Kingdom of Saudi Arabia
Aviation Investigation Bureau
AIB

Annual Report 2017

VISION رؤية 2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

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Foreword by the Director General

I am honored to present to His Excellency the Minister of Transport, Chairman of the Board of Directors of the General Authority of Civil Aviation the AIB Annual Report of 2017. This is the fourth annual report since AIB establishment in November 2013. The report, not only highlights activities and achievements in 2017, it also shows AIB 's growth and development in the various aspects of its business.

The AIB had a very eventful and productive year, conducting occurrence investigations and safety studies and at the same time vigorously pursuing build-up of capabilities to achieve our stated vision "To be recognized as an international leader in advancing global aviation safety". The AIB team continues to be committed to its mission and to conduct its function to the highest standards to promote aviation safety.

The AIB handled 628 notification in 2017 with a slight increase of less than 4% from 2016. However, the number of reported incidents has increased by approximately 32% and the number of non-reportable events has decreased by approximately 48%, which indicates a significant improvement in the reporting culture in the KSA aviation community.

There were only three accidents reported in 2017, all involving light sport aircraft, and all are still under investigation.

On the technical front, the AIB made a significant achievement with the inauguration of the Memory Access Retrieval System (MARS). This system is the first of its kind, which allows the retrieval of flight recorders data from the chip level, eliminating the cost and hassle of acquiring bench units for damaged recorders. MARS was developed in partnership between the AIB, the Canadian Transportation Safety Board, the National Research Center of Canada and Plane sciences.

The AIB continued its effort to engage with relevant Government agencies that might be involved in case of investigations to clarify roles, responsibilities and where support and facilitation is required. We took a leading role along with regional partners to enhance regional cooperation in aircraft accident investigation while extending support to other states in the region in conducting flight recorder readout and analysis in AIB facility.

Looking back at 2017, so much has been accomplished, however, realizing that aviation continues to grow and the number of aircraft and complexity of their systems and operating environment all increase, the AIB will continue to prepare and train to fulfill its mission.

Thank you

Abdulelah O. Felemban
Director General
Aviation Investigation Bureau

DEFINITIONS OF OCCURRENCES CLASSIFICATIONS	
Occurrence	**Definition**
Accident	An aircraft accident is an aviation occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which: a) A person is fatally or seriously injured as a result of: 1) Being in the aircraft; or 2) Being in direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or b) The aircraft sustains substantial damage or structural failure; or c) The aircraft is missing or is completely inaccessible; or d) A forced landing off an airport, irrespective of injuries or damage.
Serious incident	An incident involving circumstances indicating that there was a high probability of an accident.
Incident	An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.
Other Occurrences	A reported event that does not classify as an accident or incident.

DEFINITIONS OF THE DIFFERENT TYPES OF INVESTIGATIONS	
Investigation Type	**Definition**
Annex 13	Used for investigated accidents and serious incidents that involves international interested parties.
Limited Scope	Used for incidents which involve domestic interested parties only, such as ground incidents or ATC incidents.
Discontinued	An investigation that is initiated on a reported occurrence and based on the gathered information it is determined that; • Underlying factors and circumstances are well known and they have been addressed in previous investigation • Safety actions taken by the concerned entity are satisfactory and more likely would prevent reoccurrence of similar incidents • Insufficient information to draw any specific conclusions regarding the circumstances Limited safety benefit would be expected from continuing the investigation and directing additional resources.
Safety Concern	Used for safety critical observations and stand-alone recommendations addressing specific safety matters.

ACRONYMS	
Acronym	Definition
ACAC	Arab Civil Aviation Commission
ADREP	Aviation Data Reporting Program – ICAO
AIB	Aviation Investigation Bureau
AIG	Accident Investigation Group – ICAO
ARC	Abnormal Runway Contact
CVR	Cockpit Voice Recorder
DGCA	Directors General of Civil Aviation
FAS	Flight Analysis System
FDC	Flight Deck Crewmember
FDR	Flight Data Recorder
FRL	Flight Recorder Laboratory
GACA	General Authority of Civil Aviation (Kingdom of Saudi Arabia)
ICAO	International Civil Aviation Organization
ISASI	International Society of Air Safety Investigators
MENASASI	Middle East & North Africa Society of Air Safety Investigators
MLG	Main Landing Gear
NLG	Nose Landing Gear
OCC	Operation Control Center (AIB)
RAIO	Regional Accident Investigation Organization
SANS	Saudi Air Navigation Services
SAR	Stand-Alone Recommendation
SARP	Standards And Recommended Practices
SCG	Saudi Coast Guard
SR	Safety Recommendation
TCAS – RA	Traffic Collision Avoidance System – Resolution Advisory

CHAPTER 1
AIB OVERVIEW

AIB Overview:

The Aviation Investigation Bureau "AIB" of the Kingdom of Saudi Arabia was established in 2013 as an independent government entity under the direct supervision of the Chairman of the Board of Directors of the General Authority of Civil Aviation.

The AIB is financially, administratively and operationally independent from the Regulator and the industry. It cooperates with the Regulator and the industry on issues relating to aviation safety. It also cooperates with international agencies and other States' investigation authorities in conformance with the Standards And Recommended Practices (SARPs) of ICAO Annex 13, and in accordance with the agreements and memorandums of understandings to which the Kingdom of Saudi Arabia is signatory to, in the interest of improving aviation safety.

In discharging its functions of improving aviation safety, the AIB conducts the following:

- Impartial investigation of aviation occurrences;
- Make safety recommendations based on systematic processes;
- Follow up of safety recommendations;
- Studies to enhance Aviation Safety.

AIB Vision and Mission:

Vision:

To be recognized as an international leader in advancing global aviation safety.

Mission:

To advance aviation safety through independent occurrence investigations and safety studies, promote an effective and comprehensive safety reporting system and communicate risks and safety recommendations.

AIB Core Values:

Respect: Fostering an environment that allows staff to contribute, innovate and excel.
Integrity and impartiality: In all activities.
Competence: Continual professional and technical development.
Transparency: Exchange information to enhance aviation safety.

AIB Strategic Goals 2018-2020:

1. Achieve the optimal of human resources investment and employment satisfaction in a healthy work environment.
2. Sustain and enhance AIB technical capability.
3. Achieve organizational excellence as a state investigation authority.
4. Sustain and Expand national, regional and international cooperation.
5. Optimization of AIB business processes.
6. Develop AIB infrastructure, facility and equipment.

Commitment to Strategic Objectives

بيـــان الالتـــزام

نلتزم، نحن الفريق الإداري لمكتب تحقيقات الطيران، بالرؤية والرسالة والأهداف الاستراتيجية والمبادرات لهذه المنظمة كما هي موضحة في الخطة الاستراتيجية (٢٠١٨م-٢٠٢٠م)، وكلٌ منا سيتولى – بمشيئة الله تعالى – مسؤولية تحقيق ما أسند إليه من مبادرات، وسيدعم المبادرات الأخرى حسب ما يتطلبه الأمر.

Commitment Statement

We, the Management of the Aviation Investigation Bureau are hereby committed to the vision, mission, values, strategic objectives and initiatives of our organization as detailed in the Strategic Plan (2018-2020). Each one of us will undertake his responsibilities to realize the initiatives under his ownership, and will support other initiatives as deemed required.

Ismail Y. Kashkash
Director of Engineering LAB

Abdulrahman M. Younis
Director of Investigation

Theeb A. Al-Otaibi
Director of Safety Analysis

Khalil A. Nagro
Acting Director of Financial and Admin

Khaled Binyahya
Manager of Operations & Control

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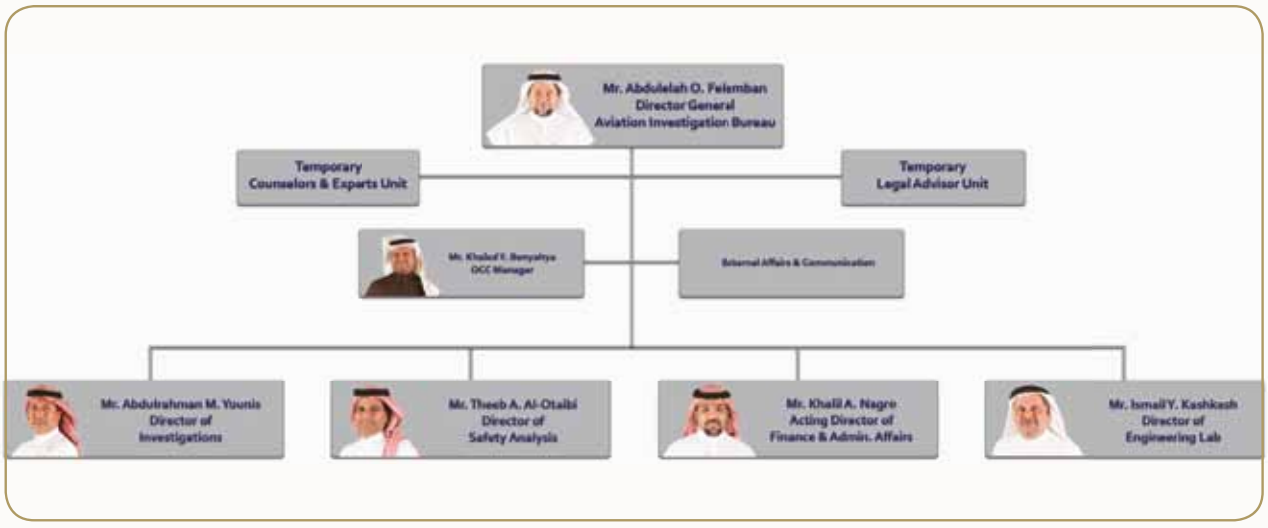
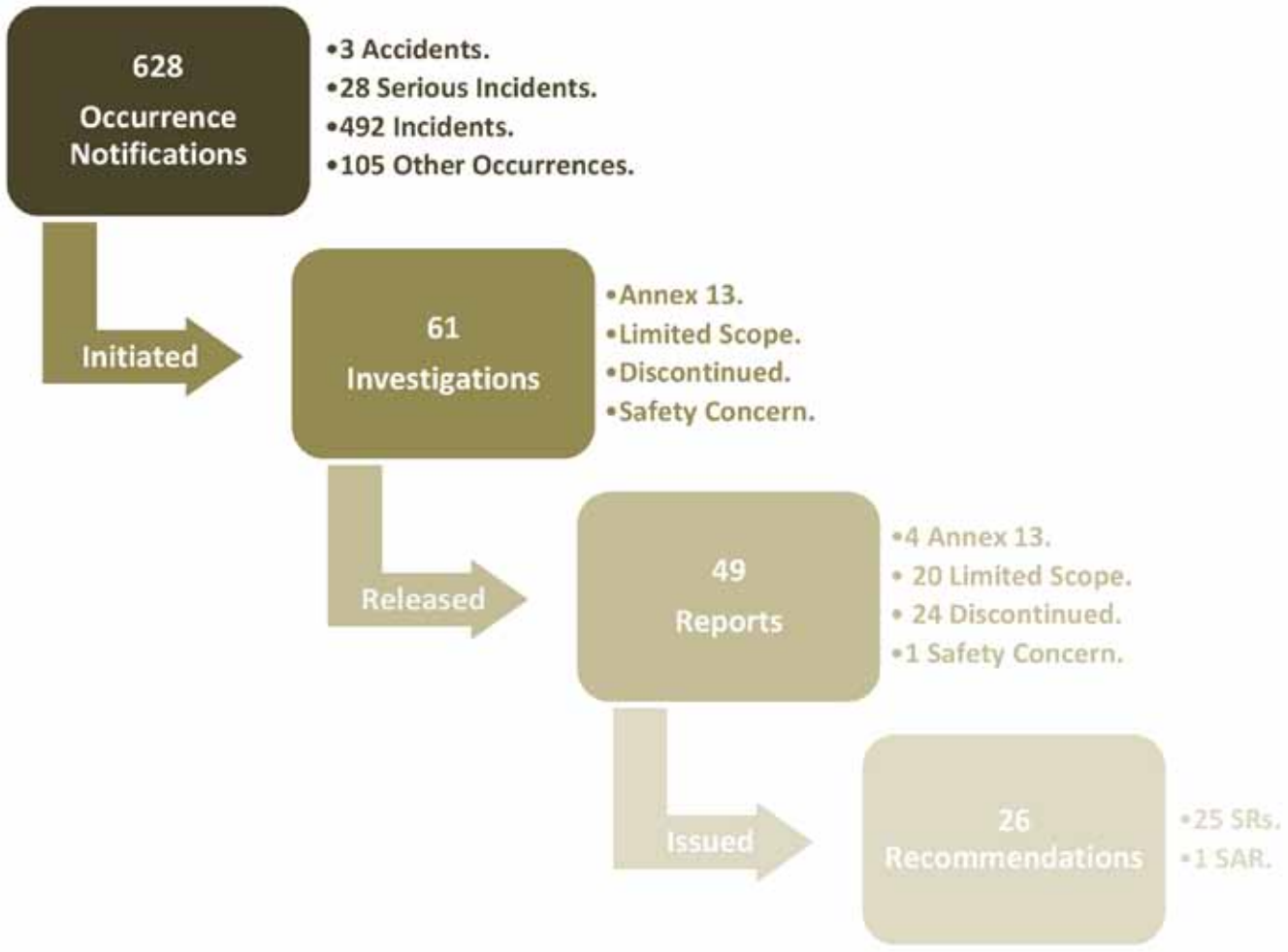
Abdulelah O. Felimban
Director General of Aviation Investigation Bureau

AIB Organizational Structure



The AIB has four major departments as seen in the organizational Chart

AIB at a glance in 2017:



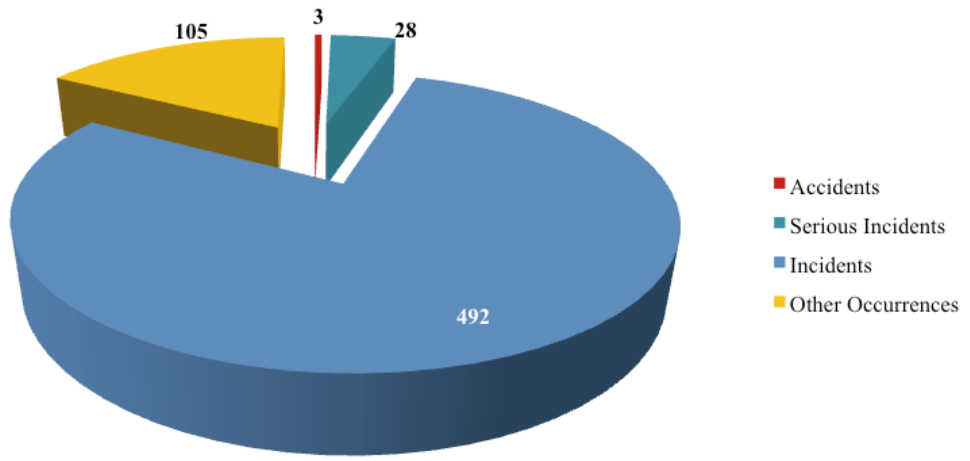
CHAPTER II
AIB OPERATIONAL ACTIVITIES

Notifications:

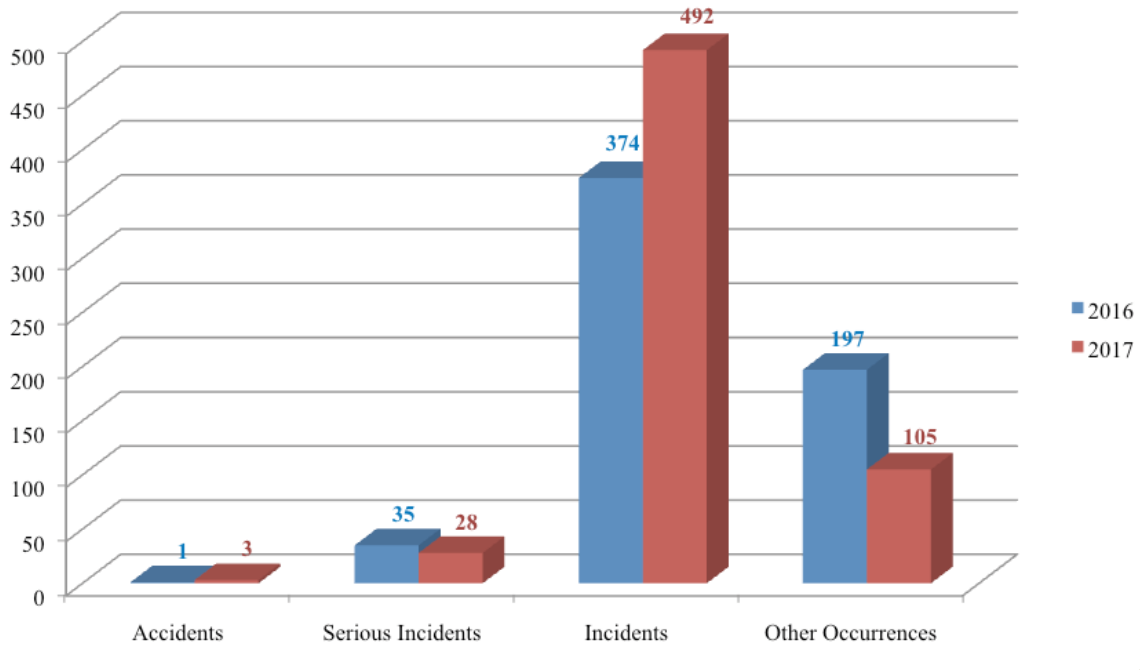
The AIB Operation Control Center "OCC" maintains a 24/7 occurrence notification service receiving all occurrence notifications, such as; telephone calls, e-mails, facsimiles and web forms that are utilized to notify the AIB of aviation occurrences.

The total number of notifications for 2017 was 628 classified as follows:

- 3 Accidents.
- 28 Serious Incidents.
- 492 Incidents.
- 105 other occurrences.



