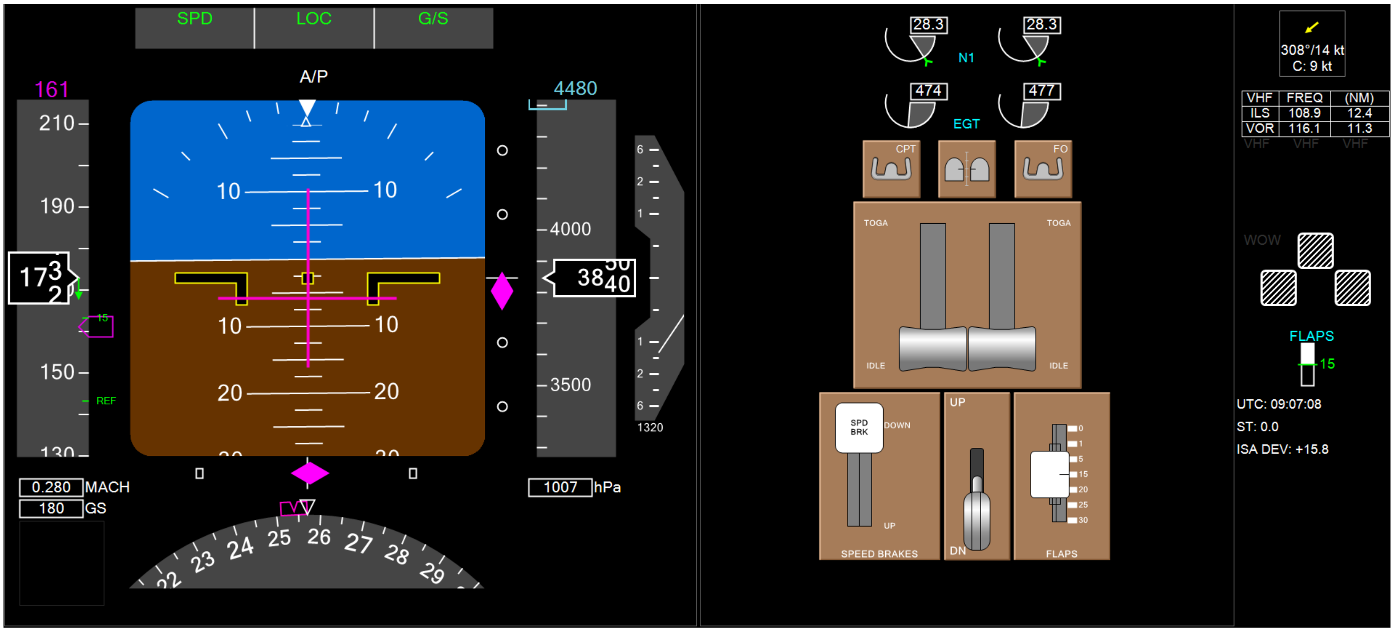


Figure 3 *above shows one second prior to the autopilot disengagement by the PF. The AFDS is commanding an increased pitch down during ILS signal interference, consistent with the behavior described in the Boeing bulletin. Immediately prior to this snapshot, the glideslope deviation pointer was oscillating. At the moment of the snapshot, the glideslope deviation pointer was rapidly moving from a full scale above to a full scale below glideslope indication.*

Event 2 summary - ILS signal interference runway 07R.

A false glideslope capture on the ILS approach to runway 07R, resulted in an early descent below the ATC cleared altitude and the minimum procedure altitude prior to the FAP. The Approach (APP) mode was disengaged at 1,700 feet QNH, and the descent continued in Vertical Speed mode until the aircraft levelled off at 1,100 feet QNH. The ILS was recaptured at 3.9NM ILS and stabilization criteria was achieved at 1,000 feet aal. The approach was conducted in night VMC weather conditions.

The flight was initially cleared for the ILS approach to runway 07L which is not associated with potential ILS signal interference due to the location of the antennas. Prior to commencing the approach, ATC re-cleared the flight for an ILS on runway 07R.

