THE INVESTIGATOR

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AIR ACCIDENT INVESTIGATION SECTOR – UAE GENERAL CIVIL AVIATION AUTHORITY

INNOVATIVE INVESTIGATION TECHNOLOGIES

How innovation is assisting aircraft accident investigations

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24 Hour AAIS Duty Investigator Contact Details

To make an immediate notification of an Aircraft Accident or Incident:

Hotline: +971 50 641 4667

This number is to be used only for notification of an Accident or Incident

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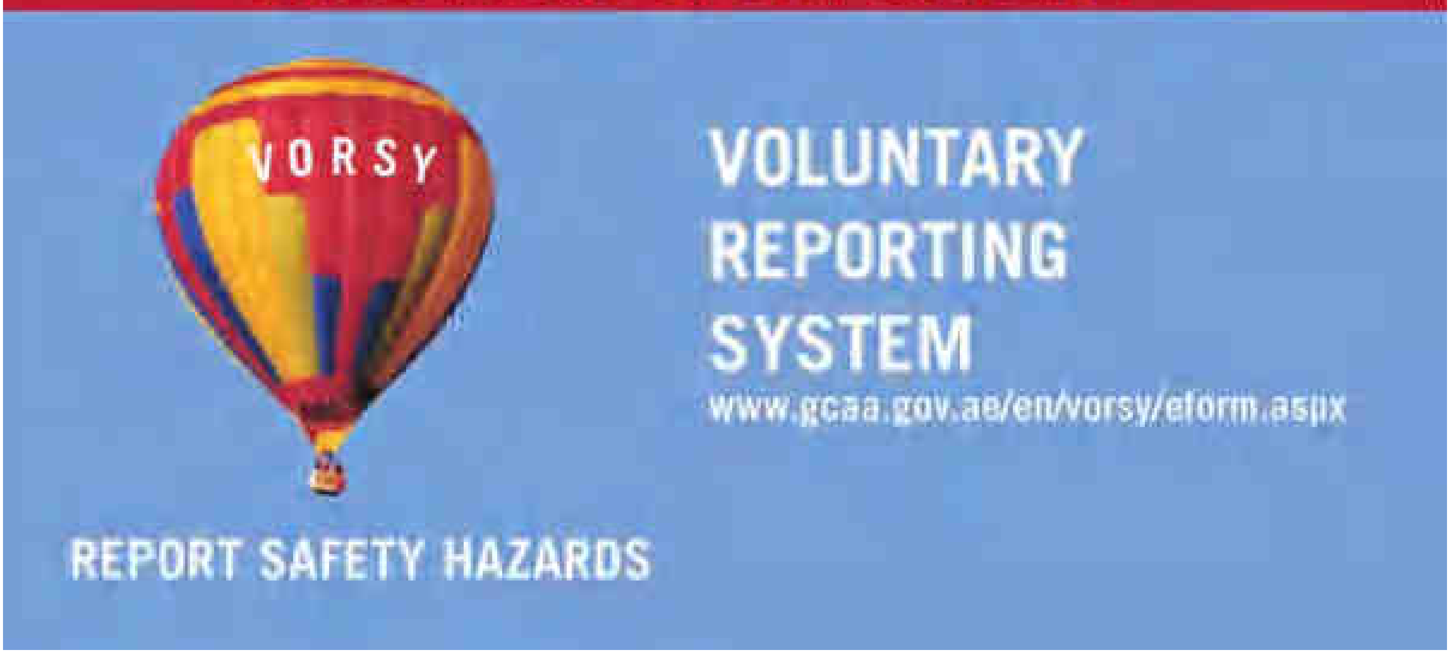


Innovative Investigation Technologies

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY

United Arab Emirates

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His Excellency Saif Mohammed Al Suwaidi,

Director General,
UAE General Civil Aviation Authority

THE TWO BOEING 737 MAX accidents that occurred in October 2018 and March 2019 which resulted in approximately three hundred and fifty fatalities emphasize the overriding importance of attention to safety oversight by aviation regulators.

It is also vital that aircraft manufacturers and the civil aviation industry maintain a proper balance between commercial priorities and the safety imperative. The potential human cost of an imbalance between commercialism and safety in aviation is too high and all of us who work in civil aviation must always maintain a relationship where safety is the first priority.

The accidents referred to above have resulted in the grounding of the aircraft type. This is a notable happening for an industry that has made remarkable strides in improving safety over the past twenty years. In 2017, there were no fatal commercial airline accidents. In 2018, over 500 people died in airline accidents and, so far, in 2019 the number is reported to be over 220 fatalities. Our goal must be to reach and maintain the zero fatalities figure achieved in 2017. There is no acceptable level of fatalities.

All of the causes of the Boeing 737 MAX accidents will become known when the investigation Final Reports are published. These reports are the investigators contribution to improving air safety. Already, problems related to one aircraft system are being addressed. The investigations will be conducted with meticulous care and attention to detail and the reports will be published without delay. In the meantime, safety recommendations will be released as conclusions become available. The safety recommendations should ensure that no accident would occur due to the same causes in the future.

As a regulatory authority, the GCAA must be constantly alert to any safety shortcomings across the whole spectrum of the civil aviation industry. Even mature aircraft designs can harbor potential safety issues involving in-service problems not previously seen.

As the aviation regulator of the UAE, we take nothing for granted. We are not complacent. We must be constantly vigilant and spare no effort to detect safety deficiencies before they manifest themselves as accidents. There is no room for complacency in any aspect of aviation.

I HAVE THE great honor of having been recently appointed by His Excellency the Director General of the GCAA as the Acting Assistant Director General of the Air Accident Investigation Sector (AAIS). The position offers many challenges and many opportunities for achievement. It is a special privilege for me to write my first foreword for *The Investigator*. This publication is an important means of promoting air safety and the activities of the AAIS. I hope that you find the material in The Investigator interesting and that it helps to maintain your focus on safety.