Notifications by classifications in 2017

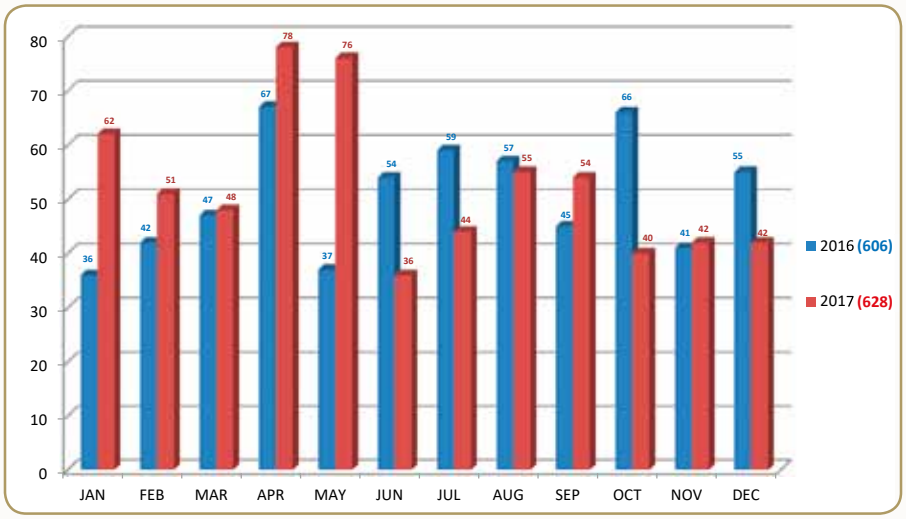


Notifications comparison by classification

Notification Trends:

Although, the total number of notifications doesn't vary much between 2016 and 2017, when looking at the details, the following observations can be made:

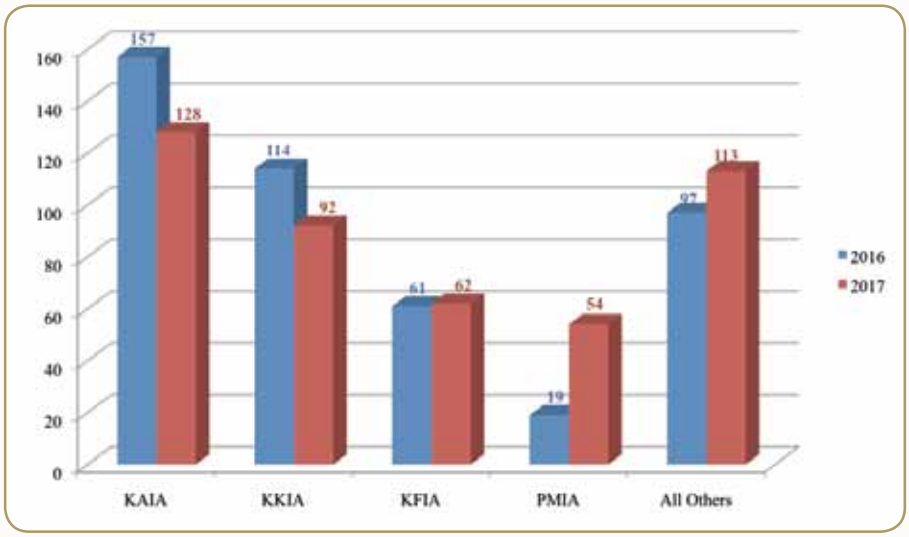
- There is an increase rate of 4% in the total number of occurrence notifications in 2017 as compared to 7% increase in the total aircraft movement in the same year, which indicates safety improvements.
- There is a 32% increase in the number of reported incidents in 2017, which indicates an enhanced reporting culture;
- There is a noticeable decrease in the "other occurrences" criteria, which indicates a raised awareness on what is a reportable occurrence;
- No significant change in the serious incident area;
- Increased accidents were in the sport aviation area.



Notifications Comparison by month

Notification Culture Rate:

These occurrences were reported by various entities, identified in the chart by KSA airports to flag location.



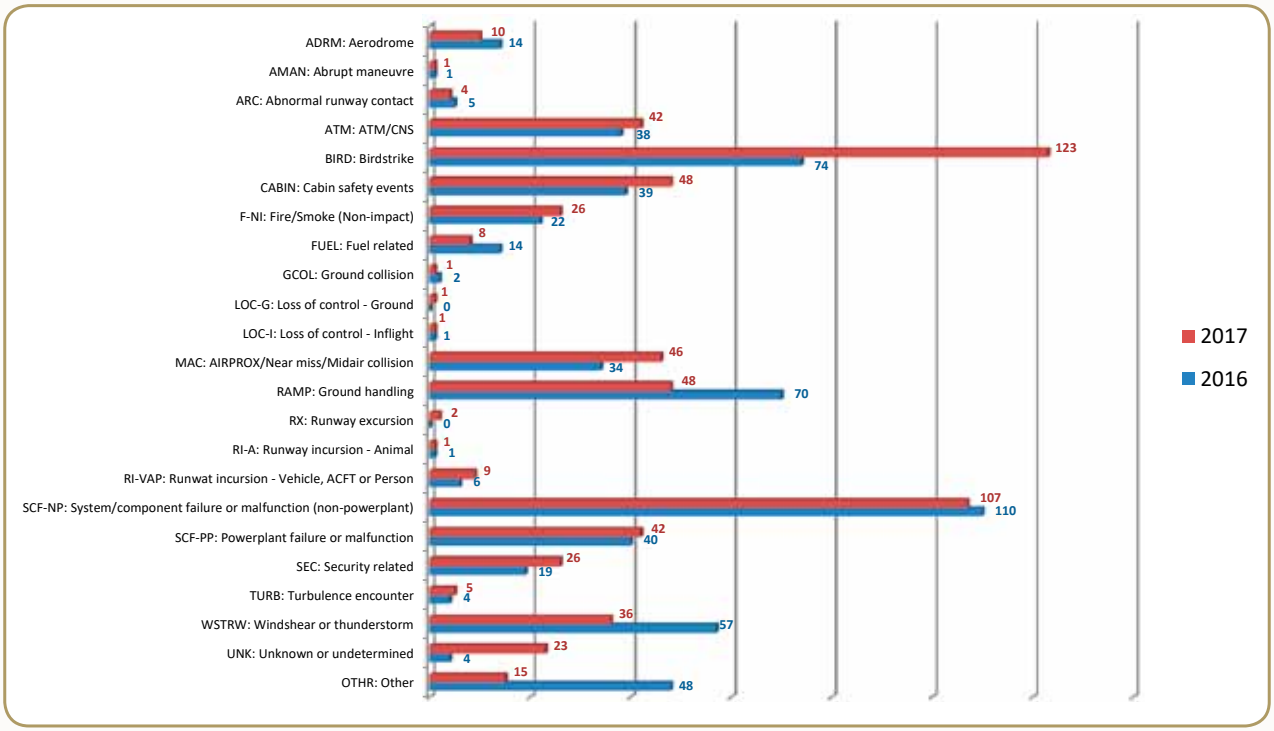
Notifications in KSA airports

The chart shows obvious correlation between aviation movement and notifications with a significant increase in reporting in PMIA and a slight increase in all other domestic airports

Notifications Categories:

All occurrences notifications are categorized in accordance with the ICAO categorization taxonomy. The taxonomy is based on ICAO Accident/Incident Data Reporting (ADREP) system to allow for international data sharing.

The ADREP taxonomy is a set of definitions and descriptions used during the gathering and reporting of accident and incident data that is forwarded to ICAO. This taxonomy is maintained by the ICAO Accident Investigation Group (AIG). Some Occurrences are categorized in more than one category depending on the nature of Occurrence. The graph below shows the comparison of occurrences categorization between 2016 and 2017.

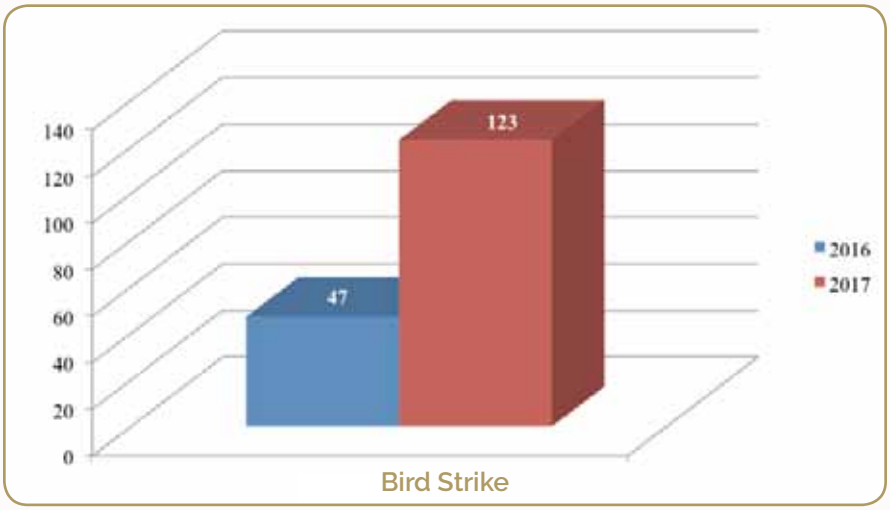


Notification Categories Comparison

Significant Notifications:

Bird Strike:

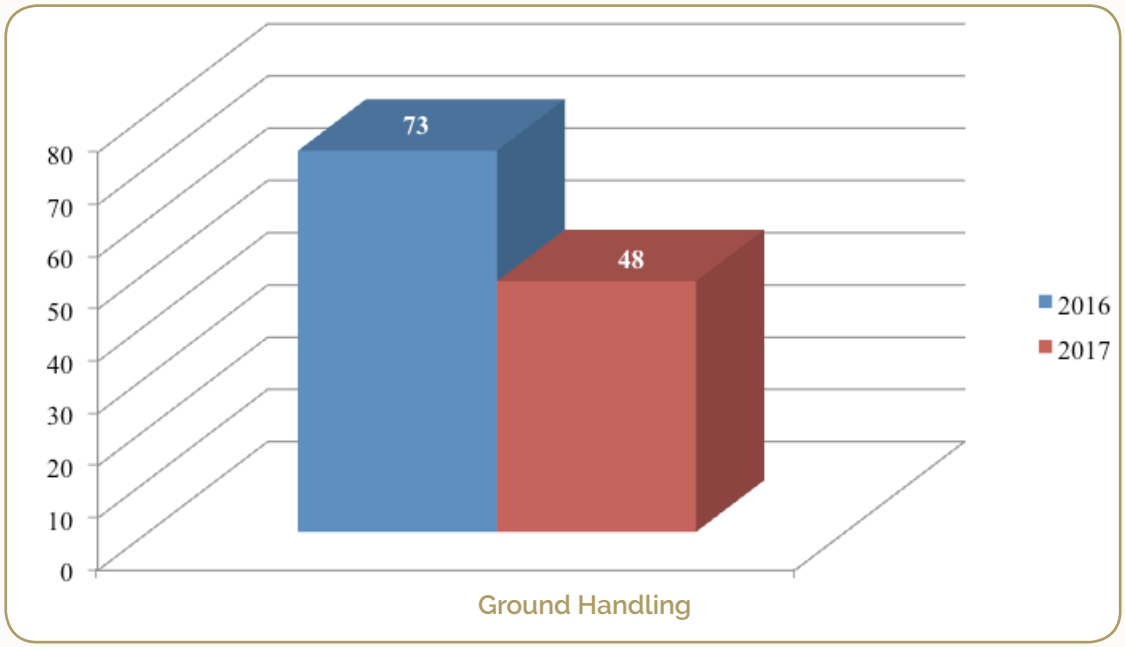
Bird strike incidents represent a significant concern for the aviation industry. As shown in the graph below, the number of bird strikes in Saudi Arabia has an increase of 49 incidents and increased up to 123 occurrences in 2017, which represents an increase of more than 67% as compared to 2016.



Bird Strike

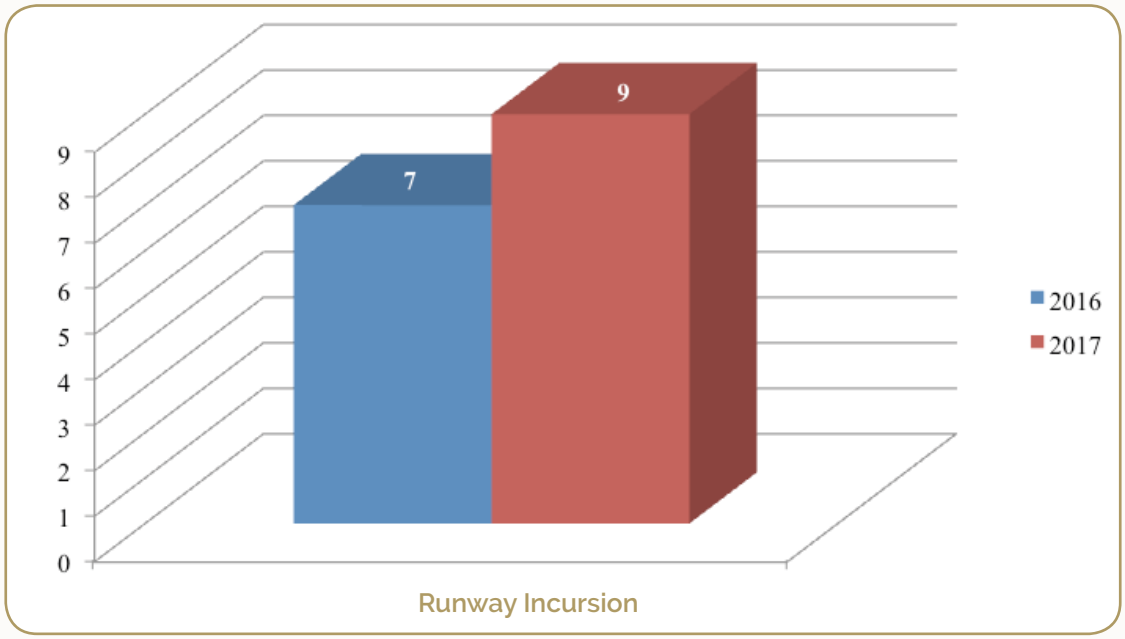
Ground Handling:

48 ground handling incidents occurred in 2017. They decreased by 25 incidents compared to 2016 with a reduction rate of 34%. This reflects the enhancements in the services rendered by catering trucks, airplane tugs and baggage vehicles which resulted in the prevention of collisions with the aircraft during servicing.



Runway Incursion:

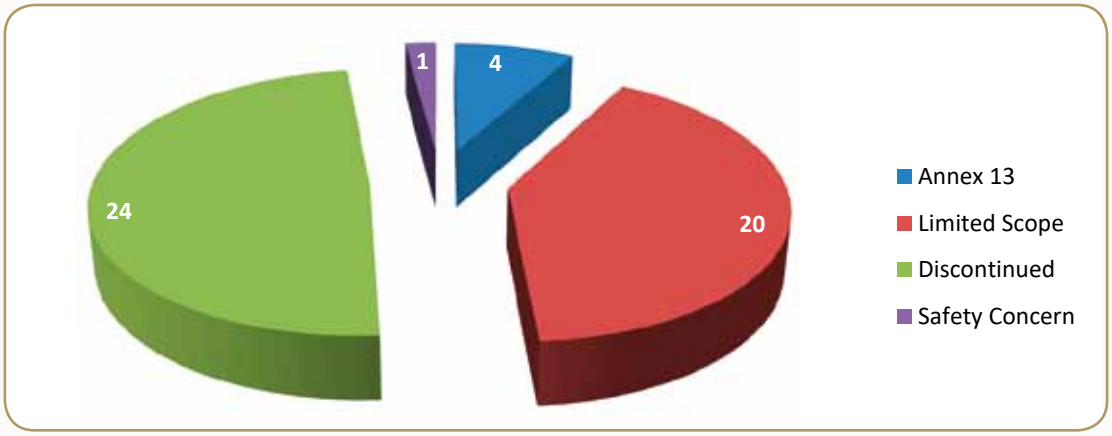
Runway Incursion events are one of AIB's safety concerns. A total of 9 occurrences were registered in 2017, which represents an increase rate of more than 28% compared to 2016. These occurrences' safety investigations are still in progress.



Safety Investigations:

A total number of 61 investigations were initiated in 2017. 49 investigations were completed and the following reports were released:

- 4 Annex 13 format investigation reports.
- 20 Limited Scope Investigation reports.
- 24 discontinued investigations reports/ short investigation closing reports.
- 1 safety concern report.



49 Released reports in 2017

The initial analysis of a reported occurrence will reveal its seriousness and the expected outcome. Thus enabling the AIB to take the appropriate decision of commencing an investigation or not. Notwithstanding that approach, the AIB has taken the appropriate measures so not to impact its obligations to conduct core business activities in accordance with Annex 13 SARPs.

Additionally, the classification of the level of response and the investigation levels has greatly contributed to the success of the AIB to conduct effective and efficient investigations within a reasonable timeframe and resources. Short/ limited scope investigations have been conducted through the office-based investigations for occurrences that are common and the underlying factors are well known.

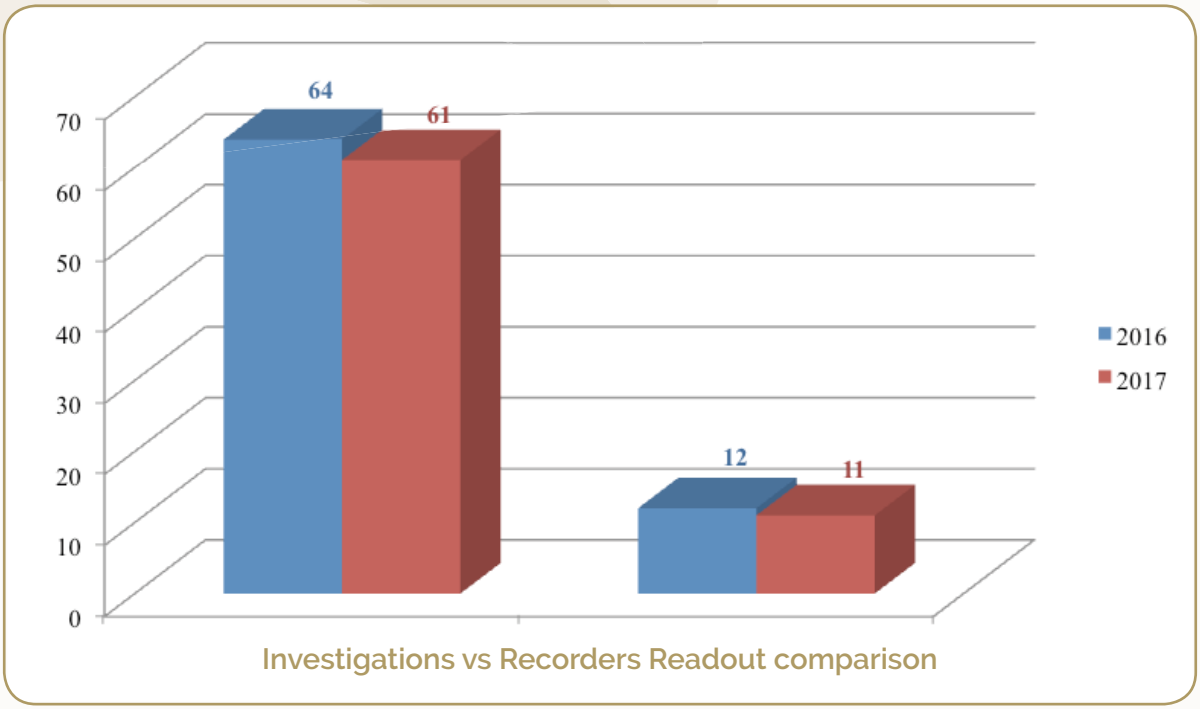
Discontinued investigation and short closing reports for occurrences sharing similar factors with previously investigated occurrences has also served the AIB objectives. This is a common practice in most investigation authorities.