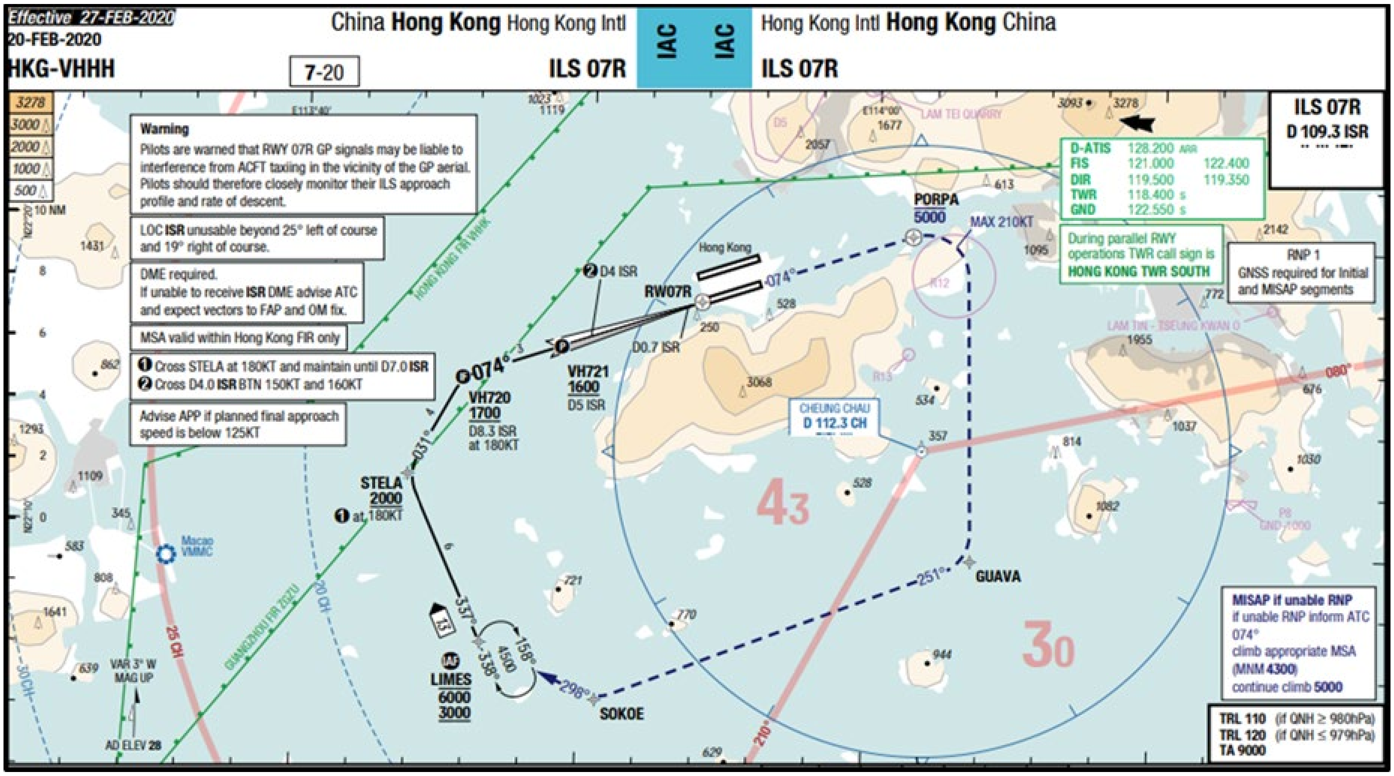


Figure 4 above shows HKG LIDO ILS 07R Instrument Approach Chart (IAC) plan view

The flight crew was aware of the hazards and possible threats of ILS signal interference during approaches to runway 07R. However, due to the late change of runway, there was no update to the approach briefing to discuss ILS interference mitigation strategies.

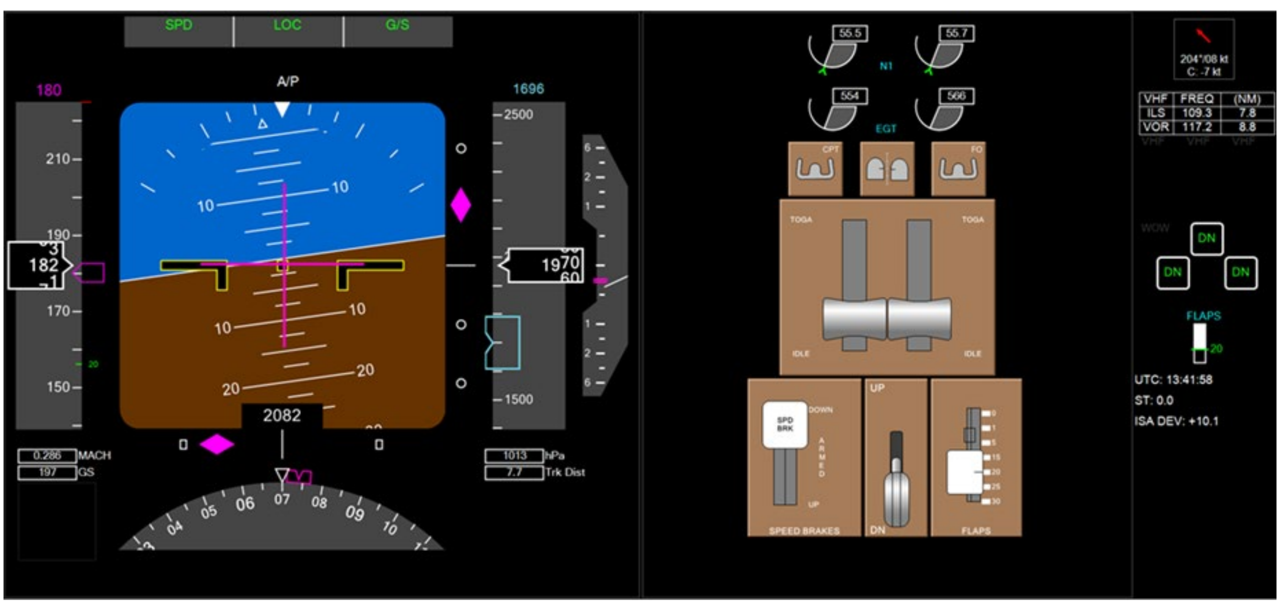


Figure 5 above shows the moment of the false glideslope capture

The flight crew did not initially recognize the false glideslope capture and allowed the aircraft to continue the descent below the ATC cleared altitude and minimum procedure altitude for the approach segment. After a short period of startle, the flight crew recognized the early descent and the aircraft was levelled off. Since the runway was in sight, terrain separation assured and the aircraft had not descended below the company stabilization altitude, the ILS was re-captured once the signal interference was resolved, and the approach continued.

The possible root cause for the ILS signal interference was a Boeing 757 that was holding at the runway 07R CAT I holding point at taxiway K1.

Event 3 summary - Perceived ILS signal interference runway 25R.

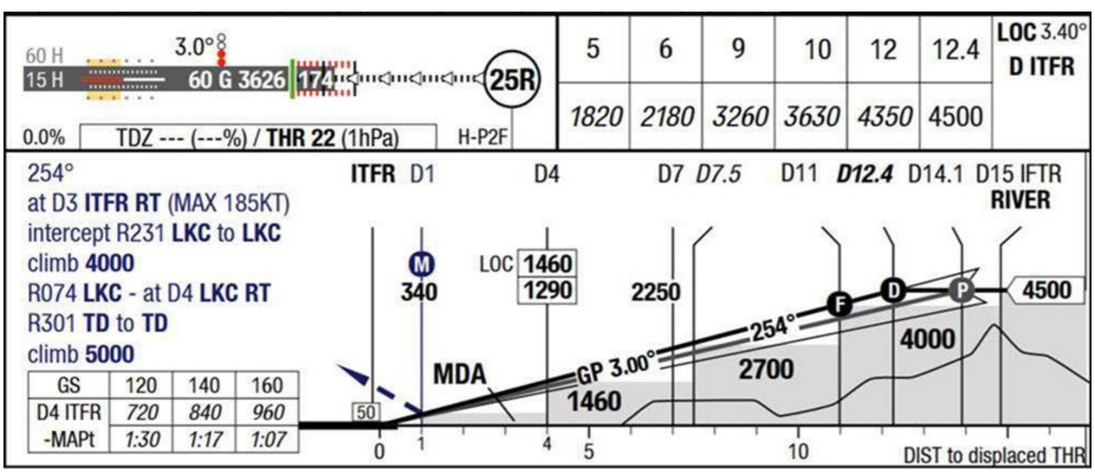
During the ILS approach to runway 25R, the PF perceived that a false glideslope capture occurred, when an altitude x distance crosscheck indicated that the aircraft was below the expected altitude. The PF disarmed the approach mode and continued the approach with visual references to the runway. During the maneuver, the aircraft momentarily deviated right of the extended centerline and above the vertical profile, before the APP mode was re-armed and the ILS was recaptured. Stabilization criteria was achieved at 1,700 feet aal. Contributing factors for the misperception were the PF expectation of a possible glideslope interference and a misinterpretation of the altitude x distance table in the approach chart, which was for the 3.4 GP localizer approach instead of the 3.0 GP ILS approach. The approach was conducted in day VMC weather conditions.