His Excellency the Director General of the GCAA officially opened the "Abu Dhabi Air Accident Investigation Laboratory" on 14 May. The new Laboratory has been equipped with the latest data downloading and analysis capability. Data can be downloaded from almost all of the recorders in service today. We also now have the capability to download data from damaged flight recorders.

The Laboratory will increase AAIS effectiveness because it provides new analysis and visualization tools, which will allow investigators to extract the maximum amount of information from the downloaded data. The incorporation of advanced CVR playback techniques with sound spectrum analysis has added another important capability.

On the same day, the Director General approved the AAIS Quality Management System (QMS). The introduction of the QMS will improve the quality and consistency of our outputs across their entire range. The QMS will be applied to every AAIS process, but its major contribution will be to facilitate and control the consistent production of best quality investigation reports. Each member of the AAIS team is committed to continuous improvement in all AAIS activities.

The United Arab Emirates – Accident Investigation Management System (UAE-AIMS) is a new software application developed by GCAA AAIS. It enhances the entire investigation process by establishing a centralized comprehensive database containing all the significant data and information gathered by the investigators. UAE – AIMS provides an evidence and correspondence management capability and a consolidated safety recommendations module. In addition, dashboards provide single screen status reports to management.

The Investigator publication has received an update in format, as will the AAIS website and the range of information provided on the website will be broadened.

The AAIS team is enthusiastic about working with the new tools and systems, which will enhance our contribution to aviation safety. I am pleased to have joined the team and I look forward to working with the dedicated AAIS staff.

Mohammad Faisal Al Dossari,

Acting Assistant Director General,
Air Accident Investigation Sector


OY-HGT

INNOVATIVE **INVESTIGATION TECHNOLOGIES**

Air accident investigators turned to innovative new technologies to locate aircraft engine parts buried under snow in Greenland's unforgiving landscape.

Photo: AIB Denmark/Air Greenland

WRITTEN BY

SUNDEEP GUPTA, Director of Flight Safety Accident Investigator Airbus S.A.S.

ALBERT URDIROZ, Director of Flight Safety Accident Investigator Airbus S.A.S.

ON 30TH SEPTEMBER 2017, an A380 aircraft fitted with Engine Alliance GP7200 engines suffered an uncontained engine failure while cruising at 37,000ft over Greenland. Engine parts, including the fan hub, fan blades and fan casing, were liberated onto the ice sheet below. The aircraft diverted uneventfully to Goose Bay.

Retrieval of the engine components is crucial to understanding the root cause, the key component of interest being the fan hub, a 250kg piece of titanium 80cm in diameter. The fan hub is the central rotating component to which the fan blades are attached. The investigation team faced a huge challenge due to the geography and the extreme climatic conditions and they looked to technology to help search for the fan hub.

The ICAO Annex 13 investigation was delegated by the AIB of Denmark to the French BEA (Bureau d'Enquête et d'Analyse), assisted by accredited representatives and advisors. Airbus, as nominated advisors, deployed resources and technologies in order to support the investigation and the search for the liberated parts on the Greenland ice sheet.

SATELLITE IMAGERY

In order to visually identify the location of engine parts, Airbus immediately acquired satellite imagery of a 20km x 20km area using the PLEIADES satellite constellation, owned and operated by Airbus Defence & Space. The two satellites are in continual orbit around the Earth and they can be programed to take images at a resolution of 50cm of any given area in approximately 6 hours.

The first images received were obscured due to cloud cover. The satellite continued to take images daily and over the next few days the cloud disappeared, and we received the first images of the visible ground beneath. However, a blanket of snow had fallen, making it impossible to visually detect any engine parts.

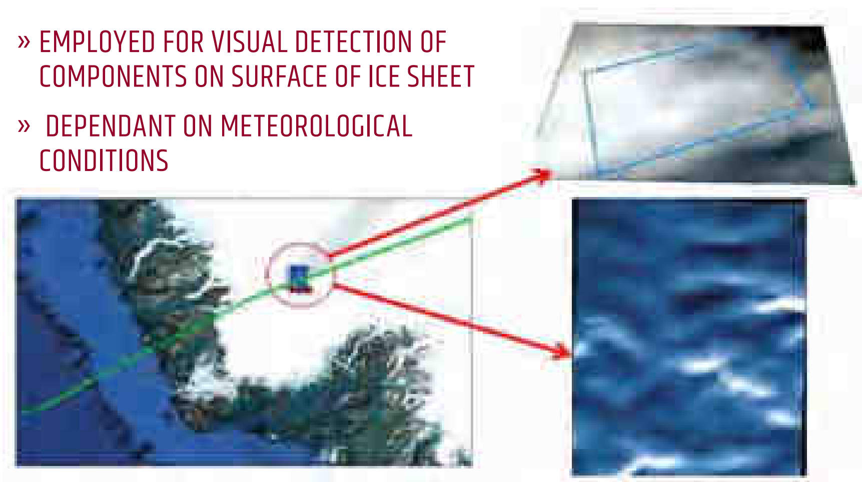
Greenland has a climate where the snow never melts back to its previous level. Only a percentage of the annual snowfall melts each year, meaning any parts covered by snow will never surface again.

While satellite imagery did not provide any tangible results during this investigation, it may prove useful for other events such as locating an accident site in a remote or inaccessible area, mapping a large accident site or runway excursion.