Flight Recorders Download and Analysis:

In 2017, Flight Recorders L ab participated in 11 investigations conducted by AIB, involving 18 recorders. The product of these analysed factual data are plots, excel sheet text data tables, audible sessions conducted in CVR LAB; all populated in FRL reports as an integral part of conducted safety investigations.

RECORDERS DOWNLOAD AND ANALYSIS					
Period	KSA Registered Aircraft	Foreign Registered Aircraft	Occurrences in KSA	Occurrences Abroad	Recorders Downloaded and Analyzed
1st Quarter	1	3	4	0	6
2nd Quarter	1	2	3	0	5
3rd Quarter	0	1	1	0	1
4th Quarter	2	1	3	0	6

RECORDERS DOWNLOAD AND ANALYSIS					
Qtr	Date	Occurrence Title	Flight Data Recorder	Cockpit Voice Recorder	FRL Report
1st	FEB 11	Iraqi Airways YI-AQZ, fire had ignited at the lower area of the left main landing gear, Jeddah.	Downloaded	Downloaded	FRL-2017-04-01
	MAR 6	Nasjet Flight, Flight number 49915, N753NS Hard Landing at Al Dawadmi.	Downloaded	N/A	In Process
	20 MAR	Nesma, VP-CXJ, Air Turbulence, Jeddah.	Downloaded	N/A	Safety study
	20 MAR	Saudia Airlines, HZ-ASI, Nose Landing gear turned 180 degrees during roll after landing, in Bisha.	Downloaded (at aircraft)	Downloaded	FRL-2017-08-01
2nd	APR 28	Nesma, SU-NMC, After landing aircraft over-run the runway, in Abha.	Downloaded	Downloaded	FRL-2017-05-01
	APR 29	Nasjet Flight, N129NS, Air Turbulence, approaching Jeddah.	Downloaded	N/A	Safety study
	MAY 3	Saudia Airlines, HZ-AQD, Hydraulic system problem, Dammam.	Downloaded	Downloaded	No Further Investigation
3rd	AUG 8	Saudia TC-OCF, Smoke in Cabin during Taxi, in Jeddah.	N/A	Downloaded	N/A
4th	NOV 3	Sudan Airways ST-ATB, Engine NO.2 had sparks coming out of exhaust section after landing during reverser power mode, Jeddah, KSA.	Downloaded	Downloaded	In Process
	DEC 9	Saudia Airlines, HZ-AK40, Tail Strike during Take-off, in Jeddah.	Downloaded	Downloaded	N/A
	DEC 23	Saudia Airlines, HZ-ASQ, Main landing gear caught fire after landing, taxi and had being parked.	Downloaded	Downloaded	In Process



Investigations vs Recorders Readout comparison

Significant Ongoing Investigations:

Abnormal Runway Contact (ARC) Hard Landing AIB-2017-0113:

On 18 January 2017 at 15:00 LT, a Hawker Beechcraft 750, registration N753NS, was being operated by NASJET on Flight Number 49915 from Riyadh, King Khalid International Airport (OERK) to Al Dawadmi, Prince Salman Bin Abdulaziz Airport (OEDM) and back to OERK. The flight was intended for landing practice of the newly hired First Officer (FO). The aircraft was also carrying five (5) non-revenue NASJET staff members as passengers and one flight attendant. The first leg was uneventful taking off from Runway 15L at OERK and planning for VOR approach on RWY 15 at OEDM. After the full stop landing at OEDM, the crew taxied back to Runway 15 to do a visual pattern to another full stop landing. The takeoff and pattern were uneventful. During the second landing attempt, at about 50 to 75 feet, the FO reduced power to idle very quickly. At that point, the Captain took the controls to execute a Go-Around (GA) but the aircraft landed hard and bounced back into the air. Since the engines were spooled up, the Captain continued the GA, raised the gear and flaps up position and decided to return to OREK to inspect the landing gears. Upon arrival to OERK, the Captain visually inspected the landing gear with no damage noted.

No technical logbook entry was made and the incident was not reported. The incident aircraft continued to operate in revenue flights for 21 cycles and a total of 35.8 hours with reports of a fuel leak and landing gear indication irregularities. On 23 February 2017, the aircraft was flown to a certificated repair station in Jeddah (OEJN), Saudi Arabia due to a fuel leak in the right wing of the aircraft.

On 28 February 2017, the incident was reported and the AIB initiated an investigation of the reported serious incident.

The investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties were notified and Accredited Representative (AR) are nominated. The flight data recorder was removed and downloaded. The investigation team visited the repair station and inspected the damages to the aircraft. The AIB has released a preliminary report on the occurrence and in the process of finalizing the final report.

System/Component Failure or Malfunction (Non- Powerplant) (SCF–NP), AIB-2017-0136:

On 20 March 2017, a Saudi Arabian Airlines Airbus A321-211, Registration HZ-ASI, was performing Flight Number SVA 1733 from King Khalid International Airport (OERK) to Bisha Domestic Airport (OEBH). The enroute phase of the flight to Bisha was uneventful. After landing on Runway 36 at Bisha Airport and during the aircraft's deceleration to approximately 70 knots, the flight crew heard a loud sound and felt a high vibration followed with the aircraft tending to slightly drift to the right. The flight crew managed to maintain the aircraft on the center of the runway until it came to a complete stop. The flight crew called Bisha Air Traffic Control Tower reporting the event and requesting assistance from both the Fire & Rescue Service (FRS) and the line maintenance crew. The aircraft was disabled on the runway. The airport was closed and all other inbound flights diverted to nearby airports. The passengers were deplaned normally on the runway and were transported to the terminal. No injuries were reported. During the aircraft recovery process, the maintenance crew managed to free the broken and stuck torsion link at the lower section of the nose strut after temporarily removing the right nose wheel & tire assembly and realigning the nose gear to be connected to the towing bar. The aircraft was towed to a remote area at Bisha Airport to clear the runway and resume operation. The runway was closed for more than three hours.

The AIB dispatched an investigation team to the incident site to conduct onsite investigation. The CVR and FDR were removed and delivered to AIB's flight recorder lab for processing.

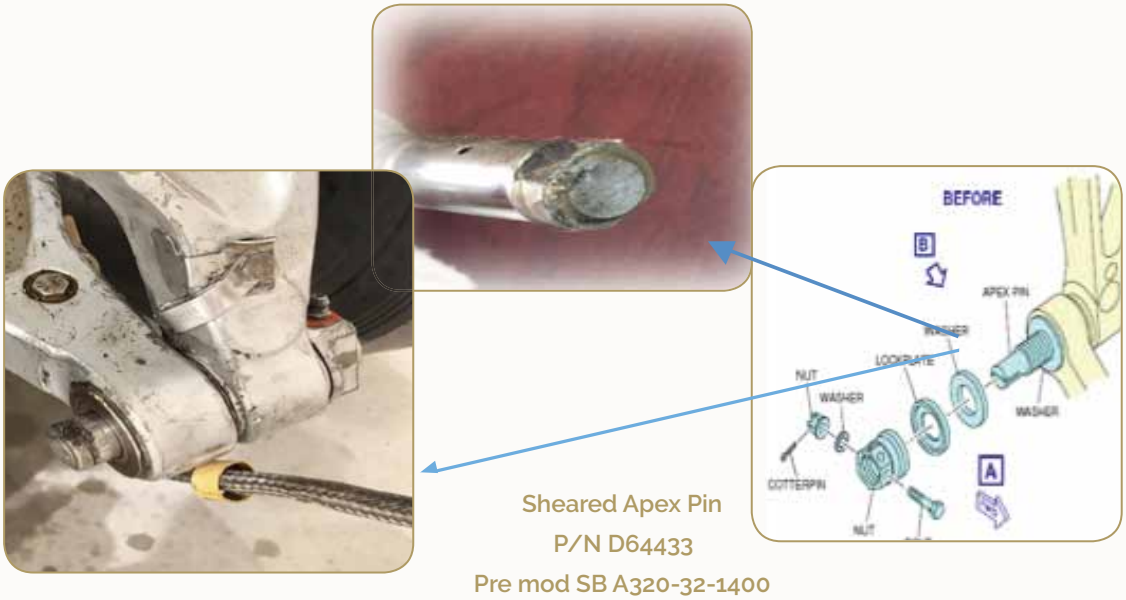
Nose Landing Gear Damage:

The investigation revealed that the NLG torque-link apex pin sheared off causing the torsion link separation and NLG lower strut to be rotated 180 degrees. Subsequent damages to the inboard wheel halves of the NLG, Tire Pressure Indication Sensor (TPIS) electrical harness separation in two halves and numerous other nose gear components.

The investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties were notified and the BEA nominated an Accredited Representative (AR).

The apex pin was sent to the BEA lab for metallurgical analysis in the presencea of the AIB and NLG manufacturer and a report was concluded.

The AIB has released a preliminary report on the occurrence and in the process of finalizing the final report.



Sheared Apex Pin
P/N D64433
Pre mod SB A320-32-1400

Runway Excursion (Over Run), AIB-2017-0225:

On 28 April 2017, an Airbus 320-232 aircraft with registration SU-NMC was being operated on a scheduled flight from Cairo International Airport (HECA), Egypt to Abha Regional Airport (OEAB), Saudi Arabia. During the approach, the weather information broadcast on the ATIS at 20:00 hours indicated thunderstorm and rain over the airfield. Wind direction 030˚ degrees at speed of 10 knots (Kts), and visibility of 9 kilometers. Runway in use was 31. On initial contact with (OEAB), the tower Controller advised the PIC of light rain and wet runway. The crew intended to land with auto brakes set to Low. Later, the tower controller advised the flight crew of a moderate rain and he had visual contact with the aircraft. The flight crew reported runway in-sight and they asked for landing clearance. The controller cleared NMA154 for landing and provided them with wind direction and speed.

SU-NMC touched-down at approximately 1446 meters from the beginning of runway 31 with a ground speed of 168 Kts and auto brakes set at Low. Twenty seconds after touchdown, with 700 meters remaining to the runway end, and at a ground speed of 100 Kts, the PIC used manual braking with the thrust reverser fully deployed. The flight crew managed to control the aircraft on the runway centerline. The aircraft overran the end of runway 31 at a Ground Speed of 60 Kts until it came to a full stop at approximately 186 meters on compacted ground on the runway-end safety area.

Plotting of the aircraft final stop on runway 31

The PIC shut down both engines and declared an emergency. He also, requested a push back truck. The tower controller initiated an emergency Alert-3 and closed the runway. Airport Fire and Rescue Services (FRS) responded to the incident site. The aircraft was visually inspected for structural damage and leak with nil findings. The aircraft was towed to the apron stand escorted by FRS. Passengers were deplaned normally at the stand with no reported injuries.

The investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties (IP) were notified and the Accredited Representatives (AR) were nominated. The AIB has released a preliminary report on the occurrence and in the process of finalizing the final report.

System/Component Failure or Malfunction (Powerplant) (SCF–PP), AIB-2017-0582:

On 29 November 2017, Sudan Airways Airbus A-300-600, Registration ST-ATB was performing a passenger Flight Number SUD-220 from Khartoum International Airport (HSSS) Khartoum, Sudan to King Abdulaziz International Airport (OEJN) Jeddah, Kingdom of Saudi Arabia. There were two hundreds and one (201) Peoples On Board (POB). The flight was cleared to land on Runway 34L by Jeddah Air Traffic Control (ATC) tower controller.

After touchdown on runway 34L and when the aircraft speed reached 80 knots, the FDC noticed the illumination of two (2) amber lights indicating the right engine "Low Oil Pressure" warning on the cockpit instrument panel and heard an unusual loud bang from the right side of the aircraft. In conjunction with that, the ATC tower controller notified the FDC that streaks of fire appeared to be coming out of the right engine. Consequently, the FDC immediately shut down the right engine. Although the FDC did not have any "Fire Warning" indications on the instrument panel, they elected to discharge one of the right engine fire bottle as a precautionary measure.

As the aircraft came to a complete stop on runway 34L, the FDC shut down the operating left engine as well. Shortly afterwards, the FRS arrived at the aircraft while it was sitting on the runway and inspected the aircraft noting there was no evidence of any fire on the right engine. The passengers were deplaned normally and were transferred to the terminal with no injuries reported and the aircraft was towed to the ramp parking area.

The CVR and FDR were removed and delivered to AIB's flight recorder lab for processing. The recorders were downloaded instantly to support the on-going AIB investigative activities. The on-site investigation phase was completed and the

investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties were notified and Accredited Representative (AR) are nominated. The Sudanese AR participated in the CVR listening session and FDR analysis. The investigation is ongoing and will further analysis of the engine parameters and engine teardown and inspection report.

Photo of the aircraft on the ramp area in Jeddah Airport

System/Component Failure or Malfunction (Non-Powerplant) (SCF–NP), AIB-2017-0616: On 22 December 2017, Saudi Arabian Airlines, Airbus A321 aircraft with registration number HZ-ASQ, was performing a passenger Flight Number SVA501 from Kuwait International Airport (OKBK) to King Abdul-Aziz international airport (OEJN). After landing on runway 16-R, the aircraft taxied-in to apron parking stand. As soon as the aircraft came to a complete stop at the designated parking stand, the ground services personnel placed the shocks at nose landing gear wheels

When he was about to move to the main landing gear, he observed right main landing gear brake assembly catching fire. Immediate action was taken by the ground personnel to fight the fire using apron wheel-fire extinguisher. Initially, they managed to put out the fire but the fire kept on reigniting. Shortly afterwards, the airport Fire and Rescue Services (FRS) arrived at occurrence site and effectively responded by fighting the fire and cooling the brakes. Afterwards, the passengers were deplaned smoothly and safely through normal air stairs with no panic or injuries reported. Upon notification, the AIB immediately dispatched an investigation team to conduct site investigation. The CVR and FDR were removed and delivered to AIB's flight recorder lab for processing. The recorders were downloaded successfully. Wheel number 3 of the right MLG was also removed and quarantined by the investigation team.

The on-site investigation phase was completed and the investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties were notified and Accredited Representatives (AR) are nominated. The investigation is continuing and will include:

- Further analysis of the FDR.
- Detailed inspection of the wheel and brake assembly and further analysis.
- Consultation with the BEA Accredited Representative and the Brake Assembly Manufacturer.
- Review of the aircraft maintenance records.

Photo showing the fire on the right wheel of the MLG as the aircraft stopped at the stand

System/Component Failure or Malfunction (SCF–NPP) departed wheel, AIB-2017-0623:

On 27 December 2017, a Saudi Arabian Airlines Airbus A330-300, registration HZ-AQC was performing Flight Number SVA895 from Lucknow (LKO) to Riyadh (RUH) with 300 passengers on board, had backtracked runway 27 and was turning around to line up for departure during which the left wheel of the Nose Landing Gear (NLG) assembly detached from the NLG axle and travelled on the runway resting on the runway curb. The Flight Crew stopped the aircraft on the runway and called for emergency services assistance.

The LKO airport authority closed the runway and initiated the necessary response. All the passengers were deplaned on the runway through movable air stairs and eventually the aircraft was towed to a designated parking in the apron. Six hours later, the runway was reopened and normal airport operation was resumed. The aircraft NLG left wheel assembly sustained substantial damage damages and limited to the NLG right wheel and the NLG axle.

The AIB has instituted an investigation into the subject incident as the Indian AAIB-MOCA decided not to investigate. The AIB has quarantined the aircraft flight recorders and incident wheel assemblies. The investigation is conducted in accordance with the AIB regulation and SARP of annex 13 of ICAO. All Interested Parties were notified and Accredited Representatives (AR) are nominated. The investigation is continuing and will include:

- Downloading of the flight recorders.
- Further analysis of the FDR.
- Detailed inspection and analysis of the wheel assembly and NLG axle.
- Consultation with the BEA Accredited Representative and the NLG Assembly Manufacturer.
- Review of the aircraft maintenance records.

Photo showing the incident aircraft on runway 27 at LKO airport

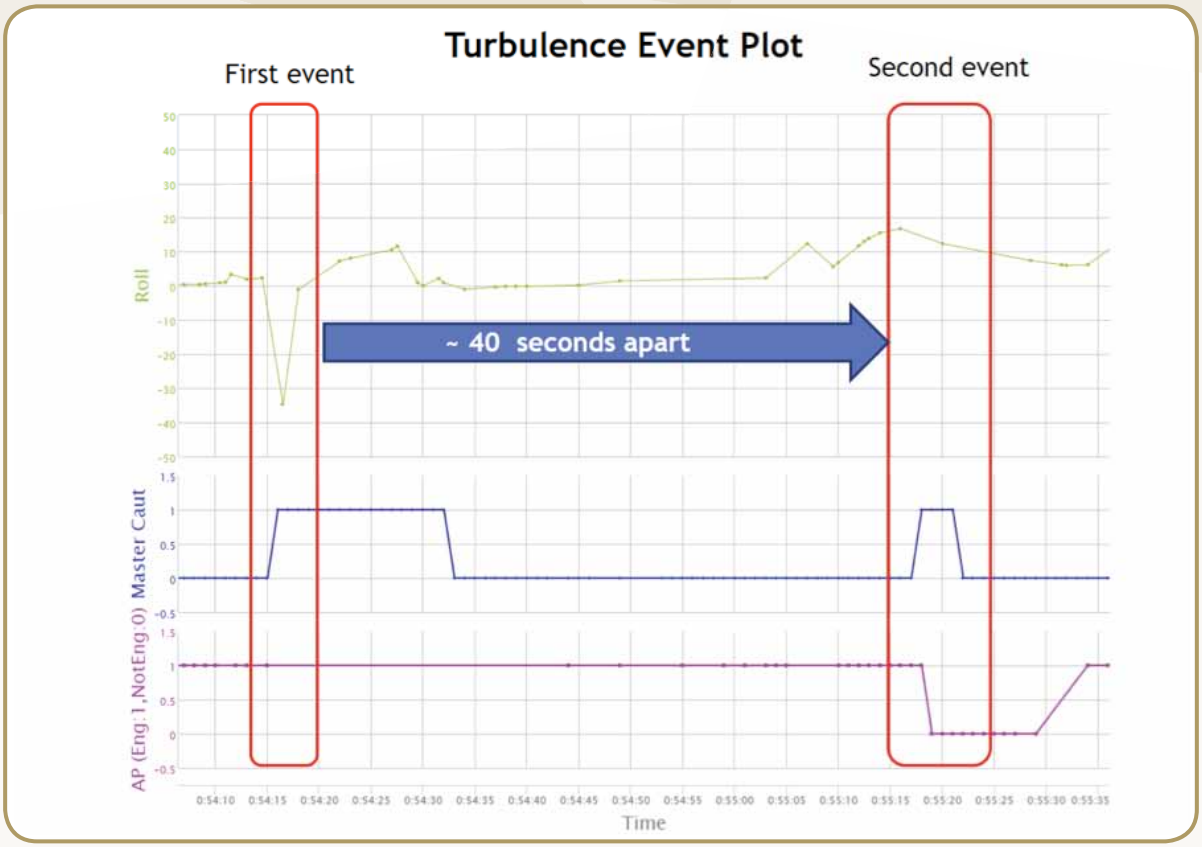
Significant Completed Safety Investigations:

The following significant investigations were completed and their reports were released during the year 2017:

Photo shows the aircraft wedged against rubble and the damage to aircraft.