The PF initially planned to fly an RNP approach to runway 07R. The ATIS available at the time indicated that runway 07R was in use and RNP approaches were available on pilot's request.

0010Z HONG KONG ARRIVAL INFORMATION H AT TIME 0010
ARRIVAL RUNWAY 07R RWY 07L IS CLSD FOR MAINT RNP AR APCH IS AVBL ON REQ

The originally planned runway 07R was changed to runway 25R, and the new ATIS did not include the option for pilots to request an RNP approach. The PF believed that an RNP approach was not available for runway 25R and prepared to fly the ILS approach with a heightened awareness of possible ILS signal interference.

One of the mitigation strategies planned by the PF, was to closely monitor the altitude versus distance crosschecks using the approach chart table. However, the PF failed to notice that the distance versus altitude table refers to the non-precision LOC only approach with a 3.4° GP angle instead of the ILS approach 3.0° GP angle.



<u>Figure 6</u> above shows the ILS 25R LIDO IAC chart profile view and the distance versus altitude table for the non-precision LOC only approach.

From the background information in the Boeing Bulletin, the flight crew are advised that: "The AFDS may initially attempt to track the degraded or unstable radio signal which may lead to large changes in pitch, high descent rates, or a pitch angle lower than required to normally track the glideslope." The flight crews are made aware of undesirable behaviors of the AFDS and are primed to react accordingly, when flying ILS approaches with known ILS signal interference issues such as Hong Kong.

After intercepting the glideslope and initiating descent, the first altitude check planned by the PF was at 12.4NM and he was expecting to be at 4,500 feet QNH. Since the aircraft was flying the ILS 3.0° GP, the aircraft was indicating a lower altitude. The PF became suspicious of the aircraft vertical profile and a possible false glideslope intercept. The suspicion was further reinforced by the PFD picture which indicated the aircraft with a higher than normal pitch down attitude and rate of descent, consistent with the behavior described in the Boeing bulletin.

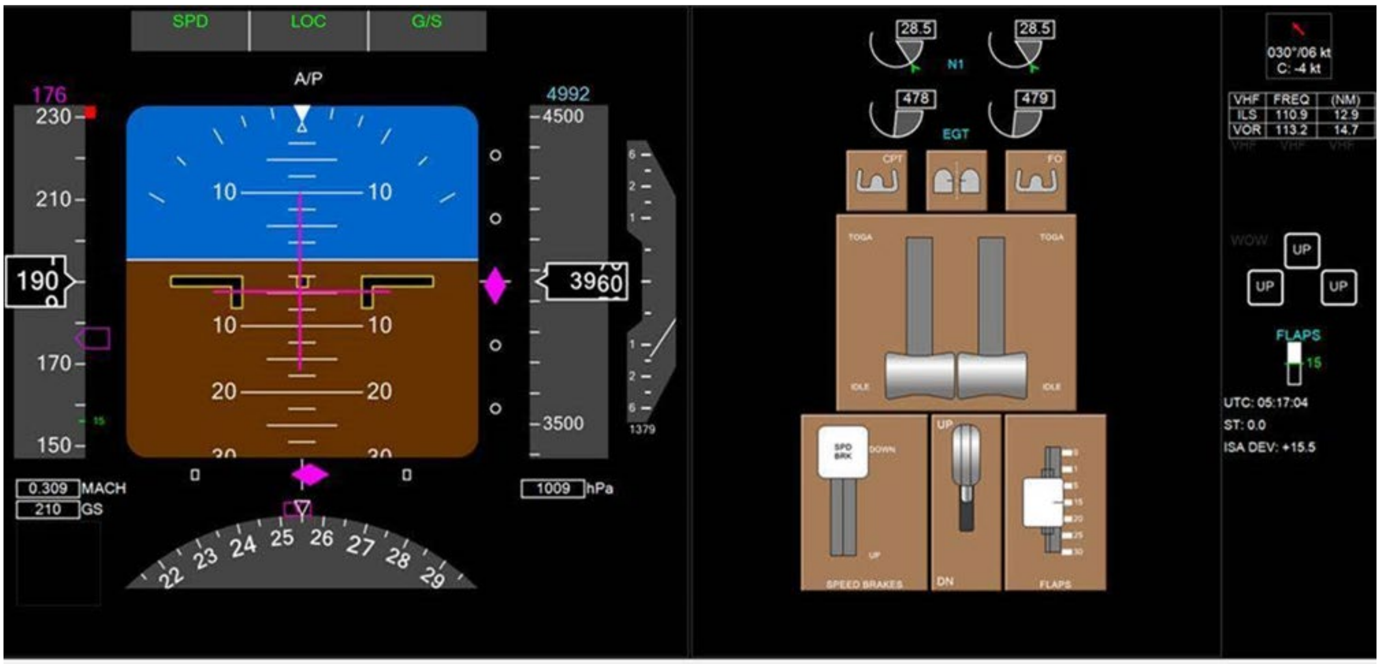


__Figure 7__ above shows the moment prior to the autopilot disengagement by the PF and the momentary PFD pitch down indication when the altitude versus distance crosscheck was first performed by the flight crew

The QAR data indicated that the ILS signal was valid at the time. Additionally, Hong Kong ATC indicated that the ILS was operating normally and no aircraft or vehicles that could have caused an interference were present in the ILS protected areas.

It is believed that the momentary pitch down attitude and rate of descent was the result of the AFDS correcting a small above glide path deviation caused by an increase in the aircraft indicated airspeed due to a wind shift, and not the AFDS behavior described in the Boeing Bulletin.

In this event, the combination of a misinterpretation of the altitude versus distance table, with the momentary down pitch attitude, resulted in confirmation bias where the PF believed that they were experiencing exactly the issue they were most concerned about and he reverted to basic AFDS modes.

This event was best described by the pilot himself which stated: "I was looking for a glideslope problem, and I found one"

Conclusion

The three events described, demonstrate some of the challenges of preparing for a possible ILS signal interference occurrence and the related erroneous AFDS system guidance. In the first event, the flight crew were well prepared. Despite not flying the RNP approach, they were quickly able to identify the ILS signal interference and mitigate against the AFDS erroneous guidance accordingly.

In the second event, although the flight crew were well aware of the threats, a mitigation plan was not discussed and they became momentarily startled, delaying the corrective actions.