SATELLITE IMAGERY

» EMPLOYED FOR VISUAL DETECTION OF COMPONENTS ON SURFACE OF ICE SHEET

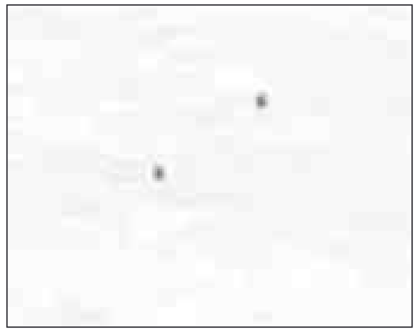
» DEPENDANT ON METEOROLOGICAL CONDITIONS



"The fan hub is the central rotating component to which the fan blades are attached. The investigation team faced a huge challenge due to the geography and the extreme climatic conditions and they looked to technology to help search for the fan hub"

GREENLAND ICE SHEET

- » Temperatures down to -35°C
- » Wind up to 25m/s (gusting 40m/s)
- » Windchill down to -50°C
- » Snowfall: Several 10s of cm
- » Snow drifts over half a metre



The image on the right above is an example of the image resolution achievable. Flags left on the Greenland ice sheet later in the investigation were captured by the satellite images.

BALLISTIC ANALYSIS

The potential search zone covers hundreds of square kilometres. To narrow down the search area, the Airbus advisors worked with Ariane Group specialists to calculate the most likely trajectory of the components from their release at 37,000ft to impact on the ice sheet.

Examination of the engine revealed that the fan hub had ejected in several pieces. Ariane Group's analytical models were able to narrow the primary search area down to 2km x 4km when provided with properties of a fragment, such as altitude, aircraft speed, wind, etc.

The ongoing investigation established the fragment ejection angle and ejection speed. This allowed the area to be refined to 1km x 2km. The parameters of the liberated parts have an effect on the ballistic analysis. Smaller heavier parts will be projected forward of the event point while lighter, larger parts which generate aerodynamic drag will be carried rearwards of the event point in the direction of the wind.

The fan hub primary search area shown on the opposite page was identified using both Ariane and NTSB ballistic analyses, which were largely consistent.

Given the extreme climatic conditions, searching the identified area with ground teams remains a challenge. The investigation team therefore looked to try and locate the fan hub using airborne radar scanning Synthetic Aperture Radar (SAR). Scanning Synthetic aperture radar is normally used for geographical surveys. This was the first time that it would be used to detect metallic objects buried under snow.

ONERA, a French aerospace lab provided two radar pods equipped with 3 radars, each scanning in a different

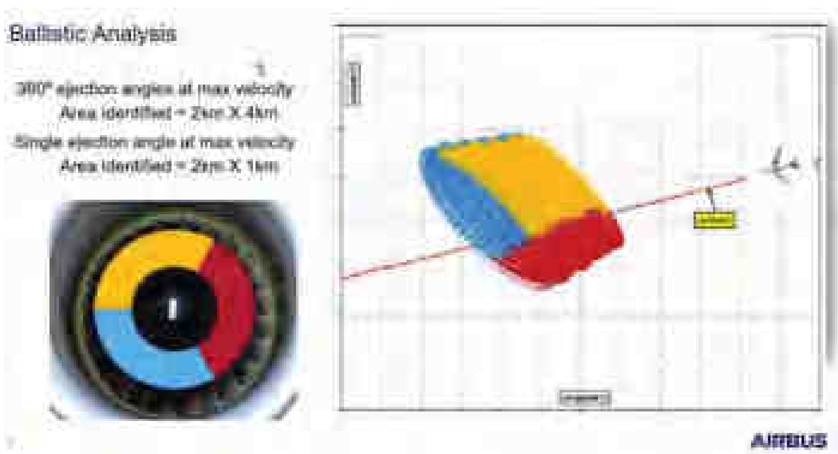
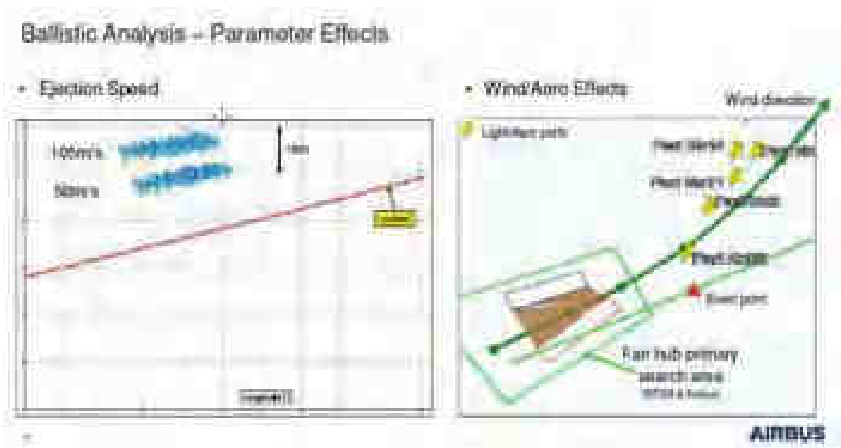


Photo: AIB Denmark/Air Greenland



bandwidth. These were mounted on a Falcon 20 aircraft provided by AVDEF, part of the Airbus Defense and Space portfolio. The team assembled in Greenland and first performed a trial to verify equipment functionality and to calibrate the data to the GPS position. A calibration test piece was mounted on a tripod and positioned on a snow covered golf course with its exact angle and GPS position noted. The aircraft overflew the area at the two radar operating altitudes to capture the landscape in all 3 radar bands. Once the image had been processed, the radar scan revealed the ground beneath the snow and ice.

Examination of the image confirmed that the test piece had been detected, indicated by a bright white return on the radar image. A second radar return was seen on the image in the vicinity of the test piece. The cause of this return was not known and when the team returned to the site, we discovered metallic fencing wire buried under the snow. This demonstrated that the technology is fundamentally capable of detecting metallic objects even when buried under snow.

An extensive area was scanned for the fan hub search and data collected. However, crevasses were present within the area and created background noise in the radar data. The radars were able to scan approximately 36 metres below the surface of the ice.