Case Number	Date	Class	Category
AIB-2014-0293	03/12/2014	Accident	Fuel Exhaustion (Fuel)

Narrative	Conclusion
A Cessna 340 twin-engine airplane was on final approach to land at King Khalid International Airport (OERK) – Riyadh, Kingdom of Saudi Arabia (KSA). At approximately 600 feet altitude, the left engine sputtered and quit and ten (10) seconds later the right engine quit. The pilot quickly notified the Air Traffic Control Tower of the emergency due to the loss of power in both engines. The airplane touched down on the desert like terrain outside the perimeter fence of the airport, skidding and then hit a pile of rocky earthen rubble. The Pilot Monitoring (PM) broke his left wrist during the accident. The other pilot did not incur any injury. The aircraft sustained substantial damage. And it was written off.	The investigation concluded that the aircraft's fuel exhaustion resulted in the subsequent off airport landing. The Pilot-In-Command (PIC) did not accurately calculate the required fuel necessary to complete the flight from Hurghada to Riyadh. The flight crew was aware that the quantity of fuel onboard the aircraft was low but did not notify ATC of the pending fuel shortage. The flight crew may have encountered continuation bias, which relates to continuing the approach into OERK, believing they may be able to land the aircraft safety. The investigation identified a number of safety issues associated with fuel adequacy when transition over remote area where avgas is not readily available.



Case Number	Date	Class	Category
AIB-2014-0220	16/09/2014	Serious Incident	TurbulenceEncounter (TURB)

Narrative	Conclusion
During the initial descent towards Jeddah at Flight Level FL307 and FL294, the Gulfstream G-IV aircraft encountered wake turbulence produced by a preceding Boeing 777. The Gulfstream G-IV aircraft rolled violently twice within a time frame of forty (40) seconds. In both instances, the flight crew immediately recovered from the unusual attitude. The remainder of the flight was uneventful and the aircraft landed safely in Jeddah. One passenger sustained a minor injury. The injury was attributed to the aircraft interior furniture that had abrasive edges.	The investigation findings concluded the facts that the aircraft flew throughthe wake vortices created by the preceding Boeing B777 and the prevailing light winds at altitude did not completely dissipate the generated wake vortices. The investigation identified a number of safety issues associated with the aircraft flight recorders and the cabin furniture.

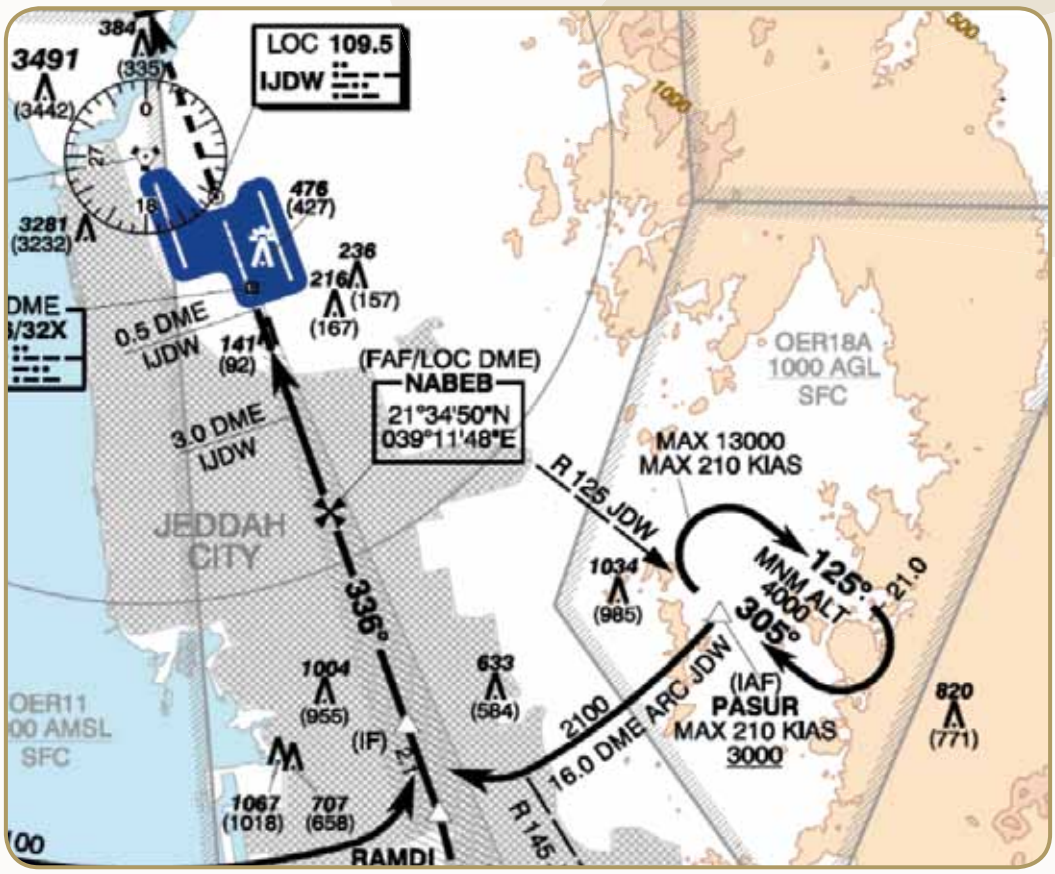
Side view of affected burn and delamination area around the aircraft engine No.4

Case Number	Date	Class	Category
AIB-2014-0302	24/03/2013	Serious Incident	System Component Failure or Malfunction (Powerplant) (SCF-PP) Fuel Related (Fuel)

Narrative	Conclusion
During the starting sequence of the aircraft's engine No.4 (P&W model PW4056 Serial Number P729221), the Engine-Indicating & Crew-Alerting System (EICAS) generated the following message, "ENG 4 FUEL VLV." The message came on and then went off after several seconds. The message disappeared and all of the number 4 engine's parameters were normal. The crew opted to continue the flight. While advancing the throttle levers ~ 64 degrees with the aircraft reaching a ground speed of ~59 knots (Kts), the No.4 engine reached a maximum of 1.1 EPR (Engine Pressure Ratio), approximately 0.2 EPR less than the other engines. During the takeoff roll, three (3) faults for the engine were recorded. The EICAS displayed the following messages, "ENG 4 CONTROL" & "ENG 4 FUEL VLV," followed by a number 4 engine N2 Redline Exceedance accompanied by a loud rumbling noise. The crew Aborted Take-Off and the aircraft returned to the gate. During the engine fault troubleshooting processes, the engine experienced an engine tailpipe fire.	The investigation concluded that contaminated fuel affected the operation of servo driven components resulting in the N2 Redline event. The fuel samples from the 9M-MPM did not meet acceptable quality standards. The Aircraft 9M-MPM had a history of number 4 engine of faults that were likely not properly addressed during previous maintenance actions. The investigation identified a number of safety issues associated with the aircraft maintenance and the CAA oversight along with the fuel storage facilities at WMKK.

Case Number	Date	Class	Category
AIB-2016-0098	17/03/2016	Serious Incident	System Component Failure or Malfunction (Non- Powerplant) (SCF-NP) and Evacuation (EVAC)

Narrative	Conclusion
An Airbus 320, Registration Number A6-AOJ, was operating as Air Arabia Flight Number ABY185 from Sharjah International Airport Sharjah (OMSJ), United Arab Emirates enroute to Taif Regional Airport (OETF), Kingdom of Saudi Arabia. During cruise flight, the aircraft's smoke detection system generated numerous warning messages concerning the detection of smoke in the forward and aft cargo bays. The Captain discharged a cargo fire bottle and decided to divert the flight to King Khalid International Airport (OERK), the nearest airport. The aircraft landed safely but the Fire Rescue Service (FRS) was not readily available to meet the aircraft resulting in the emergency evacuation of the aircraft, deploying the emergency slides. No injuries were reported.	The investigation findings concluded the facts that the aircraft smoke detection system was generating numerous false smoke warnings for both the forward and aft cargo bays. The flight crew believed there was an on-going smoke/fire event that necessitated declaring an emergency and diverting the flight to the nearest available airport. Due to the FRS delayed response and what believed to be a strong odor in the aft galley, the Captain gave the command to evacuate the aircraft. One of the galley carts was missing a lid, allowing a very strong odor to permeate the aft galley R2 door area. The investigation identified a number of safety issues associated aircraft system software and maintenace program along with airport FRS response.



IAP on ILS or LOC RWY 34C

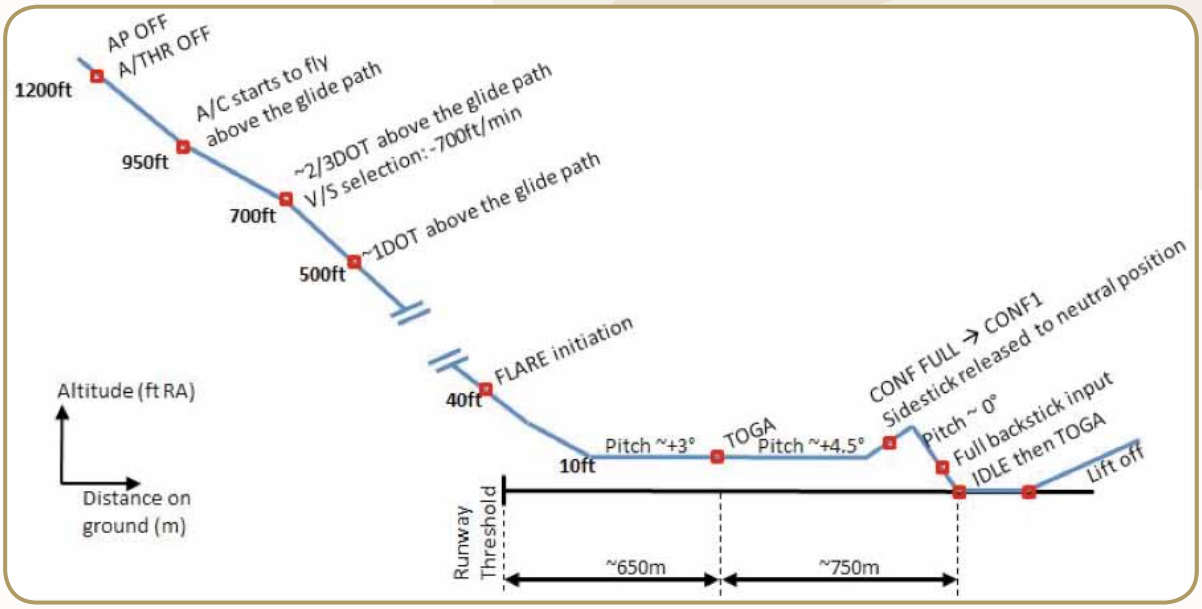
Case Number	Date	Class	Category
AIB-2017-0058	29/01/2017	Serious Incident	TCAS Resolution Advisory (RA)

Narrative	Conclusion
An Airbus A319, Czech Republic Registration OK-OER, operated by Saudi Arabian Airlines on a scheduled Flight Number SVA1290 from Gurayat Regional Airport (OEGT) to King Abdul-Aziz International Airport (OEJN). The OK-OER received TCAS Resolution Advisory (RA) while descending to 3,500ft. The threat had come from a converging traffic, an Airbus A320, United Arab Emirates Registration A6-AOH, operated by Air Arabia on a scheduled Flight Number ABY145 from Sharjah International Airport (OMSJ) to King Abdul-Aziz International Airport (OEJN) while descending to 5,500ft. The TCAS RA was generated around 09:23:05 at 16 Nm southeast of OEJN while both traffic were under lower approach control sector (APL) of Jeddah ACC. The Instrument Approach Procedures "IAP" serving these runways have PASUR point as their Initial Approach Fix "IAF". The conflict was cleared uneventfully and both traffic resumed their flight path.	The investigation concluded the Air Traffic Controller was managing traffic load that was light to moderate. However, the Air Traffic Controller planned to sequence the arrivals without radar vectoring techniques to establish an expeditious and efficient approach sequence. The separation method and the traffic complexity led the Air Traffic Controller to issue anticipated clearances based on his expectations and the Air Traffic Controller intervention to recover the situation was inadequate. The investigation identified a number of safety issues associated to the Controller Air Traffic Mnagement techniques. Two safety recommendations were issued to address the enhancement of the Air Traffic Controllers' capability on vertical speed control.

Iraqi Airways aircraft at the gate with several emergency slides deployed

Case Number	Date	Class	Category
AIB-2017-0080	11/02/2017	Serious Incident	Fire/Smoke (Non-Impact)/ Evacuation (F-NI/EVAC)

Narrative	Conclusion
On 11 February 2017, Iraqi Airways was operating a Boeing 777-200 LR, registered as YI-AQZ, on Flight Number IA2405, departing from Baghdad, Iraq enroute to Jeddah (OEJN), Kingdom of Saudi Arabia. Upon arrival to OEJN, the aircraft was taxied to Apron 6 and parked at Gate A-10 located at the Hajj Terminal. Shortly afterwards, A ground service agent contacted the cockpit crew by headset notifying them that a fire had ignited at the number 1 wheel of the left main landing gear assembly. The crew ordered evacuation and the R3, R4 and L-4 slides were deployed. Approximately 110 passengers evacuated the aircraft using the deployed slides with the remainder of the passengers departing the aircraft through the L1 door that was connected to the Passenger Boarding Bridge (PBB) for routine departure exiting from the aircraft. No injuries were reported during the emergency evacuation of the aircraft.	The investigation concluded that a newly refurbished wheel assembly was installed in the number one wheel location before the flight to Jeddah was initiated. The brake was seeping Skydrol hydraulic fluid and accumulated in the inboard side of the wheel rim. The flammable substance that flowed down the lower section of the wheel assembly reached the flash point after the aircraft was parked and caused the fire to ignite. The emergency evacuation of the aircraft was initiated due to the acknowledgement of the fire and developing panic within the cabin. The investigation identified a number of safety issues associated with operator maintenance procedures and airport FRS response.



Trajectory of the vertical profile of the aircraft during the event

Case Number	Date	Class	Category
AIB-2015-0300	16/11/2015	Serious Incident	Abnormal Runway Contact (ARC) Hard Landing

Narrative	Conclusion
On 16 November 2015, a Saudi Arabian Airlines Airbus A320-214 aircraft, registration HZ-AS34, was operating a scheduled passenger flight designated as SVA 632, from Queen Alia International Airport (OJAI), Amman, Jordan to King Abdul-Aziz International Airport, Jeddah, Kingdom of Saudi Arabia (OEJN). On the final approach for landing at OEJN, during the flare maneuver, the aircraft floated for 10 seconds before the Pilot Flying (PF) decided to go around, selecting the Take-Off Go-Around (TOGA) option and commanded Go-Around Flaps. During which, the aircraft contacted the runway at 2.734 G before the Go-Around Thrust was initiated. As a result of the hard touchdown, the Flap Lock Warning was displayed and the flaps locked at 10 degrees. The second approach was flown at speed of 172 Knots, with a Flaps/Slat configuration of Flaps 1 and Slats 2. The aircraft landed uneventfully.	The investigation concluded that the aircraft experienced gusty and turbulent wind conditions and the Pilot Flying deviated from the Saudi Arabian Airlines procedures by continuing on an unstabilized approach when landing. Additionally, the lack of the Cockpit Resource Management techniques which led to errors that could have initiated a catastrophic event. The PF's actions, according to his assumptions, were based on a pre-occupation of previous experience in a similar situation when a crewmember altered the flap setting and introduced a critical fault in an already flawed landing. The investigation identified a number of safety issues associated with the operator Cockpit Resource Management and Identification of Mental Preoccupation in the Flight Operations ground training.

Case Number	Date	Class	Category
AIB-2017-0391	05/08/2017	Serious Incident	TCAS Resolution Advisory (RA)

Narrative	Conclusion
On 05 August 2017, an Airbus A330, Saudi Registration HZ-AQ11, operated by Saudi Arabian Airlines on a scheduled Flight Number SVA1478 from Prince Mohamed International Airport (OEMA) to King Khalid International Airport (OERK). The HZ-AQ11 received a TCAS Resolution advisory (RA) while descending to 11,000ft. The threat had come from a converging traffic, an Airbus A320, Saudi Registration HZ-AS54, operated by Saudi Arabian Airlines on a scheduled Flight Number SVA1911 departed from King Khalid International Airport (OERK) on RWY 33R to Taif Regional Airport (OETF) While climbing to 12,000ft. The TCAS RA was generated at 18 Nm west of OERK while both traffic were under lower approach control sector of Riyadh ACC. The conflict was cleared uneventfully and both traffic resumed their flight path. The loss of separation incurred was significant and the circumstances, which led to this occurrence, triggered the need to investigate and to address the risk encountered with the controller situational awareness.	The investigation concluded that The Air Traffic Controller who was providing the approach control on Riyadh APL Sector was an On Job Trainee Controller (ATCO1) under supervision. The On Job Training Instructor (OJTI) was supervising the ATCO1 from different position. The shift supervisor intervened from time to time the ATCO1 and provided him with comments. The ATCO1 used non-standard pronunciation while giving instructions to traffic and did not detect erroneous read back. This resulted in the degradation of situational awareness, which led to clearing a converging traffic to an altitude that was in conflict. Moreover, the OJTI intervened to stop SVA1911 climb while both traffic were following their TCAS RA. The investigation identified a number of safety issues associated with the procedual deviation and the inadequancy of the safety features in the existing control station that have been addressed in previous investigation report but not being implemented by the service provider.