The last event, the flight crew were well prepared, but a combination of a misinterpretation of the approach chart and confirmation bias resulted in the flight crew reacting to a problem that was not present.

The threats of ILS signal interference and false glideslope capture are not exclusive to Hong Kong and can occur during any ILS approach. In certain Boeing aircraft models, the threats are increased and should be carefully considered by operators and flight crews. Boeing is working on a software fix for the AFDS issues when ILS signal interference occurs.

Lessons learned / comments

- The potential threats of an ILS signal interference are increased in certain Boeing aircraft models due to the possibility of erroneous AFDS guidance
- The quality of information provided to pilots and preparation is key
- Airlines need to identify airports with high incidence of ILS signal interference and provide guidance to pilots
- Choosing a different type of approach such as RNAV/RNP to avoid the possibility of an ILS signal interference in airports at an increased risk of ILS signal interference
- Flight crews need to be prepared to initiate a go-around if operator's stabilization criteria cannot be achieved, terrain separation cannot be assured or in IMC weather conditions.

Hazard details

Identified hazard/threat:

- ILS signal interference - unstable approach and CFIT
- Erroneous AFDS guidance - unstable approach, loss of control and CFIT
- Expectation and confirmation bias - unstable approach

5. Ground collision event during parking

Event overview

Under the COVID-19 operations, due to shortage of the designated parking area, there has been an increase in towing activities not normally performed. This event took place after dark, while the towing operator attempted to park the aircraft on a parallel taxiway.

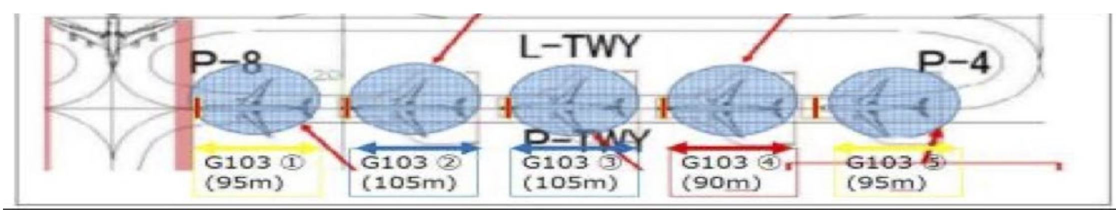
According to the report, the towing truck stopped as the towed aircraft approached the temporary parking area (P-TWY). Then the towing operator asked the assistant to get out of the vehicle and look for the stop marking, which was only temporarily written on the TWY. He noted "The stop line marking is not on TWY, but a little away from abeam the centerline of "SPOT G103①". The assistant found a number, marked in white, that said "1350" on the center line of the TWY. He thought it was the stop marking for "SPOT G103①". However, the number "1350" has no relation to G103① stop marking". Nevertheless, he recognized "1350" as the stop marking and sent a signal to the towing operator to go ahead "Push back the aircraft" towards the marking.

The towing operator pushed the aircraft back to the stop marking but felt that the vehicle was slightly floating at about 3 meters before the stop marking, indicated by the assistant. That is where the tail section of the towed aircraft collided with an aircraft that was already parked. It was established afterwards that the marking on the TWY was written for TWY construction purposes and not for the temporary parking spot.

"1350" used for the TWY construction was located 28.4m behind the correct marking.

Identified risks

There are five types of aircraft that can be parked on the parallel TWY, as show below. The collided aircraft parking spot was G103①.



The investigation revealed that the position to identify the correct temporary spot marking was written on a duct tape-like material (because of it's temporary use) at 4.3m away from the TWY center line and not at the edge of the TWY. If it were written on the TWY centerline, the marking could not be seen by the towing operator.

Wrong Marking Correct Marking

Lessons-learned

Lack of awareness of detailed stop marking shapes and positions and the presence or absence of construction-related markings on the P-TWY were the main contributors of the event. As a result, the organization has reviewed the SOP, such as the mutual confirmation and verification between the operator and assistant.

Recommendations

When carrying out parking that is different from usual, due to a reduction in flights, check the following:

- If the parking of an aircraft is different from the designated area, confirm the parking procedure between the towing operator and the assistant before starting the tow.

- If there is(are) any doubt(s) about the procedures or any concerns, it is strongly recommended to stop the work until the confusion is resolved.

6. Aircraft parking and storage - critical watch areas

Introduction

Due to the current global COVID-19 crisis, an unusually large number of commercial aircraft have been parked or stored and have been out of revenue service for an extended amount of time. To address this extraordinary situation, OEMs have proposed specific measures to support operators in storing and preserving aircraft to allow for a smooth return to service as flight activities progressively return to normal.

Considerations

There are basically 3 categories of parking / storage conditions as shown in Table 1:

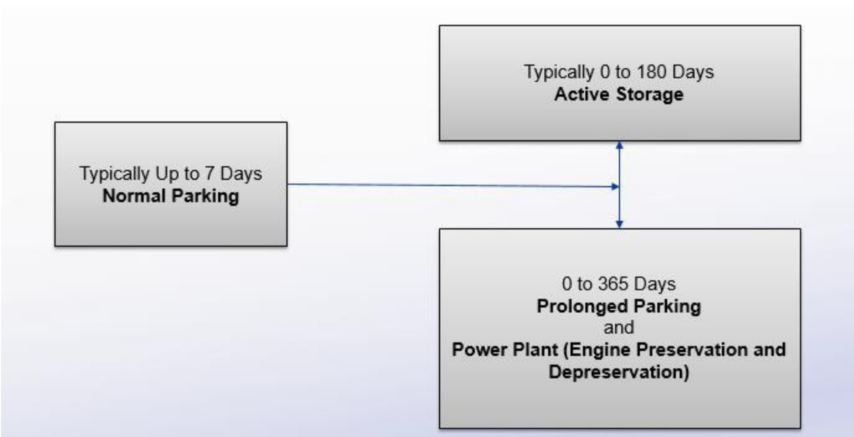


__Figure 1__: Flow chart for storage and preservation

Normal Parking

- Typical storage duration of 0 to 7 days
- Intended to keep the airplane in a flight-ready state with minimum readiness tasks required to be performed by the operator before returning to flight
- Generally, operators will choose to have airplanes in normal parking between revenue flights, maintenance activities, or major airplane modifications
- Operators required to perform a lower level of maintenance tasks during normal parking as compared to active storage or prolonged parking