On page 13 is an image covering an area approximately 4km by 2km. Each of the 200 million pixels, each covering 20cm^2 in X-Band, is scanned by a total of 72 images at different angles and polarizations. The large amount of data is now undergoing

SYNTHETIC APERTURE RADAR

- » First use of SAR technology to detect metallic objects
- » Falcon 20 aircraft provided by AVDEF

- » 2 radar pods owned by ONERA – French Aerospace Lab
- » 3 different operating bands (X, P & L)
  - › Operating altitude of 8200ft and 12000ft AGL
  - › Resolution down to 0.2m
  - › Scan width 3km and 8km

CALIBRATION TRIAL

complex post treatment to differentiate crevasse returns and background noise from credible fan hub targets.

3D LASER SCANNING

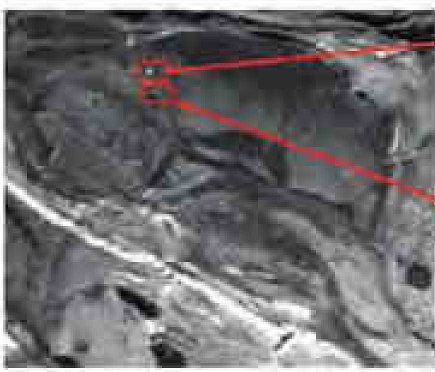
Shortly after the event, the BEA and AIB of Denmark scrambled helicopters along the aircraft track before further snowfall. The helicopters were able to locate and recover the larger, aerodynamic engine components that had been liberated during the event. Due to their size, they were easier to spot by the helicopter crew. With their aerodynamic properties, they were blown rearwards of the event point in the direction of the wind, whereas the fan hub trajectory has been analyzed to have landed in front of the event point.

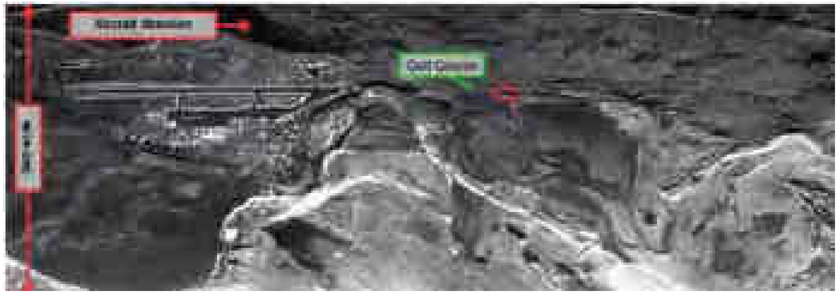
As the fan hub had not been located, the investigation team needed to ensure that maximum data was extracted from these recovered parts. The data would also support any hypothesis put forward and validate any analysis.

Airbus deployed state-of-the-art 3D scanning technology, which was provided by IDLAB, a subsidiary of Airbus commercial. Using 3D laser scanning equipment, all the parts were digitized, creating 3D models of the retrieved components, capturing details with an accuracy of 0.03mm.

The scanned data allowed an assessment as to which parts had been recovered and

DETECTED TRIAL TARGETS





EXAMPLES OF SCAN DATA USES

- » Virtual reconstruction of parts allows assessment of how an event unfolded
- » Identification of which parts recovered or missing

which remain on the ice sheet. A 3D reconstruction was produced which allowed an insight as to how the engine event may have unfolded.

Further, 3D models can be overlaid to reference data such as Catia models or scans of reference parts so that an analysis can made as to how a part had distorted or deformed. The advantage of 3D scanning is that it provides an accurate record of parts as they were recovered and before any disassembly or destructive testing. The data can be made available to all parties to the investigation so that analysis can begin simultaneously. The data can be imported into Catia, or viewed as a 3D pdf model. Any hypothesis can be cross checked against this 3D data.

SUMMARY

The investigation team led by the BEA have been working hard to progress the investigation. The engineering analysis to date has allowed mitigating actions to be taken on the A380 fleet powered by EA GP7200 engines. The investigation, search and analysis continues.

When Airbus are engaged in an investigation, in addition to Airbus commercial, we can also engage the resources and expertise of Airbus Helicopters and Airbus Defence & Space domains. By utilising the resources from across the Airbus Group, Airbus advisors have been able to deploy a number of innovative technologies to gain the maximum amount of knowledge possible from the components already retrieved and to locate the key component to the investigation, the fan hub.

Article courtesy of Airbus SAS

THE AUTHORS:

SUNDEEP GUPTA is an accident investigator within the Product Safety team of Airbus. As one of the investigation team, he is an Airbus advisor to the Bureau d'Enquête et d'Analyse of France (BEA) and to many international agencies on a number of investigations. His scope of activities involve any aircraft of the Air- bus fleet whatever the nature of the investigation.

Prior to becoming an accident investigator, Sundeep was a senior fuel systems engineer within Airbus Customers Services, charged with major in-service issues and consulting best practices. Including 16 years in automotive design and development prior to joining Airbus, he has accumulated over 28 years of experience within systems engineering and product safety domains.

Together with his colleague Albert Urdiroz, he has been involved in the investigation of an A380 which suffered an engine #4 failure whilst in cruise over Greenland on 30th of September 2017, which forms the basis of this technical paper.

ALBERT URDIROZ has acted as an accident investigator within the product safety department of Airbus since 2004. As such, he has lead the Airbus team providing advice to the Bureau d'Enquête et d'Analyse of France (BEA) and to many national agencies in a number of major investigations. His scope of activity involves any aircraft of the Airbus fleet whatever the nature of the investigation.

In this role and together with his colleague Sundeep Gupta, he has provided advice to the BEA who lead the investigation into the in-flight separation of the fan of an Engine Alliance GP7200 that oc- curred over Greenland on the 30th of September 2017. The GP7200 is one of the two engine options available for the A380, the other one being the TRENT 900.

Albert Urdiroz has accumulated a wealth of experience in on-site investigations since he joined the Airbus go-team as a systems specialist in 2000. Prior to becoming an accident investigator, Albert Urdiroz was a flight controls systems engineer within Airbus Customers Services and Test Centre. In total, he has spent over 30 years in the systems and product safety domain.