Safety Studies:

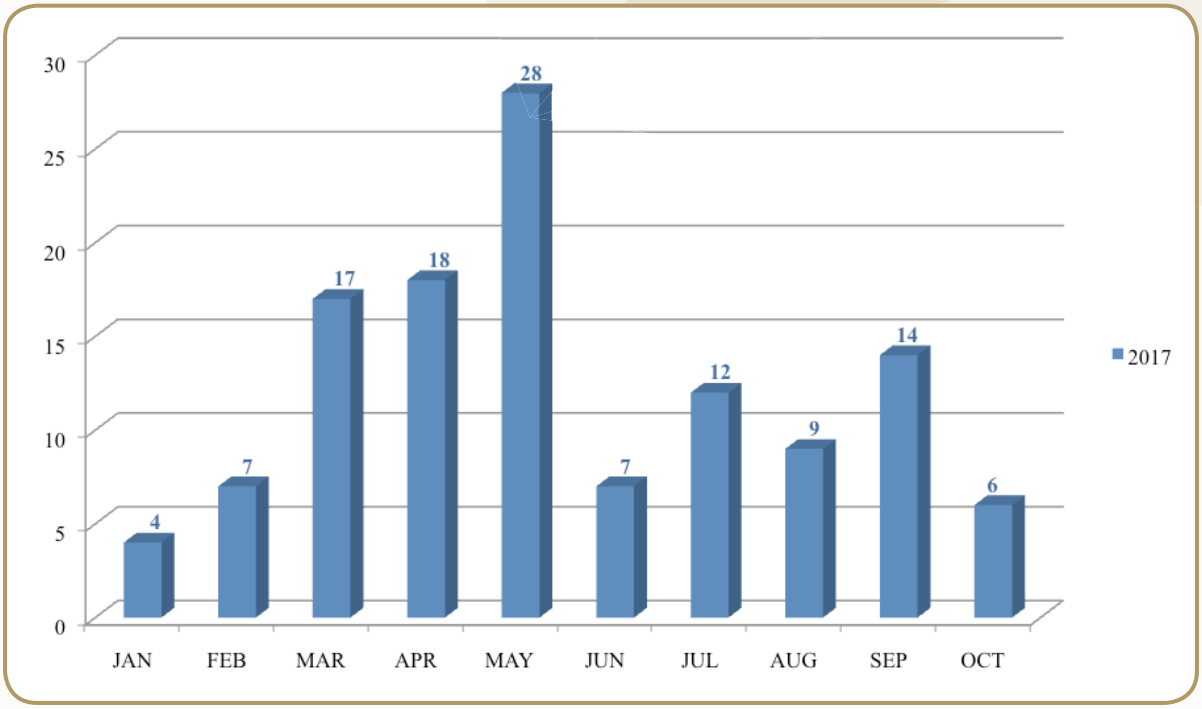
AIB is continuously monitoring the aviation occurrences and coordinate with other stakeholders to conduct safety studies in order to analyze the root causes of these occurrences and define the need for necessary actions to help reducing aviation accident. In 2017, AIB has conducted two ongoing studies, a bird-strike and a Wake-turbulence with all stakeholder's participation.

Bird strike:

Bird strike incidents represent a significant concern for the aviation industry. As shown in the graph below, the number of bird strikes in Saudi Arabia has an increase of 49 incidents and increased up to 123 occurrences in 2017, which represents an increase of more than 67% compared to 2016. AIB has initiated a bird-strike study to analyze the phenomenon and identify the root causes.

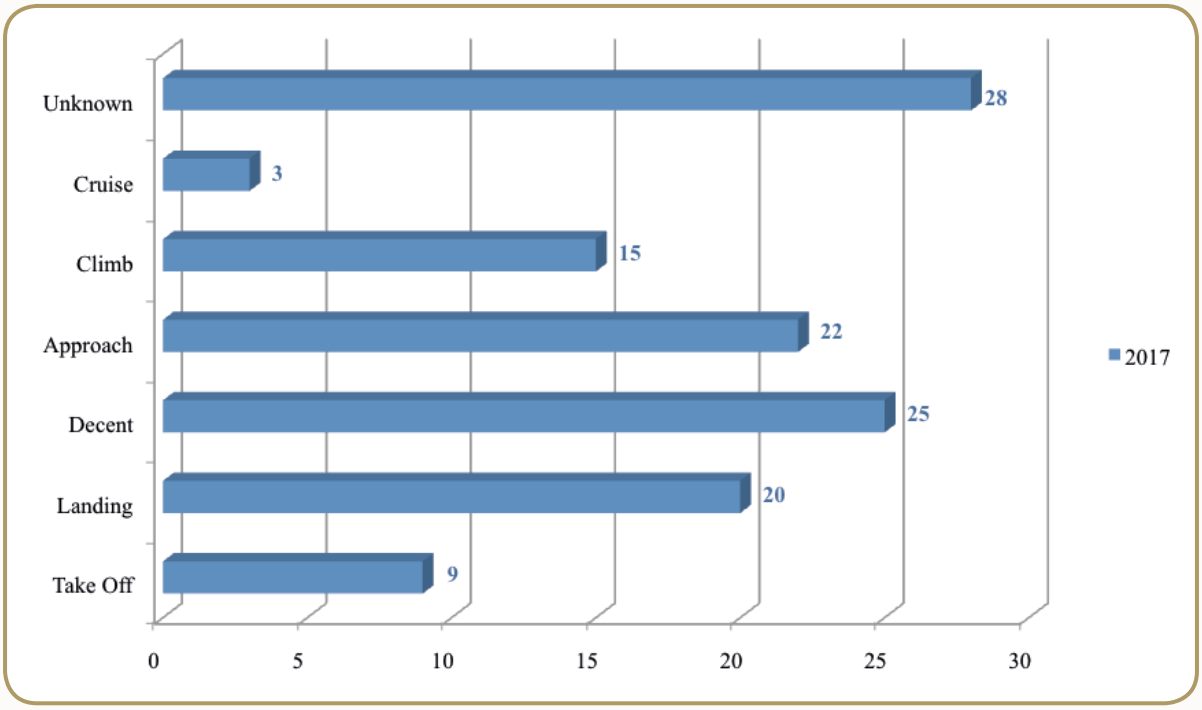
It was observed that the number of bird strike incidents in 2017 has increased to 123 compared to 74 incidents in 2016. The damages to the aircraft were reportedly minor, and all of the occurrences were consequently not serious in nature.

Most bird strike events occurred in May with 28 events. and the least was in January with 4 events.



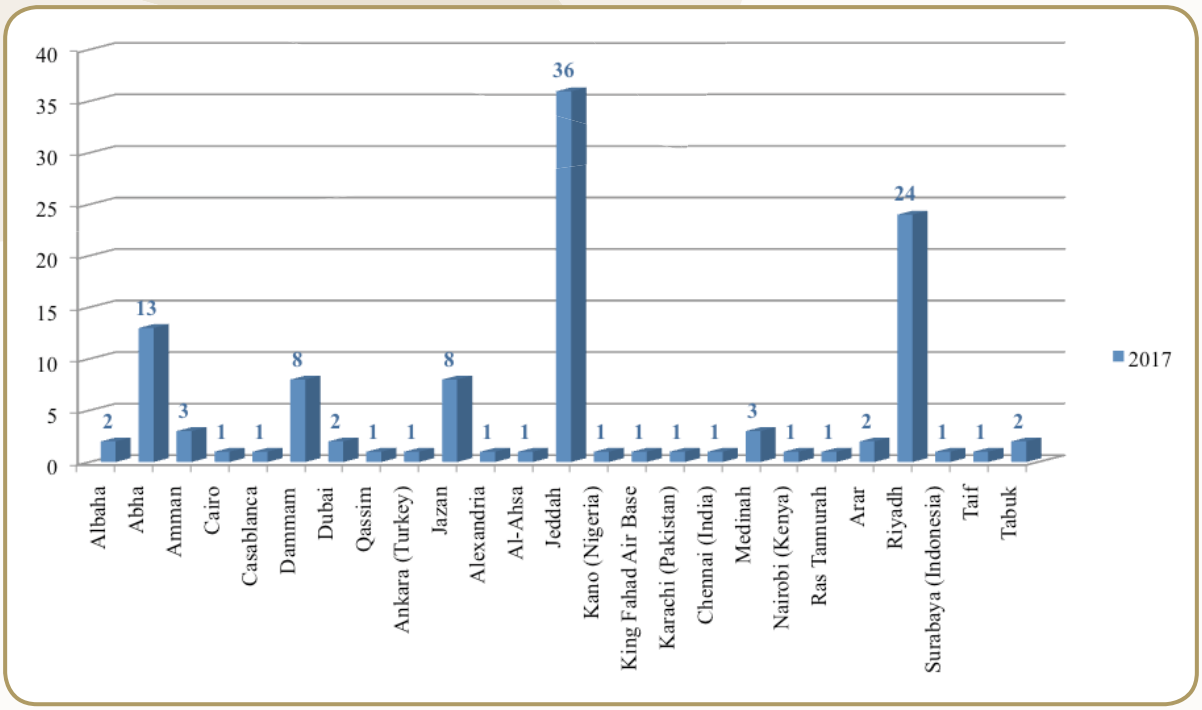
Bird Strikes in 2017 (JAN-OCT)

However, it was observed that 9 (7%) occurrences were during takeoff, 20 (16.6%) during landing, 25 (20.8%) in Descent phase, 22 (18.3%) during approach, 15 (12%) during climb, 3 (2.5%) during cruise and 28 events were unknown.



Distribution of bird strikes according to phase of flight

Out of 122 reported bird strike events, 103 events occurred in SaudiA Arabia. Most of them were reported in Jeddah with 36 events (30%), followed by Riyadh with 24 events (20%), Abha with 13 events (10.8%) and both Dammam and Jazan with 8 events each (6.7%). Other KSA airports had a total of 14 events (11.6%).



Distribution of bird strikes notifications according to airport

All stakeholders agreed on enhancing reporting and providing more details in the notifications to allow for future in-depth analysis.

Wake turbulence:

With the increase of the overall volume of air traffic and enhanced navigation precision, wake turbulence encounters in the en-route phase have progressively become more frequent in the last few years. AIB has initiated a wake-turbulence study to analyze the phenomenon and get to the root causes.

On January 7th, a Bombardier Challenger 604 aircraft encountered wake turbulence when it was passing 1000 feet underneath an opposite direction Airbus 380. The effect of the wake turbulence caused the aircraft to lose control, roll three to five times, flame out engines and lose almost 9,000 feet of altitude before recovering. The aircraft received damage beyond repair due to the G-forces, and was no longer serviceable due to the encounter of this incident which exceeded the Bombardier CL604 Challenger's airframe certification design load and the aircraft could not be repaired to an airworthy state.

The incident occurred as the aircraft was flying at 34,000 ft. between Male, Maldives and Abu Dhabi's Al-Bateen airport, when a UAE-registered A380 flying at 35,000 ft. from Dubai to Sydney, Australia, passed overhead. Around 45 seconds later, the Challenger began to roll, with the bank angle steadily increasing, from 4 deg. to 6 deg. over 10 seconds. Then, within one second, the bank angle increased to 42 deg. The airplane continued to roll despite control inputs by the crew and it completed several rotations.

Flight data recorders showed vertical acceleration of 1.6G before fluctuating to 3.2G. The aircraft lost some 8,700 ft. of height, and airspeed increased to 330kts before the pilots managed to engage the spoilers. The crew declared an emergency and diverted to Muscat, Oman where the aircraft landed safely two hours after the incident.

A statement from the flight attendant, who had been looking after the aircraft's six passengers states the "airplane had turned three times around its longitudinal axis, during which the occupants had been thrown against the ceiling and the seats". In the cabin, there was damage to seats and panels while seat armrests on four seats in the front had been deformed or had fractured. The investigation of this incident continues.

The wake turbulence effect simulation

Damage caused by wake turbulence in a recent investigation

There is now a worldwide concern regarding the effects of the A380 wake and other heavy aircraft, and the objective of this safety study is to enhance the awareness of risks associated with wake turbulence encounters, and find out the appropriate actions with the purpose of mitigating the associated risks.

A working group of experts from the aviation community in KSA called for by the AIB and a workshop was conducted in August 2017.

Wake Turbulence Workshop Session

The working group evaluated the current precautionary measures implemented in KSA to mitigate the risks associated with wake turbulence and conducted a review and an evaluation of similar studies on the topic conducted by EASA and other regional states. The study is still in progress.

Safety Recommendations:

Safety recommendations are the primary product of the AIB safety investigations. They address specific issues revealed during investigations and specify actions for the recipient to help prevent recurrence. There are two types of safety recommendations as follows:

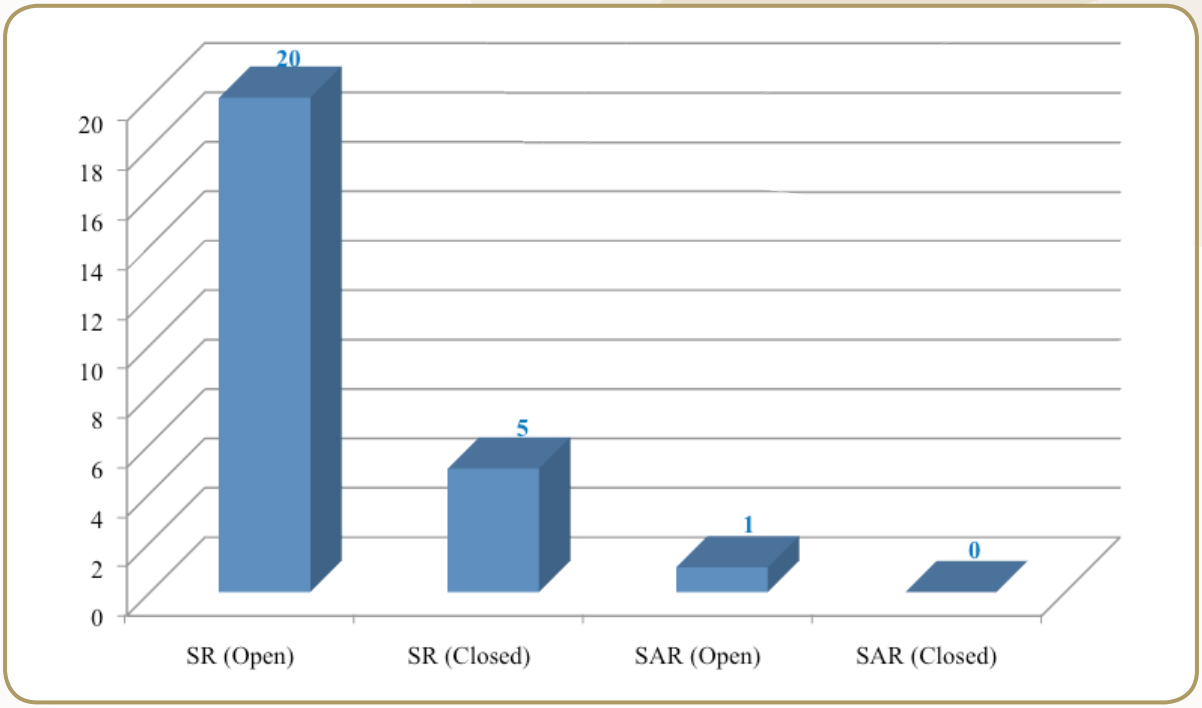
Safety Recommendation (SR):

A proposal by an investigation authority based on information derived from an investigation made with the intention of preventing aviation occurrences and which in no case has the purpose of creating a presumption of blame or liability for an aviation occurrence. In addition to safety recommendations arising from aviation occurrence investigations, safety recommendations may result from diverse sources, including safety studies.

Stand-Alone Recommendation (SAR):

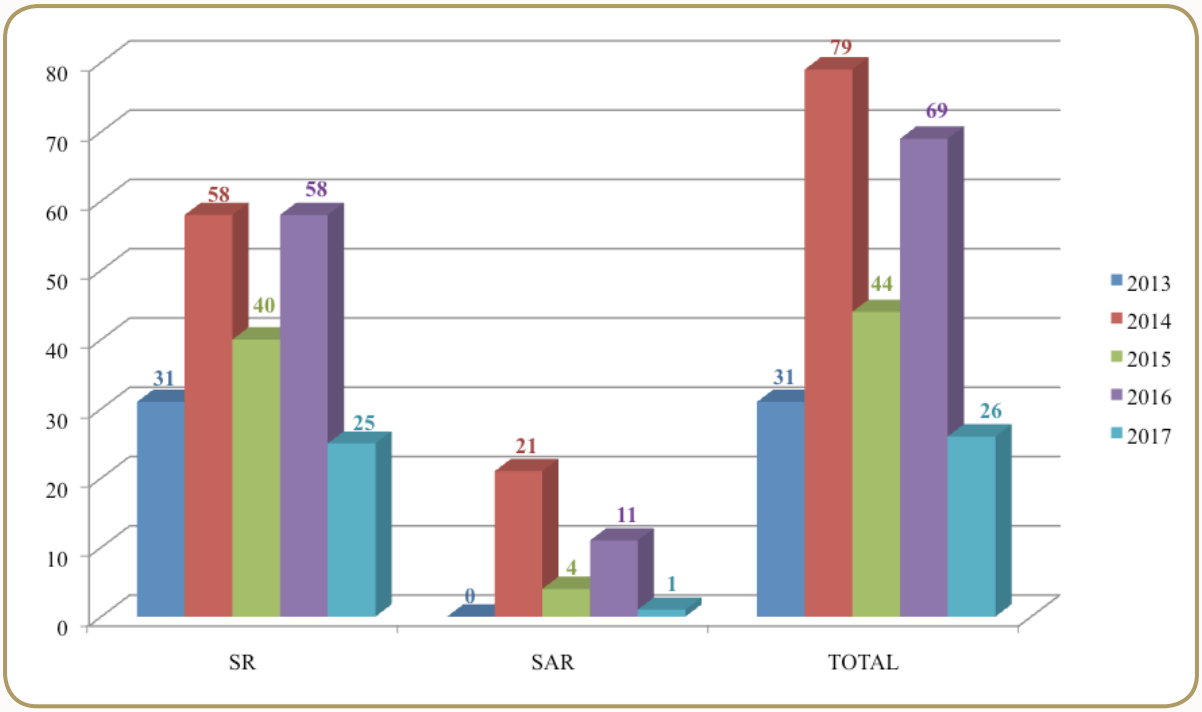
Any safety deficiency that becomes known during the course of the investigation for which prompt preventative action is required, shall be disclosed immediately through a Stand-Alone Recommendation (SAR) to all concerned parties including appropriate authorities in other States and ICAO, whenever any ICAO documents are involved.

Recommendations are addressed to the relevant interested parties In 2017, AIB issued a total of 26 safety recommendations (SR & SAR) upon completion of investigations.