Active Storage

- Typical storage duration of 0 to 180 days of storage
- Intended to keep the airplane in a flight-ready state with intermediate readiness tasks required to be performed by operator to return the aircraft to operational service
- Airplane is considered to be preserved in a short to medium storage condition with limited workload to prepare the aircraft for preservation
- The operator will typically maintain cabin humidity within the normal limit, which allows the interiors and other electronics components to remain on board
- The aircraft power plant is typically not in preservation state which may require periodic engine runs

- The operator typically is required to perform a larger number of periodic line maintenance activities during preservation as compared to prolonged parking

Prolonged Parking

- Typically, storage duration of 0 to 365 days
- Intended to maintain the aircraft in a long-term storage state with increased workload to return the aircraft to operational service
- The aircraft is considered to be preserved in a medium to long term storage condition with increased workload to prepare the aircraft for preservation as compared to active storage
- The operator will typically maintain a higher than normal cabin humidity which would require the interiors and other electronics components to be removed and stored in a climate-controlled environment
- The airplane power plant is typically in a preserved state which requires less periodic maintenance as compared to active storage
- The operator typically is required to perform fewer line maintenance activities during preservation as compared to active storage

Challenges along the way

During the COVID grounding a large number of operators have decided to maintain the aircraft utilizing active storage programs. Since these aircraft are stored all over the world in a wide range of environments, each operator has to build a variety of preservation programs to properly maintain these aircraft. In addition, operators must have varying staffing requirements to perform tasks at atypical outstations, which is a challenge in the COVID environment. The workload of regulators and supporting organizations such as maintenance facilities may increase when handling multiple operators with unique operational requirements, which necessitates a larger amount of planning and forecasting.

Since active storage is time-limited, the operators may be required to transition from one type of parking to another (such as moving from active storage to prolonged parking). This typically requires preparation procedures in addition to those the operator has already performed as part of initial storage.

When the operator plans to return the aircraft to operational service, it will need to plan ahead in order to perform all the required tasks and procedures to safely return its aircraft to revenue service. Depending on how the operator chooses to store the aircraft, there may be an impact to the operator's scheduled maintenance programs; this would require extra planning and coordination with responsible groups (e.g., interval extension related to aircraft maintenance program). The operator would need to work with its local regulatory agency and be aware of OEM line maintenance requirements needed to qualify for scheduled maintenance interval extensions.

Lessons learned

The large scale of this grounding in every conceivable environment has created unique needs for certain operators. OEMs have worked with operators to collect information about these unique conditions in order to help translate them to fleet requirements. As needed, OEMs have incorporated these lessons learned into released parking and storage documentation in order improve the state of aircraft preservation which will allow for a safe and timely transition from parking/storage to operational service. OEMs have been meeting with operators regularly, both individually and in multi-operator meetings, to communicate these lessons learned across the fleet. Operators should contact the OEMs for any deviation to parking and storage requirements and, be aware that mismanagement of parking and storage requirements may increase workload and cause delays to the aircraft returning to operational service.

Below are several critical watch areas:

- Exterior corrosion on bare metal surfaces
- Cabin temperature and humidity
- Fuel drainage and bio-contamination
- Power plant and APU health
- Flight controls operational capability
- Landing Gear and Tires
- Electrical components
- Seals and gaskets
- Scheduled maintenance interval extensions
- Aircraft security during storage
- Airplane spacing at storage location

Summary

The large grounding of multiple fleets is like nothing the industry has ever experienced, and has created unique challenges for operators, OEMs, and regulatory agencies. The measures put in place by these groups have been tested and validated in order to allow for a safe return to service as the industry returns to normal. The relationship between the operators and OEMs is key in these situations in order to flow information quickly and respond to changes in real time. The work put into preserving these aircraft during this time and the effort of all maintenance personal will pay off in the end by ensuring the world continues to have safe and reliable air travel.

7. Aircraft parking and storage and return to service

The COVID-19 pandemic has led to the unprecedented grounding on a large proportion of the world's fleet. Despite already having mature and robust parking and storage procedures, feedback from this experience has identified some key points to ensure the continued safe operation of our aircraft and those working on them during this time.

The objective of this briefing is to recall some of the key issues observed, share our experience to support the continued parking/storage, and to help with ensuring a safe and efficient return to service. The examples below are not an exhaustive list but are among those most frequently reported to Airbus by different operators around the world.

Explosive door opening due to residual cabin pressure

Situation

An operator reported to Airbus structural damage on an A320 family aircraft. The aircraft required the completion of periodic maintenance in the cabin, and to make a comfortable working environment the aircraft cabin was being conditioned. As part of the storage conditions the aircraft was also in ditching mode. This combination of factors led to an increase in cabin pressure. To continue the maintenance action the crew opened the forward passenger door - which opened explosively - causing minor damage to the aircraft structure. Fortunately, in this event, no injuries occurred.

Synopsis

Opening a cabin door when the aircraft is pressurised can cause serious injury (ref EASA SIB 2019-02 dated 12 February 2019). With more aircraft in parking/storage conditions, there is an increase in the risk of the scenario described above occurring. Indeed, due to the storage requirements - both the physical disconnection of batteries and design of the system - the existing residual pressure warning systems will not be operational.

It is therefore reminded that when accessing an aircraft to follow the manufacturer maintenance recommendations to ensure that the cabin is not pressurised - disconnecting any ground conditioning equipment and seeing if an internally opening access door (e.g. avionics access door) can be opened. Similarly, when working in an aircraft ensure that the aircraft is not being conditioned at the same time as all outlets are closed (e.g. in ditching mode).

Fuel Contamination

Situation

An operator reported to Airbus that a fuel sampling on their fleet showed more than one third of the tanks tested being confirmed with moderate contamination. Recent operational issues mean that there is now officially only one biocide on the market for aviation usage (EASA SIB No.: 2020-06 Issued: 20 March 2020) - and that this is not worldwide approved.

Treatment is timely and costly, but microbiological contamination can have numerous safety effects - from erroneous fuel gauging to the blocking of fuel filters to extreme cases where structural corrosion can occur.

Synopsis

Prevention is better than a cure, microbiological contamination requires a combination of three factors - microbes, fuel and water. Since the presence of the microbes cannot be eliminated, and fuel is required in the tanks when storing the aircraft, in order to prevent fuel contamination the action is to remove the water. This can be done by regular water drainage.

Awareness and actions

Whilst a scheduled water drainage task is likely to be included in the parking/storage procedures, operators should assess and adjust this accordingly. It may be that the drainage interval for normal operations may no longer be adequate, and as a consequence the interval should be reviewed and if necessary reduced. Regular water drainage and also fuel contamination checks can help avoid an expensive problem before it occurs.