MORE ATTENTION NEEDED FOR WATER SALUTES

Water salutes are frequently deployed to celebrate special events. But these celebrations are not as risk-free as one may think.

WRITTEN BY

HANS MEYER,
Senior Air Accident Investigator,
GCAA AAIS

THE AVIATION INDUSTRY, like many other industries, has some unique traditions. Water salutes, for example, were historically initiated by airport fire services to celebrate special events such as an inaugural flight, final airline service, or the retirement of a respected pilot. Typically, a water salute involves two or more fire vehicles, parked perpendicularly outside the taxiway, spraying a water jet in an arc above a taxiing aircraft. The spray pattern is adjusted to a high-velocity jet, to achieve the necessary spray height and distance.

Clearly, a water salute is a novel and risk-free celebration and cannot cause any harm, so what has this tradition to do with aircraft accident and incident investigation?

On 20 September 2018, an Airbus A320 arrived from Jeddah International Airport, Saudi Arabia, with two flight crewmembers, five cabin crewmembers and 119 passengers onboard. The flight and the landing were uneventful and the aircraft taxied to gate C58 as instructed.

After turning towards the terminal, two fire-fighting vehicles, which were located on either side of the taxiway, started

Photo used for illustrative purpose only spraying water to welcome the aircraft with a water salute in celebration of the Saudi Arabian National Day.

One of the fire-fighting vehicles experienced a problem in controlling the roof turret causing the high-pressure water jet to suddenly spray a jet of water upwards, then downwards, just as the aircraft passed underneath. The water jet struck the opening latch of the aircraft emergency exit hatch, causing the hatch to release and to fall into the cabin. This resulted in the deployment of the left over-wing emergency slide ramp.

The flight crew were alerted to the opening of the left hand forward emergency hatch by the master warning system. The aircraft was stopped immediately and the engines were shutdown. The crew believed that a passenger had opened the hatch from the inside and might be exiting the aircraft. However, this was not the case. The aircraft was towed to the gate with the slide ramp attached, where the passengers disembarked normally from the forward left passenger door. The opening of the over-wing emergency exit hatch into the cabin slightly injured a passenger seated in the window seat. The passenger received medical attention at the airport medical center and decided to continue the journey after being medically cleared.

The flight crew was not aware that a water salute had been arranged and therefore could not inform the cabin crew or passengers prior to the event. The water salute was also unexpected, as the Saudi Arabia National Day was three days later.

SO WHY DID THIS HAPPEN?

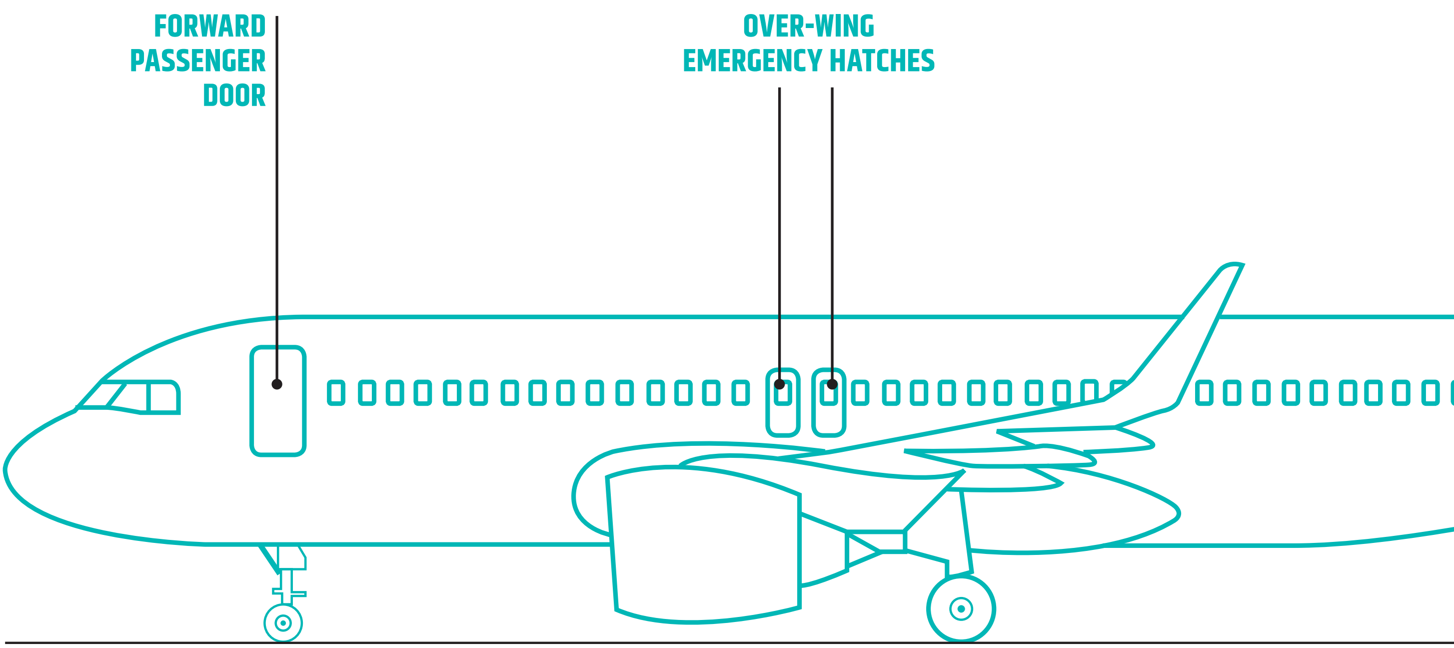
The A320 is equipped with four floor level type I emergency exits, which are the forward and aft passenger doors on the left side and the two service doors on the right side of the cabin. The aircraft is additionally fitted with four type III emergency exits on either side of the cabin at seat rows 35 and 36. These exits are called ‘hatches’ because they are not hinged and are designed to fall into the cabin, from where they are picked up and thrown outside by the passenger seated nearest to the hatch. Each emergency exit hatch weighs approximately 15 kg.