26 Safety Recommendations (SRs and SARs) issued in 2017.

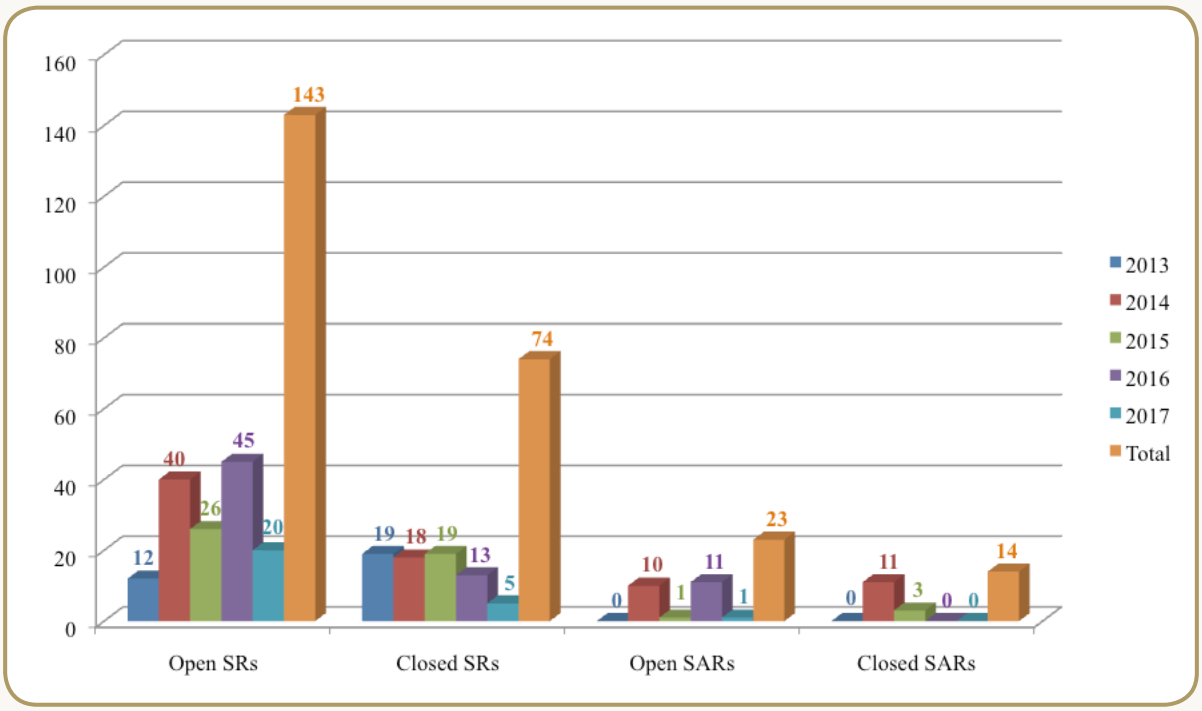
Once a safety recommendation issued, the safety department develops and coordinate strategies to encourage recommendation recipients to implement the recommendations. The AIB also tracks and analyzes the recipients' responses and suggests a classification for the recommendation panel review. Each recommendation followed and evaluated until it is closed, and each closed proposal designated with a notation, such as "acceptable action" or "unacceptable action." Various other designations denote satisfactory, neutral, and unsatisfactory results.



Recommendations status by year

Recommendations Response Status:

Since the establishment of the AIB in 2013, 35% of total issued safety recommendations were closed. AIB is targeting to achieve an 80% closure of all issued safety recommendations in the next three years as a benchmark with reputable state investigation authorities.



Recommendations response status comparison

CHAPTER III
COOPERATION

Cooperation:

Aircraft Accident Investigation is a complex process that requires interactions with numerous organizations, both nationally and internationally. The interaction could be in a number of matters such as exchange of occurrence information, provision of resources or expertise and requirement of facilitation. That is why, it is important for an investigation authority to identify what interactions are required and engage in proper cooperation agreements and mechanisms to ensure readiness for any eventualities. This section discusses cooperation agreements conducted by the AIB.

National Cooperation:

Technical Advisors Program:

Approved by HE The Chairman, and supported by GACA, SANS, and National Operators, AIB developed a program to engage industry professionals from various fields to support AIB investigations. The program included the following:

- Certification by Cranfield University.
- Rules of participation in investigations.
- On-going investigations to ensure continuous On Job Training to maintain credentials.

The program certification training will be repeated in 2018 with industry constituents to complete the array of specialties targeted.

Participants of the Technical Advisory Program

Marine Committee for Disaster Response:

In coordination with the Saudi Coast Guard (SCG) and the King Abdullah University of Science and Technology (KAUST), a national exercise took place in Al-Khafji Port. This exercise comes in line with the AIB strategy to enhance the cooperation with local authorities and ensure readiness through planned activities with the participation of all related authorities engaged in the national disaster committee.

To maintain appreciable level of readiness, the AIB planned for periodic hands-on practice in using the underwater locator beacon detectors. Those exercises involved the participation of our partners at the KAUST Marine Science Unit utilizing their facilities, vessels and AIB equipment.

Two exercises have been conducted in the year 2017 at different locations offshores the Red Sea with the participation of AIB investigation team and KAUST team. The AIB plans to carry on with periodic exercises to achieve the optimum level of readiness and know how to use the underwater beacon detectors utilizing the newly purchased pinger detectors (Hydrophones) which are used for under-water search and locating the position of FDR. There are two types of hydrophones; RJE-PRS 275 and RJE-STI 350.

AIB Investigator on Coast Guard boat receiving FDR in preparation for shipment to shore

FDR (Flight Data Recorder) retrieval by the Coast Guard diver

AIB members adjusting hydrophone receiver during a pinger locating exercise

AIB investigator reading the compass direction after FDR pinger detection

STI 350 Hydrophone receiver used for locating FDR pinger

General Directorate of Civil Defense:

AIB participated in the meeting with the General Directorate of Civil Defense in Jeddah to discuss the emergency drill that was held on 13/12/2017 for the crash of an aircraft outside the airport to clarify the role of the AIB and the mechanism to activate its role and turn over the accident site to the Investigator In Charge (IIC). The AIB participated in this drill and achieved the required objectives. The most important of all in this drill was activating the mechanism of handing over the site of the accident to the investigation team.

General Aviation Security Command:

A visual presentation about AIB and its roles, functions and responsibilities was presented to the General Aviation Security Commander in line with the cooperation and collaboration required in case of aviation accidents. A facilitation Agreement to transfer the investigation teams to accident sites is currently under review.

Saudi Customs:

On 23rd of October 2017, a facilitation agreement was signed between Saudi Customs and the Aviation Investigation Bureau to facilitate the clearance of aircraft parts and equipment for investigation purposes.

The agreement was signed by Mr. Mohammad A. Al-Neaim, Assistant Director General of Customs for Customs Security Affairs and Mr. Abdulelah O. Felemban, the AIB Director General.

The agreement signature ceremony

Regional Cooperation:

Regional Accident Investigation Organization (RAIO) Workshop in Jeddah:

The AIB hosted a RAIO workshop in Jeddah on 25-27 April 2017 that was jointly organized by ACAC and ICAO MID Regional Office. The focus was to revise and finalize the RAIO strategy for endorsement by the DGCA-MID/4 Meeting. Seven Regional States participated in the workshop including representation from ICAO HQ and the MID office.

The aim of the strategy is to contribute to improvement of aviation safety in the MENA states by enabling states to conduct effective and independent investigations of civil aviation accidents and incidents; and support states in fulfilling their investigation obligations in annex 13.

The revised strategy defined three levels of cooperation as follows:

- Level 1: Cooperation among MENA States under the framework of Annex 13 or a standard bilateral agreement.
- Level 2: Cooperation among MENA States under the framework of a regional cooperation mechanism with a defined scope and coordinated mechanisms.
- Level 3: Establishment of a RAIO if deemed necessary by participating states.

The Strategy was endorsed by the DGCA-MID/4 meeting in Muscat Oman on 17 October 2017.

RAIO Participants

RAIO Group Discussion

MENASASI Annual Seminar 2017 – Jeddah

The AIB had the honor to host and organize the 5th annual Middle East & North Africa Society of Air Safety Investigators (MENASASI) Seminar in Jeddah on 7-9 November 2017. The general theme of the Seminar was "Investigation Organization and Management". The first day was dedicated to a full day workshop discussing the organization that is charged to conduct investigations, its requirements and challenges. The following two days agenda addressed the different aspects of the theme, starting from the organization tasked with the function to the process of investigation and its challenges and finalizing it by addressing effective recommendations.

Approximately 150 safety and investigation specialists attended the Seminar from 38 organizations representing the various parts of the aviation industry as follows:

- ICAO.
- ISASI.
- Investigation Authorities.
- Civil Aviation Authorities.
- Operators.
- Air Navigation Services providers.
- Airport Operators.

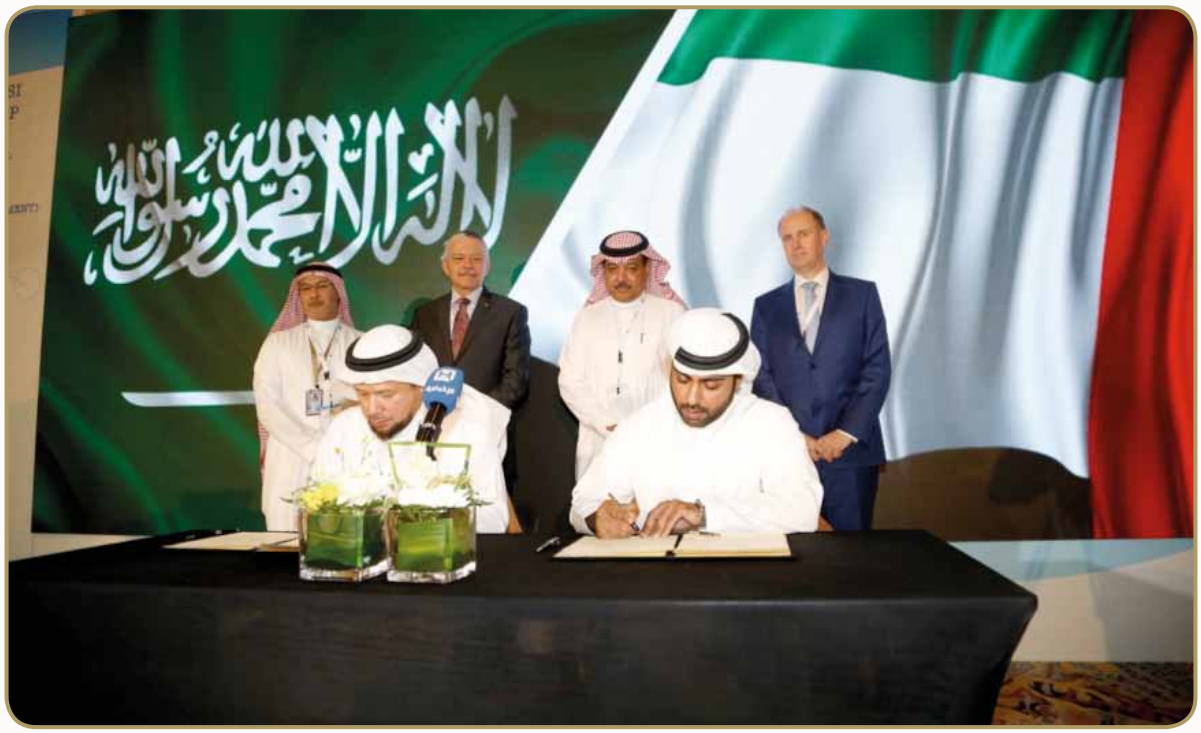
HE GACA President giving the opening speech in the MENASASI Seminar

On 10th November 2017, the third day of MENASASI, A cooperation program agreement in aircraft accident investigations was signed by Mr. Khalid Al-Raisi, GCAA Assistant Director-General for Air Accident Investigation and Mr. Abdulelah Felemban, AIB Director General.

MENASASI Participants

MENASASI Participants

MENASASI Participants



Signing Cooperation Program agreement between KSA AIB and UAE GCAA

Regional Investigation Authorities:

As AIB is actively promoting regional cooperation, and in the spirit of regional and international cooperation, AIB has facilitated for download and readout of 6 recorders for two regional investigation authorities and provided the requesting state authority with full support during the process.

Cooperation with regional investigation authorities					
Qtr	Date	Occurrence Title	Flight Data Recorder	Cockpit Voice Recorder	FRL Report
1st	4 JAN	Royal Air Morocco, runway excursion at Casablanca, Morocco.	N/A	Downloaded	N/A
2nd	24 MAY	Jordan Aviation Company, JY-JAP, Runway Excursion at Tombouctou / Mali.	Downloaded	Downloaded	FRL 2017-05-02
4th	1 OCT	Royal Air Maroc, CN-RNW, Engine Shutdown during cruise mode, Lisbon.	Downloaded	Downloaded	FRL-2017-10-01
		Royal Air Maroc, CN-ROJ, After Landing during roll mode run over the right side lamp post at run way, in Conkary, Guinea.	Downloaded	Downloaded	N/A
	29 OCT	Royal Wings – Jordan, JY-SOA, Run Way Excursion at Aqaba.	Downloaded	Downloaded	FRL-2017-11-01

International Cooperation:

Accident Investigation Group Panel (AIGP) meeting:

On 08 March 2017, the President of the Air Navigation Commission (ANC), the technical body within the International Civil Aviation Organization (ICAO), approved the AIB nominee as a member of the Accident Investigation Group Panel (AIGP). This panel is responsible for the review and development of international Standards and Recommended Practices (SARP) related to accident investigation under the direction of the ANC.

The third meeting of the AIGP was held at the ICAO Headquarters in Montreal, Canada during the period from 18 to 21 July 2017. Prior to this meeting, the AIB submitted a proposal to add a new recommendation to; "improve alignment of the provisions of Annex 13 and Annex 19 related to the expedition of the Accredited Representatives (AR) facilitation to participate in an on-going site investigation in a State of Occurrence". The Panel member accepted the proposed working paper as a note in 5.24 of Annex 13. The paper was submitted to the President of the ANC for approval and inclusion in the next amendment to Annex 13.

AIGP Meeting Participants

Underwater Search and Recovery of Flight Recorders:

On 28th March 2017, the AIB participated in the third workshop and exercise on Underwater Search of Flight Recorders organized by the Transport Safety Investigation Bureau (TSIB) in Singapore. The two-day workshop was conducted on-board an offshore accommodation vessel with the participation of the hosting authority and other regional authorities.

The workshop featured presentation on recent development and relevant technologies for the search and recovery of flight recorders using small tender boats to receive ample opportunities on the hands-on practice in using the underwater locator beacon detectors. The workshop exercise provided the participants a sense of realism of the environment investigation may have to face during the search and recovery phase of when an aircraft crashes at sea.

Participants of the underwater search and recovery of Flight Data Recorders

AIB FDR/CVR Specialist is preparing the Hydrophone for an underwater search

AIRBUS Company:

AIB engaged with the safety sector of AIRBUS company to share and expand safety related activities with the aircraft manufacturer giant. The cooperation comes beyond the expected and usual cooperation that aircraft manufacturers offer to investigation authorities. In April 2nd 2017, Airbus conducted a special 3 day training for investigators attended by all AIB investigators, specialist, and also included few newly certified Technical Advisors. The training included:

- What does Product Safety mean to Airbus?
- The challenges faced by manufacturers in a major investigation context.
- What statistics tell us in investigations?
- Immediate response to an accident notification – Airbus organization.
- Data collection at an accident site.
- Feedback of on-site experience.
- Flight data recorders and maintenance data analysis.
- Landing performances.
- Handling Qualities analysis.
- Available test means to support ICAO Annex 13 investigation.
- Flight operations and human factors analysis.
- Study cases.
- Airbus reports, comments to draft reports, answers to safety recommendations.
- Flight Operations – Airbus training and documentation philosophy.

HE The Chairman, approved a commendation letter to AIRBUS CEO for their contribution to promote safety awareness and sharing investigations methods and philosophies.

AIRBUS training participants

AIRBUS also invited AIB leadership to attend an annual seminar dedicated for developed state investigation authorities from around the world, AIB participated at the seminar in May 2017. On top of the high level networking with world leaders in safety investigations, the seminar included a thorough visit to AIRBUS crisis management center.

AIRBUS provided AIB with 8 go team specialists to support AIB with any AIRBUS related occurrence, the team were issued multiple 4 year visa to KSA to be readily available for dispatch as and when needed.

CHAPTER IV
DEVELOPMENT

Human Resources:

AIB maintained a Saudization rate of 94% in 2017.

Training:

AIB continues to diversify training and acquire knowledge and skills from all accredited reputable sources as follows:

- Accident Investigation
- Aircraft Accident Investigation and Management
- Air Accident Investigation

Training provided by universities

- IATA Safety Management System
- ICAO Universal Safety Oversight Audit Program, Continuous Monitoring Approach, and the online framework
- ICAO Regional workshop on protection of Safety information

Training provided by organizations

AIRBUS Course for Investigation

General Familiarization
and Investigation Training

Accident and Serious
Incident Investigation

Training provided by manufacturers

Human Factors for Transport Safety Investigators

Managing Communications
Following an Aircraft Accident or Incident

3rd TSIB Workshop on Underwater Search
of Flight Recorders

Training provided by investigation authorities

Operating Manual Project (processes and procedures):

After over 40 months of operation, and as AIB matured organizationally, the project to document processes and procedures was launched in June 2017 and concluded in September 2017 with an Operating Manual consisting of 4 primary parts as follows:

- Administration.
- Accident Investigation.
- Investigation Management.
- Training and Development.