Unreliable Air Data

Situation

Since the start of the return to service, Airbus has received multiple reports of unreliable air data readings. The most common one reported is a disagreement between speed readings. An initial assessment completed by Airbus, comparing the average rate per month (pre COVID crisis) shows that the rate of warnings linked to Unreliable Airspeed indications is up to 8 times higher in June 2020. However, the issue is not just air speed (Pitot probes), with reports of other critical air data probes being impacted after return to service post storage.

Synopsis

The most common cause of erroneous air data is due to contamination of the sensor - in the form of dirt or debris from insects, or due to water or moisture contamination if the probes are not correctly protected during washing or in high humidity conditions.

Awareness and actions

As well as Airbus communication, EASA has also issued a reminder to operators on the increase of Pitot Static issues after storage - Refer to SIB 2020-14 dated 05 August 2020. Airbus supports the recommendations issued and reiterates the importance of ensuring that the aircraft air data probes are correctly protected from the environment during parking or storage.

Even if covers are used, it is also recommended that before return to service particular attention is paid to the condition of the air data probes, and to flush the lines to ensure that there is no blockage.

It is reminded that to protect the air data probes, for storage and for cleaning purposes, only official equipment should be used. This has been designed and tested for the purpose. Use of “homemade” protections (plastic wrapping, bubble wrap, cellophane etc) is not approved, and could cause damage causing air data inaccuracy on return to service.

Do not forget that the air data probes may be heated on the ground, and therefore to pay special attention to any maintenance procedures that may lead to heat the sensor - remove the protection or deactivate the heating before performing the procedure.

And finally, do not forget to remove the protections and place them in the correct storage location before flight.

Bleed Air System Reliability

Example

An A330 operator experienced a Dual Bleed Loss just after take-off. The QRH actions were performed, which initially cleared the fault. However, further warnings triggered again shortly thereafter. Taking into account the conditions en-route the decision was taken to return to the originating airport.

Known issue/analysis

A long period of parking in combination with severe environmental conditions (high humidity, big differences of temperatures…) could lead to mechanical blockage or difficulties to move bleed valves, with possible misbehaviour during aircraft operation. The consequence may vary from operational disruption or increased maintenance actions, to actual loss or failure of both bleed systems - such as occurred in the above case. This could, in extreme examples, lose the capability to pressurize the cabin.

Awareness and actions

The large number of aircraft that are being parked or stored means that the normal periodic checks of the bleed air systems during high power engine runs are not feasible to perform. Based on this, modifications to the parking procedures coupled with additional maintenance actions on return to service, are now required to ensure that the system is operational (e.g. perform an operational test at high engine power to test the entire Engine Bleed Air System).

Conclusion

Despite already existing, and mature, parking and storage procedures in our documentation, the unique socio-economic factors created by the COVID-19 pandemic, with the consequential mass parking and storage has led to different challenges for operators in comparison to normal operation. This is highlighted by the increase of maintenance associated reports and questions coming from our operators.

However, the operational and safety risks can be effectively mitigated by following the storage and return to service checks, and specific guidance issued associated to this unprecedented situation. If steps are not followed, or are missed, or deviations to procedures intentionally or unintentionally occur then this could have adverse effects on the reliability and continued safe operation of the aircraft on return to service and normal operations. A time when additional operational stress needs to be avoided.

8. The evaluation and risks associated with not using a fuel biocide[1]

Editorial note: *Following border closures due to the COVID-19 crisis, airline traffic has been drastically reduced and operators have been forced to park much of their fleet for an undetermined time. Tremendous efforts have been made to ensure proper maintenance of aircraft and its systems to mitigate risks related to long-term parking, including the risk of contaminated fuel.*

Microbes are everywhere. They are in the air, ground, fuel and fuel systems. As such, the risk of biodeterioration is always present with the potential for increase, absent a fuel biocide. Rob Midgley, Global Technical and Quality Manger for Shell Aviation, recently pointed out that "somewhere around 50% or more of those aircraft" parked are showing "signs of microbial growth after two to three months of storage." He goes on to say that "you really need to have a strategy to treat the aircraft." Since there is no such thing as a sterile fuel system, biodeterioration can occur in the best maintained systems. To recognize the solution, lets briefly evaluate the problems, identify the risks and offer a practical conclusion.

Evaluating the Problems

Microbiological contamination begins the moment fuel leaves the refinery and continues to accumulate through the supply chain to its final destination. Microbes need water and food to survive and multiply. The consensus is, keep fuel dry and you reduce the chance of biodeterioration. However, that is easier said than done. Water is always present in fuel at some level and it doesn't take much to sustain life. Fuels systems are constantly breathing, bringing in more contaminants including additional microbes and water in the form of condensation. A single drop of water can sustain colonies of microbes. As condensation forms, free water accumulates exacerbating the problem of microbial contamination. Long-term storage magnifies all of the problems linked to biodeterioration.

Figure 1 *- 30-day old untreated fuel sample*

Fuel is a food source. Microbes consume fuel, breaking down the hydrocarbons and producing corrosive acids. They also change the composition of the fuel as they metabolize it. Microbes multiply at high rates and typically live in consortia. Never found alone, different species establish symbiotic relationships beneficial to each other forming biomass environments at water-fuel interfaces (Figure 1) on tank walls and linings or most any place in a fuel system capable of concealing a tiny fraction of water.

Ready sources of fuel and water are not the only problems. Aircraft fuel systems are designed for everything except easy microbiological control. While many designs incorporate water-scavenging systems and other devices to limit water, the complicated tank designs including baffles and individual tanks with transfer systems create a host of

[1] *Article submitted by Hammonds Fuel Additives, Inc.*

complications. Aircraft have limited access points making it difficult or near impossible to retrieve acceptable samples for testing or to inspect the system for the presence of biodeterioration. While draining sumps does help, the automated scavenging systems that are in use during operation are of no help while aircraft are parked. Water and bioburdens can easily accumulate in places hard to reach or detect and often go unrealized until contamination reaches very high, dangerous levels.

Fuel system design and the nature of the fuel testing process attribute to inconclusive results. Sample testing is diagnostic, not representative. A reliable sample should come from a location in the tank likely to harbour microbes such as a sump drain. That being said, testing can still be inconclusive. A negative test result does not indicate the fuel is free of microbial contaminants. In contrast, a positive result makes it that much more important to act, no matter how low the level of microbial contamination. If the test indicates a positive result, the likelihood of biodeterioration is dramatically increased.