Opening either of the passenger or service doors in the armed position automatically deploys a slide to assist evacuation. The opening of any of the over-wing emergency hatches deploys a slide ramp over the trailing edge of the wing to provide the evacuee with a safe escape path.

Similar to the passenger doors, the over-wing emergency hatches are only operational when the cabin pressure is equalized. They are accessible from the outside via the upper surface of the wing and are opened by applying a moderate force to a push panel.

When the water jet struck the hatch push panel the hatch release mechanism operated and the hatch fell into the cabin.

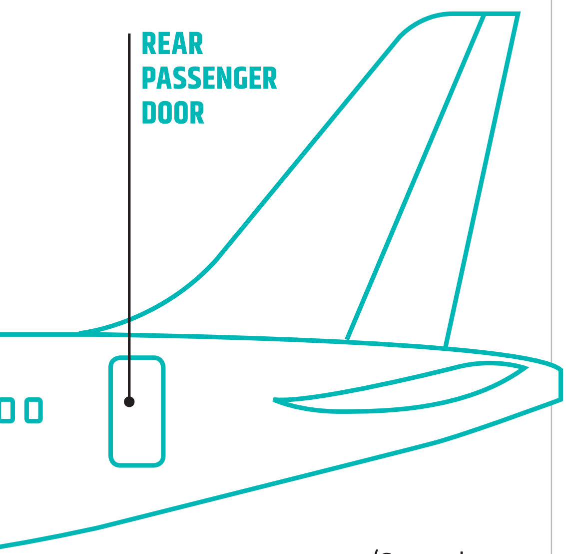
A320 (EMERGENCY EXIT) DOOR CONFIGURATION



Aircraft arrival at gate (start of water turret malfunction)

Water jet strikes the over-wing emergency hatch push panel

Over-wing emergency exit hatches



(Same door configuration on right side)

As a result of the opening of the over-wing emergency exit hatch, the slide ramp deployed and inflated as designed. An inspection of the slide ramp approximately one hour after the incident, identified that the slide deployment mechanism operated, the slide ramp deployed, and the slide remained inflated, as designed and certified. A company engineer inspected the emergency exit hatch and the airframe hatch attachments. No damage was found to the aircraft, and the emergency exit hatch was refitted.

WHY DID THE FIRE VEHICLE WATER JET STRIKE THE EMERGENCY EXIT LATCH?

The investigation focused on the fire-fighting vehicle and found that a failure in the operator's hand controller, resulted in an unresponsive, erratic turret movement, which sprayed the high-velocity water jet against the aircraft fuselage and the hatch release push panel.

HOW CAN THIS BE PREVENTED IN THE FUTURE?

The intent to carry out a water salute must be properly communicated in advance to all parties, including the flight crew. If the pilots feel confident that the water salute will not pose a threat, it may proceed. This will prevent any confusion on the ground and onboard the aircraft, and the cabin crew can brief the passengers. This briefing is critical, as unsuspecting passengers may panic and behave erratically, which could escalate to unsafe passenger actions and pose a threat to the safety of those onboard.

The process of water salutes is not generally formalized by airlines, airport operators, or airport fire services. While water salutes are celebratory in nature, they are also non-normal practices with the potential for harm and damage. Therefore, airport operators, airlines and airport fire services need to have a risk assessment process in place to ensure that damage and injury can be avoided.

The correct functioning of fire vehicle water turrets is critical and not only in an emergency situation. Because, as this incident has shown, they have the potential to cause injury, hinder fire-fighting or rescue activities, or cause damage to aircraft, or equipment. A routine "dry" turret check procedure was recommended to ensure that malfunctioning turrets are identified prior to their operation with water or foam.

WHAT CAN WE LEARN FROM THIS EVENT?

Even apparently benign events can cause unforeseen safety significant problems.

PREPARING FOR
AIRCRAFT ACCIDENTS AT SEA

WRITTEN BY

PARK YOUNG WOON, Team Leader of Air Accident Investigation The Aviation and Railway Accident Investigation Board, Republic of Korea

During an exercise at sea not far from Incheon International Airport, the Aviation and Railway Accident Investigation Board of the Republic of Korea initiated joint training with the other agencies who would respond to such an event.

Photo used for illustrative purpose only

ARAIB exercise debriefing

THE FOLLOWING ARTICLE is about a simulation training scenario that the Aviation and Railway Accident Investigation Board (ARAIB) of the Republic of Korea carried out in 2018.

SCENARIO

"On 18 October 2018, at 09:30, a Boeing 737, operated by ABC airlines departed from Incheon International Airport (ICN), the Republic of Korea (ROK). During takeoff, a fire developed in the number 2 (right hand) engine and the aircraft made an emergency landing on water approximately 3km to the south of the airport. Because of the accident, several people were injured and the aircraft went down in waters 30 meters deep. The 119-rescue team immediately responded to the accident location and conducted search and rescue operations. The Ministry of Land, Infrastructure and Transport organized a team of accident investigators and mobilized relevant departments, institutions and airlines to cope with the accident."

On 18th October 2018, ARAIB implemented joint training with the relevant institutions to make preparations for possible accidents at sea in accordance with the training exercise scenario above.