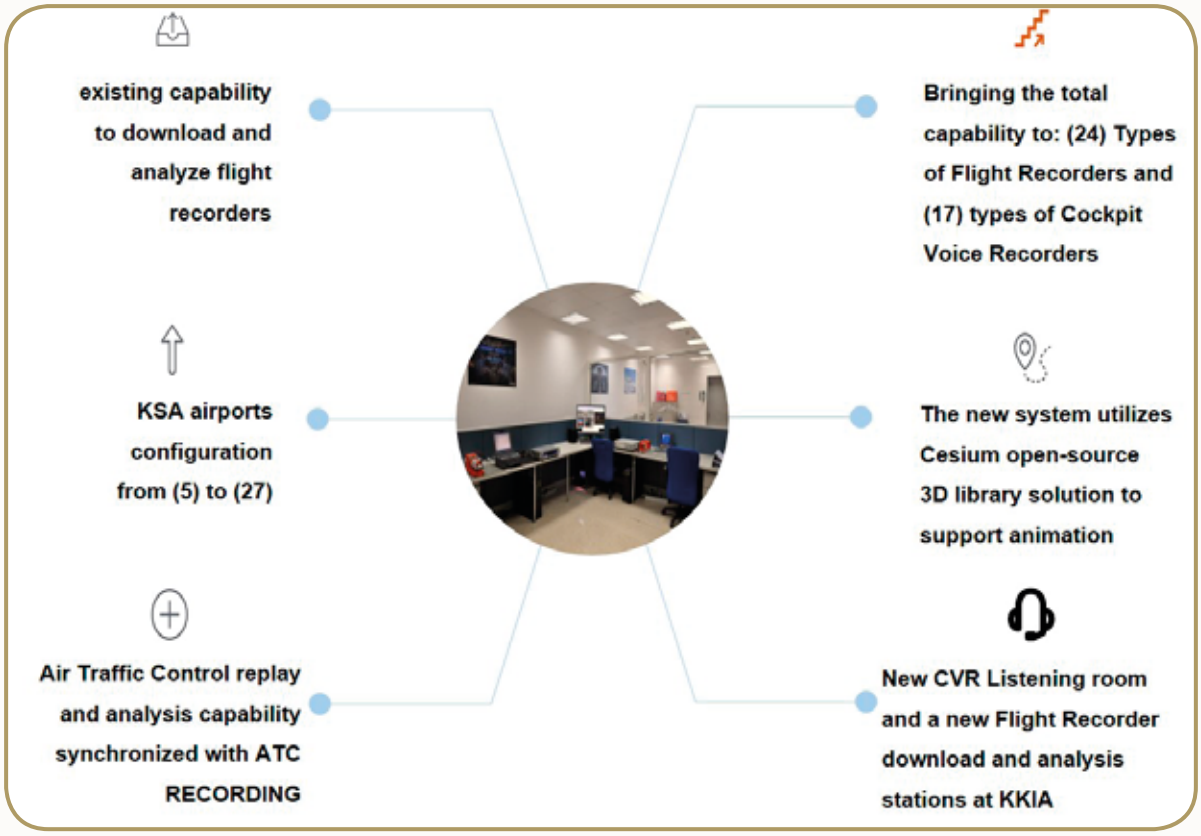
The operating manual will be tested in 2018 in a full scale desktop drill arranged with industry experts. The fully functional Operating Manual is a milestone in ICAO certification process.

Engineering Laboratories Technical Development:

New AIB Labs Project:

Business case approved in February 2017 as a project in 2020 transformation initiatives. Project contract was signed in December 2017, site preparation commenced on 10 December 2017, with a target to complete in October 2018. The project includes:

a) Upgrade Flight Recorders Lab.



b) Develop new Engineering Lab sections.

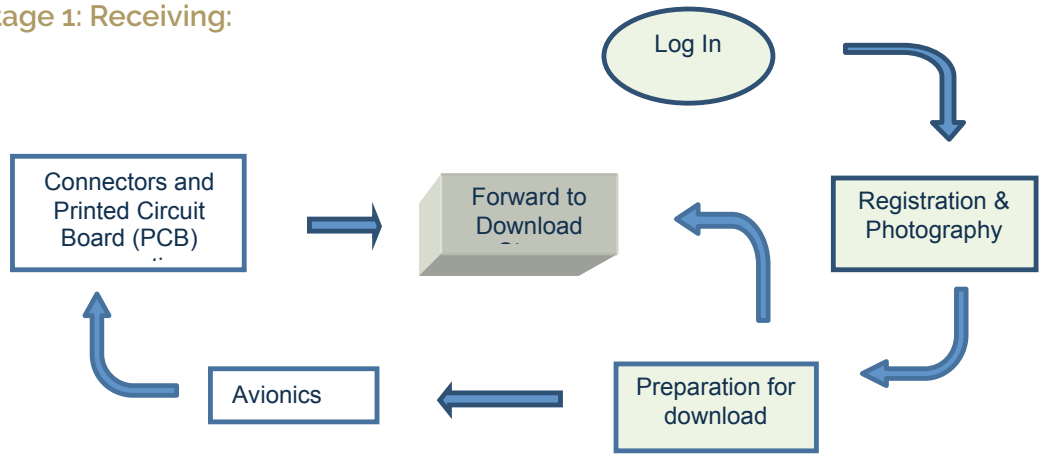
Flight Recorder Laboratory (FRL):

Further rearrangement of the FRL facility to accommodate process improvement and new capability introduced. FRL arranged in the following stages:

1) Receiving/Cleaning.
2) Avionics Bench for level two and three recovery.
3) FDR/CVR Download.
4) Analysis and Animation.
5) CVR Listening and transcribing.

We will talk about each one separately as follows:

1) Stage 1: Receiving:

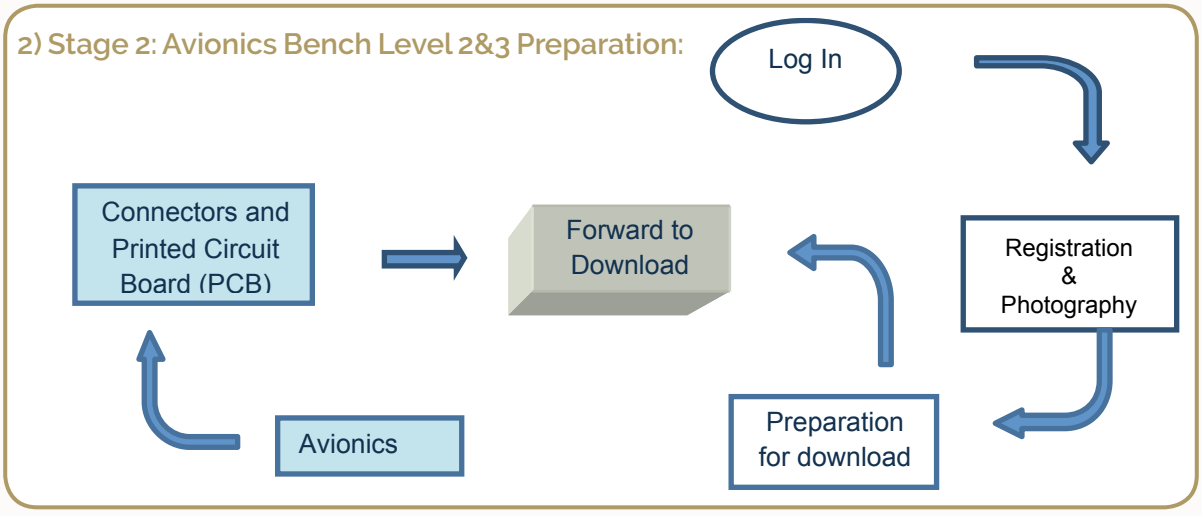


Receiving room is the introductory phase of the flight recorders at AIB premises.

Flight Recorders will be inducted in this room in the same state as received from the operator i.e. damaged or undamaged, and comply with the receiving inspection check-list.

A. Photographing the Flight Recorders as received status.
B. Cleaning Flight Recorders as needed, if the Flight Recorders are damaged all necessary tasks will be accomplished in this room i.e. crashed, or underwater recovery procedures.

Receiving room

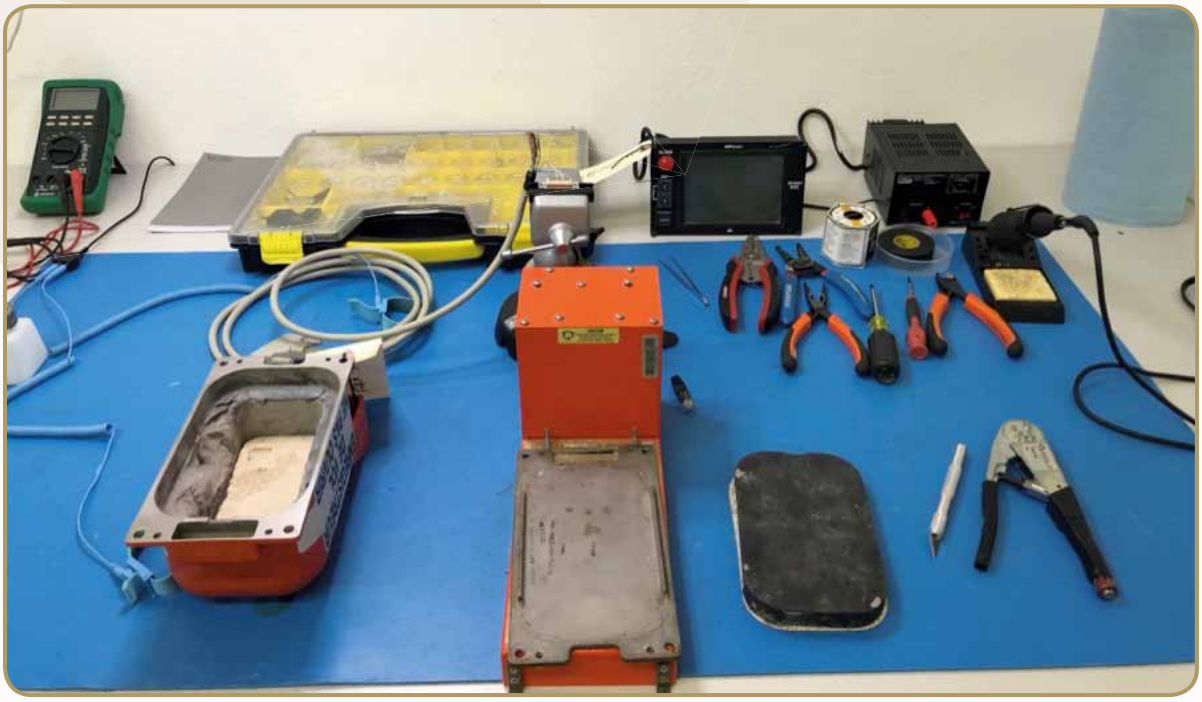


This stage is designated to prepare damaged Flight Recorders for the downloading stage.

Cleaning area

Drying process

Ultrasonic Cleaning:	To remove residuals and contaminants from memory boards and/or Crash Protected Memory Units (CSMU).
Incubator:	Slow drying process for memory board and/or Crash Protected Memory Unit (CSMU).

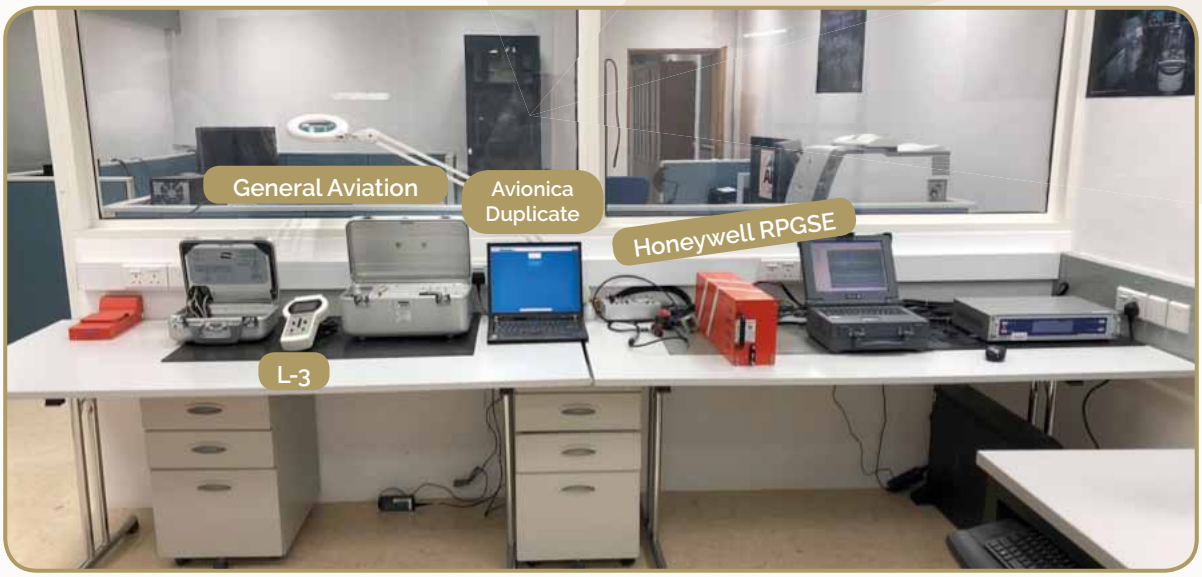


Avionics Bench

3) Stage 3: FDR/CVR Download:

This stage is designated to download data and voice recording from all types of recorders regardless of condition. For damaged recorders, AIB added capability to download data and voice recording from damaged / erased recorders, the newly inducted equipment: Memory Access Retrieval System M.A.R.S may also be utilized as independent equipment replacing the variety of bench units in use.

FDR/CVR Data download room



Array of recorder downloaders

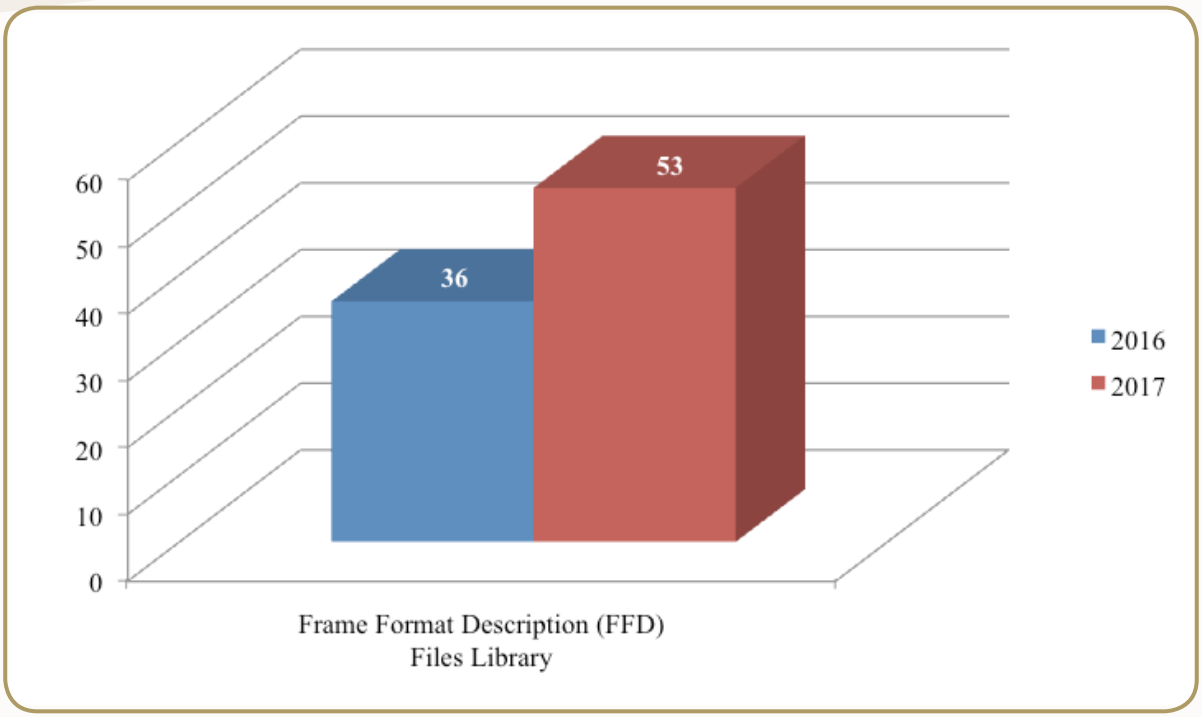
4) Analysis and Animation:

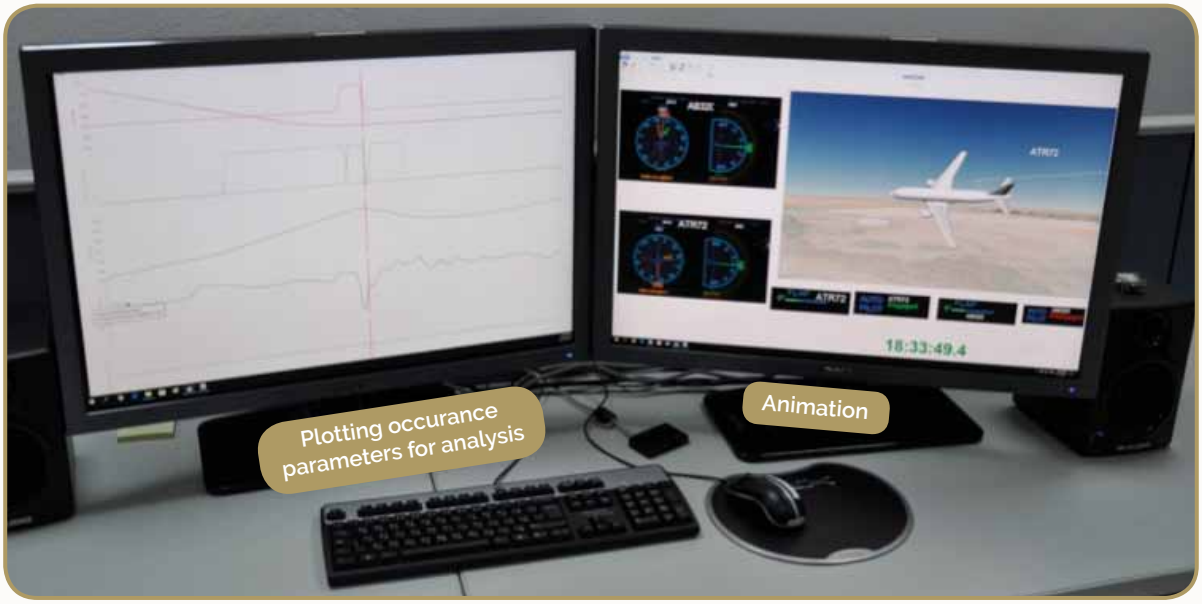
The main function of the FRL is carried out at this stage; configuring the retrieved data into readable files for flight data analysis systems INSIGHT & FAS.

INSIGHT System version 4.6 developed by CAE, maintained and supported for State Investigation Authorities by Plane Sciences Company.

Frame Format Description Files (FFD):

INSIGHT System requires Frame Format Description FFD to convert downloaded files to system readable files, the AIB FFD Files library increased in 2017 by 23% from 36 to 53 files covering most of flown aircraft types in KSA.