Identifying the Risks

What are the risks associated with microbial contamination and more specifically with not using a fuel biocide? Table 1 represents the main risks linked by microorganism type. It is not difficult to see how potential problems can become both catastrophic and costly to remediate if not managed in a fundamental way. The facts are straightforward:

- Microbes are EVERYWHERE
- Water is ALWAYS present
- Microbes need WATER and FOOD
- Fuel is FOOD
- Fuel systems are NEVER sterile
- Good housekeeping ALONE is not enough
- Biocides KILL microbes
- The systematic use of **BIOCIDES WORK**

Problems	Primary Microorganism
Pipe, valve and blockage	Fungi; biopolymer bacteria
Fuel probe damage	Fungi; biopolymer bacteria
Sludge formation	Fungi; bacteria (all)
Surfactant production - coalescer/water separator malfunction and fuel/water emulsions	Fungi; aerobic bacteria
Corrosion (MIC)	Fungi; anaerobic bacteria and sulfur reducing bacteria
Downtime	ALL
Suspended solids in fuel	Fungi; bacteria (all)
Hydrocarbon breakdown	Fungi aerobic bacteria
Filter clogging	Fungi; bacteria (all)
Injector fouling	Fungi; aerobic bacteria
Increased sulfur content	Sulfur reducing bacteria
Damage to protective linings	Fungi
Loss of Life	ALL

Table 1 Problems associated with microbial growth

The risks are straightforward as well. From a risk approach, any of the problems in Table 1 will certainly increase operational costs as well as the potential for catastrophic event. They are all a cause for concern and action.

Practical Conclusion

Compare the cost to treat the fuel with a biocide and the cost to remediate repairs associated with the problems in Table 1. The cost differential and the risk associated with not using a biocide are staggering. The Scale of Risk illustrates this fact. A biocide treatment costs in the $100s versus repairs ranging in the $100,000s. The risks associated with not using a biocide are much higher than its use.

The present unprecedented long-term storage of aircraft is proving to be more than a challenge. Inactivity raises the risk of serious contamination issues, often hidden from plain sight. A proactive, preventative approach reduces the risks associated with long-term storage.

Early intervention is the key. If a diagnostic test indicates any level of microbial presence, a biocide treatment is the only way to ensure the risks are reduced.

9. Managing pilot training and licensing during covid-19 operations

In the context of the COVID-19 crisis, operators and training organizations have been facing difficulties to comply with their national regulatory requirements regarding flight crew licensing and qualification validity because both, flight and training operations, have been significantly disturbed.

In response to this situation, National Aviation Authorities have been globally supporting the approval, for a limited period of time, of alternative solutions to the traditional licensing and operational requirements. The objective of these alternative solutions being to maintain operations when the training capacity is limited, or when the administrative licensing revalidation process is disrupted.

To support operators and training organizations manage the risk assessment associated with the regulatory alleviations and to provide best practices for the operational special conditions mitigating the identified risks, IATA published the document "**Guidance for Managing Pilot Training and Licensing During COVID-19 Operations**".

As the national regulatory requirements are drafted based on ICAO standards and recommended practices published in Annex 1 and Annex 6 of the Convention on International Civil Aviation, the IATA guidance provides global mitigation measures to ICAO standard deviations.

The guidance provides a practical example from an operator of alternative means of compliance to a specific national pilot recency requirement. It also proposes medium- and long-term solutions for the operational recovery and for the enhancement of the training effectiveness, e.g., reference to the IATA White Paper: **Refresher Competency-Based Training and Assessment (CBTA) Session for "Post COVID" Operational Recovery**.

10. An aviation professional's guide to wellbeing

Published August 4, 2020 in United Airlines' Aviation Safety Library for pilots
From the Flight Safety Foundation: An Aviation Professional's Guide to Wellbeing

The following article was excerpted by Captain Jill Mills, B-737 DCAFO. Capt. Mills is also a Technical Staff volunteer for the Flight Safety Foundation. "An Aviation Professional's Guide to Wellbeing" is published in the Aviation Safety Library with Flight Safety Foundation permission.

Your wellbeing has an impact on others (family/friends), on your work/performance and on safety.
Recently, Flight Safety Foundation members, academic researchers and aviation professionals across the industry published a guide, **An Aviation Professional's Guide to Wellbeing**, as part of its effort to help the industry cope with the personal and professional impacts of the COVID-19 pandemic.

Aviation safety performance is directly related to how people perform their various roles, and overall performance relies on individual and collective states of wellbeing. A recent study of 1,059 aviation professionals undertaken by researchers at Trinity College, Dublin, identified the most significant lifestyle factors found to influence the psychological resilience of aviation professionals were:

- Stress
- Sleep
- Diet
- Exercise
- Activities
- Relationships

Our wellbeing influences the nature and quality of our relationships with others (i.e., family, friends, work colleagues and community) and it impacts directly on human performance – on our awareness, decision making, and concentration. Finally, our performance as aviation professionals, underpinned by our wellbeing, directly impacts safety.

With COVID-19, the scenarios of continued operations, cessation of operations and re-establishing operations are generating some unusual challenges and may be affecting these factors.
The fundamental personal challenges associated with wellbeing are not new. Whatever our position or responsibilities, the current context requires all of us to think hard about our own wellbeing and how it impacts others. Wellbeing is addressed by using simple tools based on some fundamental psychological concepts that will help each one of us to make decisions and take actions that will maintain or improve our state of wellbeing.

This approach breaks wellbeing into three pillars, (mind, body and social) that create a three-legged stool of wellness. By assessing each of these pillars with three simple questions each day you can maximize your individual wellbeing and optimize aviation safety.

For each of the pillars (body, mind, social), ask yourself these three questions every day:

- How do I feel?
- How am I doing?
- What can I do about the situation?

The table below is a visual aid intended to assist you in reaching answers to the three daily questions. It is intended to help you quickly identify which areas of your wellbeing may need some attention.

WELLBEING ACTIVITIES

• Exercise Daily • Diet and Hydration • Sleeping OK	• Family Situation OK • Not Very Anxious • Positive Activities (Hobbies or Learning) • Low Stress Levels	• Good Connections with Friends • Good Connections with Colleagues • Good Connections with Extended Family
• Occasional Exercise • Negative Change in Diet • Change in Sleep Patterns	• Family Situation Unbalanced • Anxious About Situation • Irregular Positive Activities • Manageable Stress Level	• Limited Connections with Friends • Limited Connections with Colleagues • Limited Connections with Extended Family
• No Exercise or Activity • Irregular or Unbalanced Eating • Disturbed Sleep/ Tiredness	• Family Situation Negative • Constant Anxiety • No Positive Activities • Feeling Constantly Stressed	• Little or No Connections with Friends • Little or No Connections with Colleagues • Little or No Connections with Extended Family

Source: Flight Safety Foundation's "An Aviation Professional's Guide to Wellbeing."