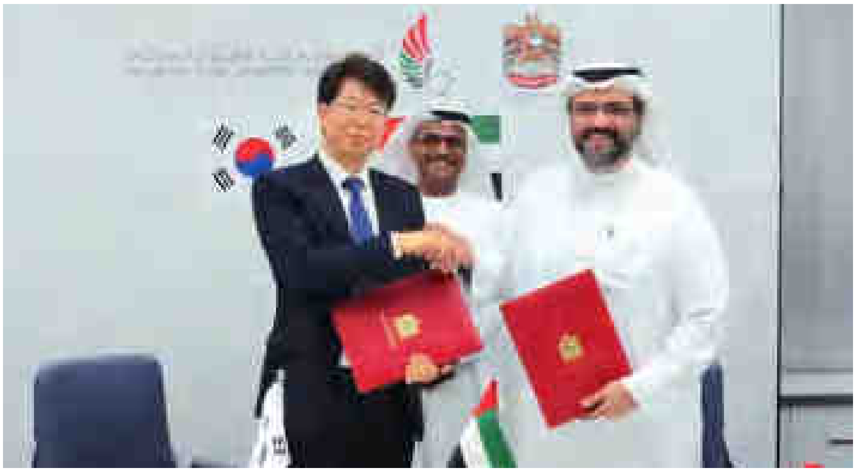
On 28 July 2011, a B747-400 airplane, operated by Asiana Airlines crashed in international waters west of Jeju International Airport. A fire had developed on or near pallets containing dangerous goods. While the aircraft attempted to divert to Jeju International Airport, some portions of the fuselage separated in midair, resulting in the crash. The depth of the sea where the aircraft impacted was estimated at 85 meters. There were four phases of search operations from the time of the accident to search for and recover the FDR and CVR. The search operations were not successful. The Republic of Korea is surrounded by the sea on three sides. For Incheon International Airport, the departure and arrival routes are all over water. If an accident takes place, it is likely that an aircraft would crash in the sea. Taking into consideration the Asiana accident case, it was prudent to perform a joint training exercise to enhance accident investigators' capabilities and cooperation among related institutions in order to swiftly respond to any similar accident occurring in the sea.

Maritime aviation accident investigation training was divided into two sectors comprising morning and afternoon training sessions. During the morning session, people involved in the training disseminated the accident information and made a quick response to the accident. Through the training, they learned about their roles and the missions they were to achieve. During the afternoon session, field training was carried out to locate and retrieve a black box that had been submerged under the sea. Underwater detection equipment was used to accomplish this mission

"Taking into consideration the Asiana accident case, it was prudent to perform a joint training exercise to enhance accident investigators' capabilities and cooperation among related institutions in order to swiftly respond to any similar accident occurring in the sea"

The morning practice session included the following actions: briefing accident occurrence, reporting the situation, emergency teams fast response, emergency notification call to investigators, team organization for the investigation, contact point for relevant institutions, control of access to the accident scene and actions to prevent further damage.

During the afternoon session, a team of investigators moved to the training



Mr. Min Poong Sik, Director General ARAIB, Mr. Saif Mohammed Al Suwaidi Director General GCAA and Mr. Mohammad Faisal Al Dosari Acting Assistant Director General GCAA AAIS following the MoU signing at GCAA Headquarters

(L-R): ARAIB team members using a pinger to locate a recorder. Departure and arrival routes at Incheon International Airport are all over water. If an accident takes place, it is likely that an aircraft would crash in the sea

ARAIB team with hovercraft in the background

area of the Korean Coast Guard, which was near Incheon International Airport in order to establish a command post where first responders were trained how to use detection equipment to retrieve a black box. The responders also boarded a boat and carried out an exercise to locate a submerged ULD (Unit Load Device) by using detection equipment.

The morning and afternoon sessions were successfully completed and the participants found much to debate during the course of the training. Many issues were suggested such as difficulty in identifying the black box due to a weak signal, as the signal was located far from the ULD, difficulty when the signal was used in the neighboring fish farm and mixed with the ULD. Likewise, ARAIB realized that there were many challenges to resolve regarding coordination of the investigation in the case of an aircraft accident in deep water, which will make it hard to search for the black box. As an investigation organization, ARAIB has been diligently reviewing plans to resolve these and other issues.

The Republic of Korea has seas on three sides and also many rough mountainous regions. In order to reinforce accident investigators' capabilities, ARAIB is willing to implement training periodically by assigning various accident scenarios. In October this year, ARAIB is expected to conduct training in a mountainous area to prepare for possible accidents and incidents in difficult terrain. ARAIB will prepare various scenarios including ARAIB control of access to the designated accident site, use of PPE (personal protective equipment) and retrieval of wreckage from a steep mountainside accident site.

SIGNING OF MEMORANDUM OF UNDERSTANDING BETWEEN ARAIB AND GCAA AAIS

The ARAIB and AAIS signed a memorandum of understanding (MoU) at GCAA Headquarters in Abu Dhabi the on the 5th March. The ceremony was attended by the Director General of the GCAA and the MoU was signed on behalf of the Korean ARAIB by Director General Mr. Min Poong Sik and on behalf of GCAA AAIS by the Acting Assistant Director General Mr. Mohammad Faisal Al Dossari.

WRITTEN BY

CAPTAIN MARK BURTONWOOD,
Senior Vice President,
Group Safety

MANAGING **SAFETY AT EMIRATES**

Captain Mark Burtonwood, Senior Vice President of Group Safety at Emirates Airline, shares how he and his team implement and maintain a culture of safety.

AS THE WORLD'S largest international airline, Emirates Airline has become synonymous with comfort and luxury, but its priority has always been safety. Over 50 million passengers travelled on Emirates last year to its global network of over 150 destinations, and as the passenger and destination count continue to grow; managing safety at the airline inevitably becomes even more critical.

HOW DO YOU IMPLEMENT A CULTURE OF SAFETY AT EMIRATES AIRLINE?

Safety in aviation is especially crucial when you are responsible for over 60,000 staff and over 50 million passengers each year. We continuously strive towards a generative safety culture at Emirates by making safety the responsibility of all employees, focusing on safety behaviour and its enablers. Everyone is encouraged to identify hazards, intervene if appropriate and report. All our employees have access to the company online safety reporting system and are actively encouraged to report all safety hazards and events. We've had great success with above industry-average reporting levels.