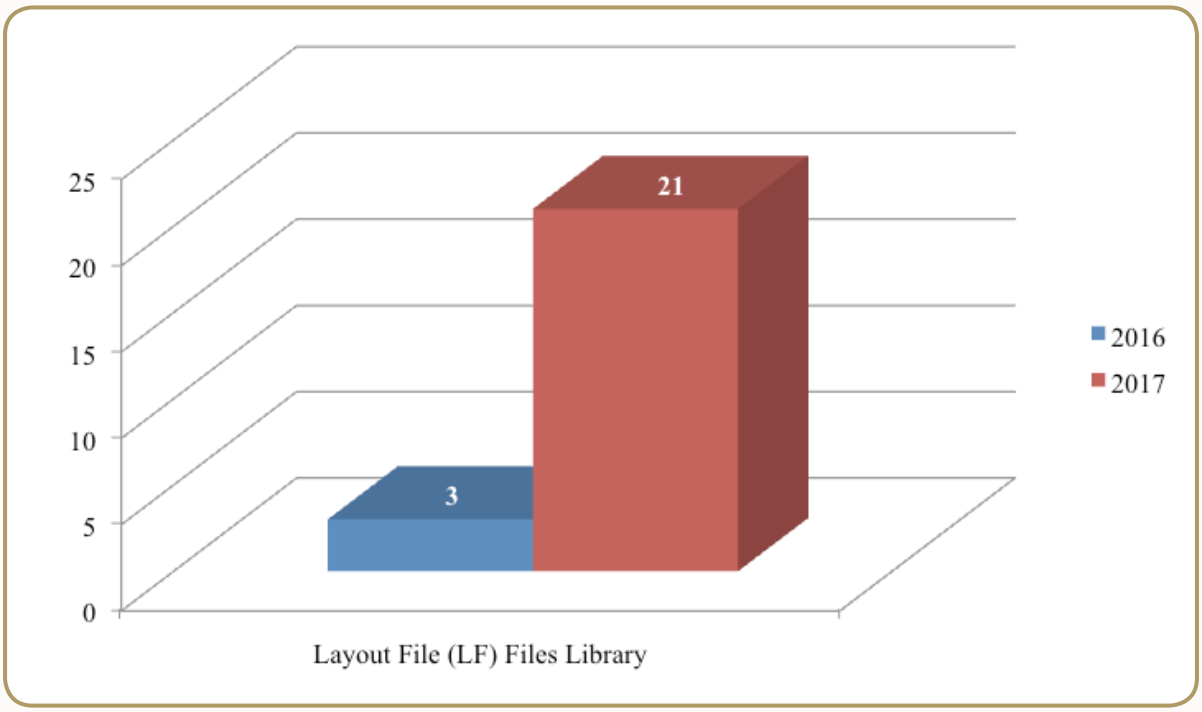


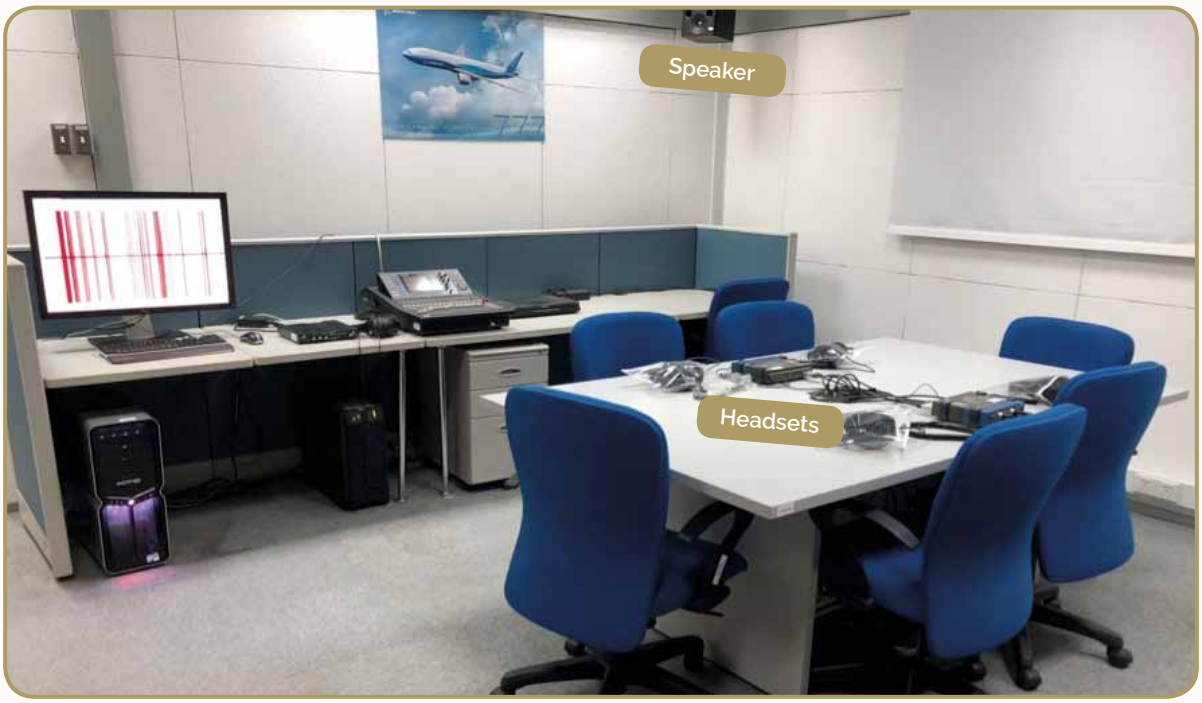
Flight Analysis System (F.A.S) System version 1.5.2, developed by Plane Sciences Company and AIRINC Inc.

F.A.S. requires files conversion from original format to Layout File (LF). The LF is a file format that integrates the downloaded data into the real time data which is used with F.A.S.

AIB is converting FFD files library to LF files library to enable the utilization of both systems INSIGHT and FAS for investigation analysis depending on the event. In 2016, the year FAS system was acquired, 3 files were converted, in 2017 the LF library has 21 configuration files.

AIB Lab upgrade project includes a feature to automatically convert files from FFD to LF format according to aircraft configuration.





CVR transcribing room

FRL Capability Upgrade:

HONEYWELL RPGSE Downloader:

Honeywell recorders are supported by a Ruggedized Portable Ground Support Equipment RPGSE to download data from various types of the manufacturer installed recorders in most airplane types. Part of Honeywell continuous support to RPGSE users is to introduce software and hardware updates to improve the product and include newly manufactured recorders such as the HRF. In 2017 AIB managed to upgrade the PRGSE with the latest software and hardware introduced to date.

A) Software:

1) Installed Down Load Unit (DLU) Pattern search tool part number 998-3420-502 to search for errors in old types of Honeywell CVRs.
2) Installed new Playback 32 software, part number 998-3414-510, this upgrade qualifies the downloader for all types of Honeywell recorders.

B) Hardware:

The new Ground Board Equipment (GBE) card part number 722-4376-010 along with Playback 32 software allows interface of RPGSE with new generation recorders (HR5).

Memory Access Retrieval System (MARS):

MARS is an advanced patented technology in retrieving memory out of damaged flight recorders, sponsored by AIB, supported by Canadian Transport Safety Board (TSB) and Canadian National Research Center (NRC), and developed by Plane Sciences Company, with an objective to:

1) Eliminates need for inventory of Golden Chassis" Bench Units.
2) One integrated system handles ALL ARINC recorders types.
3) Memory structure / format source documentation provided (for potential chip level retrieval).
4) Bit editing for recovering sync losses/missing data.
5) Circumvents CVR erase logic.
6) Improves playback probability without reliance on recorder OEM.

Bench Units. Default technology for downloading damaged recorders.

MARS Bench

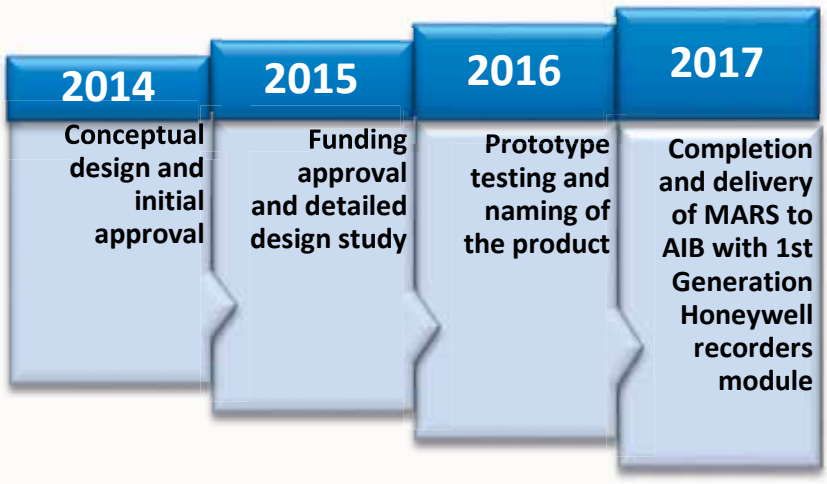
A complete one stop Bench to inspect Printed Circuit Boards, download data without the need for a Bench unit or a downloader, Analyze flight data and validate Cockpit Voice Recorder in the same Bench.

Honeywell direct memory readout

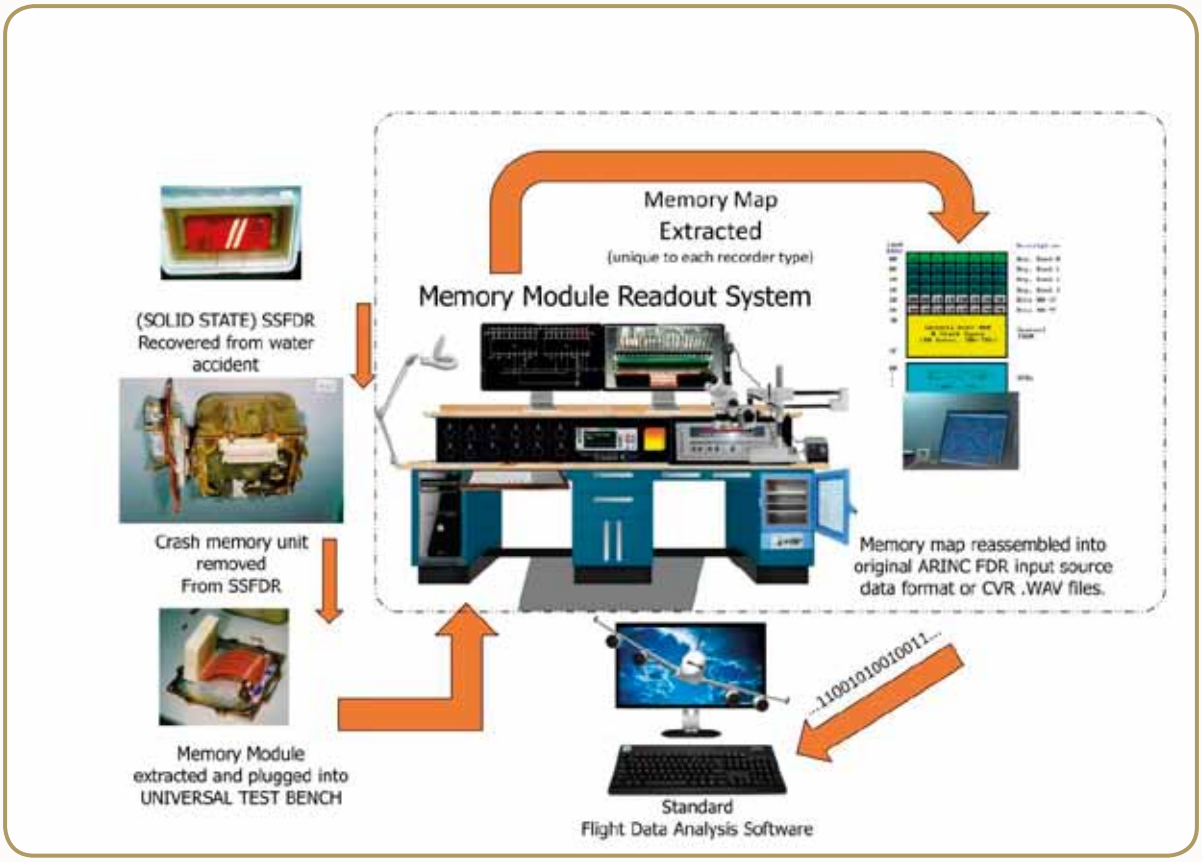
M.A.R.S. Project

Inspired by TSB Canada development of a unique method to recover data dropouts by digitizing the raw signal from the tape head and using special software, instead of the OEM's hardware. MARS is the Solid State equivalent to the digital tape philosophy adopted by authorities to understand the entire process above and beyond the standard OEM replay

MARS Project progress:



• 2014: Initial approval of HH the Chairman to proceed with the initiative , reached out to TSB COO and NRC Director of Development for technical support



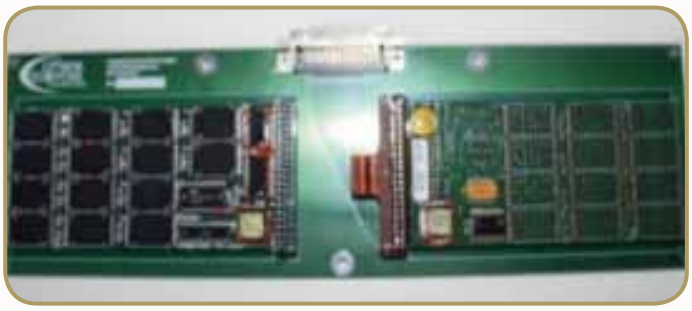
Conceptual design

• 2015: Approval of HE the Chairman to fund the R&D project as a Sponsor and launch State Investigation Authority. Agreement with developer concluded and held the first project steering committee. Design document completed.

MARS Project Team

From left to right: Plane Sciences SME Victor Lynch-Stunton, Saudi AIB recorder specialist Ghazi Al Harbi, Saudi AIB MARS SC Chair Ismail Kashkash, TSB Director Leo Donati (SC member), NRC Director Viresh Wickramasinghe (SC Member), Plane Sciences Project Lead Bob Hoyle, Plane Sciences CEO Mike Poole (absent Robin Bassom, Plane Sciences SME Advisor)

• 2016: Completed the first proto type targeting 1st Generation Honeywell recorders, tested the prototype in 2 cases, both successful. The product is named MARS



• 2017: Italian ANSV and Swiss STSB expressed interest to join MARS steering committee, Malaysian Ministry Of Transport ordered the second MARS Bench.

The first Bench Capability is:

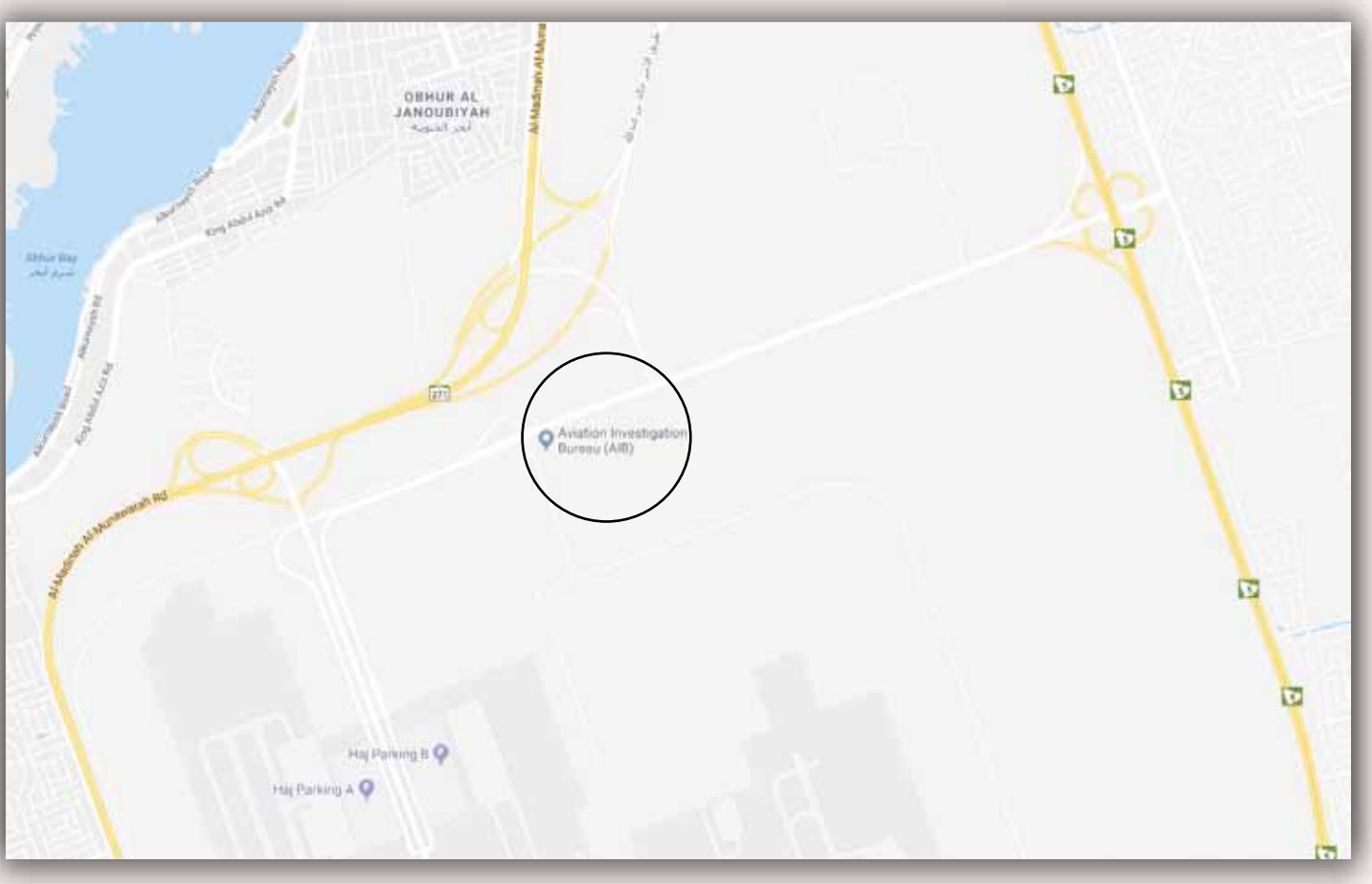
1) Honeywell 980-4700-XXX SSFDR
2) Honeywell 980-6020-XXX SSCVR
3) Honeywell 980-6022-XXX SSCVR
4) Honeywell 980-4710-XXX AR-FDR SSFDR
5) Honeywell 980-6023-XXX AR-CVR SSCVR
6) Honeywell 980-6021-XXX AR-Combi
7) L-3 Com S603-1000-XX (80% working V2. software update required)
8) L-3 Com S703-1000-XX (80% working V2. software update required)
9) L-3 Com S800-X000-XX (80% working V2. software update required)
10) L-3 Com S903-X000-XX (80% working V2. software update required)

As an interim solution, MARS is supported by a PACK and GO kit for the recorders types not included by MARS and are under development, prepared by Plane Sciences Company and sponsored by Canadian National Research Center, Plane Sciences specialist will be dispatched along with the Pack-and-Go Kit to State Investigation Authorities with MARS to download the data from recorders under development.

Pack and Go kit

MARS Project Future Plans:

Steering Committee to engage with Recorders Manufacturers to obtain specific proprietary information relevant to memory retrieval only and exclusively for investigation authorities to recover data from damaged recorders.



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