If you find yourself, or suspect others, in the yellow or red areas, please take active steps to decide what you will do to improve your situation toward a green assessment.

Also, please consider reading the Flight Safety Foundation's **full guide** for more helpful tools, information and guidance.

11. Covid-19 crisis – a perspective from cabin crew

The safety of our employees and customers has always been our number one priority, and this became even more evident in the past several months. Back in January, we began following the news out of China regarding COVID-19 and started making plans in case the virus made its way to the United States. Our first communication to our flight attendants included assurances that we were in close contact with the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), Federal Aviation Administration (FAA), and others.

From the beginning of the pandemic, we started taking steps with the well-being of our employees and customers in mind. We stressed the importance of good hand hygiene, started weekly communication for our employees, and began sourcing Personal Protective Equipment (PPE) in anticipation of a shortage. While we knew changes were on the horizon, none of us could have anticipated the rapid rate of change that would affect our flight attendants. We were asking them to adapt quickly during a time of great uncertainty. Not only were people concerned about their health, but the topics of flight and staff reductions soon dominated conversations.

By the middle of the first quarter, we stopped inflight service on flights under 250 miles and only offered a very limited service on longer flights. This action was taken out of an abundance of caution to limit touchpoints between flight attendants and passengers. Soon after, we stopped all onboard service to further support limiting touchpoints. For a company known for its exceptional customer service, this was not an easy decision to make.

As the weeks went on, we took additional measures to mitigate possible risks onboard the aircraft. At a time when the CDC began recommending physical distancing, we recognized there were concerns about sharing a jumpseat with another individual.

Working with industry partners, we sought relief from this (and other) regulatory requirements. Based on temporary exemptions from the FAA, we took flight attendants off double jumpseats and gave them the option of sitting in passenger seats. To reduce potential exposure to COVID-19, the FAA granted us the flexibility to use alternative methods to demonstrate the use of the O2 Mask and Passenger Life Vest during our safety demonstration. Realizing the training environment posed a risk of exposure, recurrent training was halted for a period of time to allow for improved cleaning of classrooms and equipment, as well as scheduling smaller class sizes. We paid close attention to both flight attendant feedback and customer sentiment and started limiting the number of customers onboard to allow middle seats to remain open. This gave our passengers the ability to distance themselves from someone sitting immediately next to them, while reducing the number of people with whom our cabin crew interacts in the cabin. Additionally, verbiage was added to longstanding onboard announcements reminding passengers of mask requirements. All changes like we have never seen before.

As guidance from the CDC and WHO began to change at an unprecedented pace, it was often challenging to keep up. In March, government authorities were not recommending that healthy individuals wear masks, but within a short time almost all carriers in the United States were allowing crew members to wear masks. By the summer, all employees and passengers were required to wear some type of face covering, and carriers began denying travel to those individuals who refused. Flight attendants were asked to enforce mask policies while still showing empathy.

Our Safety Management System (SMS) has been vital during the pandemic. Throughout all of the changes implemented, data was reviewed, risk assessments were completed, and outputs were carefully documented. Teams worked around the clock to confirm procedural changes met the regulations while mitigating the risk of spreading COVID-19.

Our flight attendants did a fantastic job of adapting to an ever-changing work environment. We quickly moved from a time when uniform compliance focused on ironed shirts and skirt lengths to seeing our employees in masks, gloves, and optional face shields. When a worldwide shortage of PPE became evident, our crews provided their own gloves, masks, and hand sanitizer while our supply chain department worked tirelessly to secure more products. Changes were definitely happening on the aircraft, but there were just as many taking place off the plane.

With flight bookings lower than ever, it was imperative that we cut costs immediately. While some carriers quickly began to plan for furloughs, we were lucky that our leaders looked to other options. We have not had a single involuntary furlough throughout the history of our company, and this proud statistic is something we want to retain. Generous leave options and early retirement packages were offered, and thousands of individuals were able to take advantage of these. Not only did this allow folks to seek other opportunities about which they are passionate, but it allowed us to work toward right sizing our work force and protect the jobs of those who remained.

As the virus spread across the country, many states implemented safety measures. Some of these measures included numerous closures of establishments such as restaurants, gyms, and other places frequented by crew members on layovers. To provide our crews with access to meals, we worked with our hotel partners to provide meals to go. We also provided a list of hotel amenities so folks would know what to expect upon arriving at a specific hotel. Some cities went on "lock down" and only allowed essential errands to be accomplished. All of this created extra stress for a work group who is used to exploring new cities on layovers.

Realizing mental health is just as important as physical health during this uncertain time, our company promoted the many assistance programs we have available. From professional counseling to peer conversations to webinars, we have tried to offer something for everyone. We want to take care of our people in every way possible.

Needless to say, we are learning and adapting on a daily basis. Seeing our flight attendants face challenges while still taking great care of our customers is definitely a source of pride. Hopefully, the day will soon come when we can all look back on this time and marvel at what we accomplished as an industry.

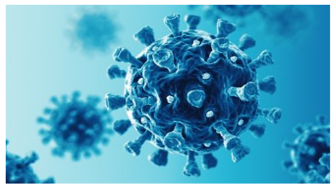
COVID-19 reference material

(to access references, please click on images or links)

The COVID-19 pandemic is having an immense impact on aviation and the air travel industry.

To support airlines and other aviation stakeholders in this process and to help the industry's restart, IATA has developed guidance material, which includes Safety Risk Assessments for various operational areas (IATA Safety page).

IATA COVID-19: Resources for Airlines & Air Transport Professionals



Includes guidance and risk assessments for the following areas:

- Airport (incl. Ground Operations)
- Aircraft
- Crew
- Cargo

FLIGHT SAFETY FOUNDATION

Pandemic

NON-MEDICAL OPERATIONAL SAFETY ASPECTS

SUPPLEMENTAL MATERIALS

EASA European Union Aviation Safety Agency

Continuing Airworthiness domain

Return to service of aircraft from storage: guidelines in relation to the COVID-19 pandemic

IATA canso IFATCA

Safely Navigating the Industry Restart

Bulletin 1

Mitigating Human Factors Hazards in the context of the operating environment during and post COVID-19

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Bulletin 3

Flight Crew and ATCO Interface during Restart

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