HOW HAS SAFETY MANAGEMENT DEVELOPED AT EMIRATES?

Safety has always been at the heart of Emirates with our Chairman and Chief Executive, His Highness Sheikh Ahmed bin Saeed al Maktoum, setting a clear direction with our Corporate Value of Safety. There were numerous safety processes and activities in place long before the formal regulation of SMS. We formally introduced a new system to enhance safety best practice and compliance within the company in 2012, called the Emirates Safety Management System (SMS). It is designed to align with the International Civil Aviation Organization (ICAO) standards, recommendations and practices, through the regulatory requirements of the GCAA. It integrates workplace health and safety and other identified best practices. As a member of IATA, Emirates also incorporates the requirements of the IATA Operational Safety Audit (IOSA) within our SMS.

The Emirates SMS has four components and 12 elements which cover Safety Policy and Objectives, Safety Risk Management, Safety Assurance and Safety Promotion.

The formal structure of the Emirates SMS is vital to the effective and safe operation across our diverse and expansive organisation. Our safety communication and training makes sure that every employee understands their responsibilities and the role they play in the overall safety of the airline.

The company SMS manual has been conveniently made available on the company intranet where all employees can access both in the office and remotely.

We're currently working on implementing a new Safety Data Collection Processing System (SDCPS). This will provide us with improved safety and data management capabilities and enhanced predictive safety analysis.

HOW DOES EMIRATES' SMS WORK?

The success of SMS lies in the hands of every Emirates employee and we provide regular training and communication to encourage employee participation. Group Safety provides support and guidance to the various departments in the continual improvement of the company Safety Management System (SMS). This includes assistance in understanding hazard identification, classification and risk management, advice on risk assessments, and maintenance of the risk registers. Regulatory compliance is regularly assessed through external audits with a constant strive for excellence in many areas going beyond regulatory compliance standards in all areas of safety management.

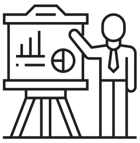
WHAT HAZARD IDENTIFICATION STRATEGIES DO YOU HAVE IN PLACE?

We have three strategies in place.

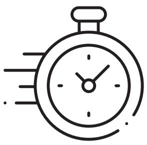
Firstly, the reactive strategy. This involves the analysis of past events. Hazards are identified through investigation of safety occurrences. Incidents and accidents may be indicators of system deficiencies and therefore can be used to determine the hazards that either contributed to the event or are latent.

We have a proactive strategy. This involves the analysis of existing or real time situations, which is the primary job of the safety assurance function of our SMS with its audits, evaluations, employee reporting, and associated analysis and assessment

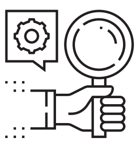
HAZARD IDENTIFICATION STRATEGIES



Reactive Strategy
Analysis of past events



Proactive Strategy
Analysis of existing or real time situations



Predictive Strategy
Gathering of high-quality data in order to analyse and identify possible future outcomes or events

processes. This involves actively seeking hazards in the existing processes.

And lastly, we have a predictive strategy. This involves the gathering of high-quality data in order to analyse and identify possible future outcomes or events, analysing system processes and the environment to identify potential future hazards and initiating mitigating actions.

Together, the different methodologies help us to avoid exposure to certain situations which are identified as threats through pre-emptive action and planning. They help reduce the potential outcomes from events if they do occur and better isolate and provide redundancy to recover from events.

HOW DO YOU THINK THE ROLE OF FLIGHT SAFETY WILL EVOLVE IN THE COMING YEARS?

Risk management, safety investigations and debriefs, safety assurance, and safety promotion activities will always be part of what we do. In the future, there will be an increasing focus on the use of big data for predictive safety management. Data received from safety reports already goes through a detailed analysis process, enabling us to present useful and relevant safety information – we are committed to further improve this.

We will continue to be leaders in the area of safety management systems, sharing safety knowledge both internally and externally.

The Contingency Response Planning team makes sure all aspects of the Emergency Response Plan are in place so that we can respond professionally in the event or an accident or an incident

CRISIS MANAGEMENT AT THE EMIRATES GROUP

Preparing for the unthinkable is challenging, but it is an important part of our culture at Emirates. Our Contingency Response Planning (CRP) team makes sure that all aspects of the Emergency Response Plan (ERP) are in place so that we can respond professionally to our customers, colleagues and their families in the event or an accident or an incident.

The team manages a comprehensive command, control, coordination and communication system required for an emergency response, which is handled in the Crisis Management Centre.

They also manage an in-house and dedicated Telephone Enquiry Centre offering information to family and friends of people affected in an event, as well as a Family Assistance Centre which supports affected people and their family members.

In addition, we have a programme called emcare and Immediate Response Teams, so that we can offer humanitarian support where required.

"In our Emirates training we talk about how 'it's better to be prepared for something that doesn't happen, than be unprepared for something that does'. We conduct activation exercises regularly to make sure that every department understands, prepares and practises their role in our ERP," says Gill Sparrow, Manager Contingency Response Planning.

"We have emergency response branding in different departments to act as a continuous reminder of the need to be prepared. It also offers quick access to the Immediate Response Checklists for that department," adds Gill.

IMPORTANCE OF MANAGING CHANGE IN OUR SMS

At Emirates, the Management of Change is an important aspect of how we manage risk and an element of the Safety Assurance component of our SMS. This is an area of focus that we're further developing within our SMS and we're working closely with all areas of the business to do this.

Everyone, no matter what job they do is responsible for managing change safely. Our SMS manual provides the policy framework and the Procedures Manual provides a detailed process, documentation template and supporting guidance to employees on how to do this.

We've recently introduced a Change Management Register tracker. The aim of the tracker is to provide a high-level overview of the main change management activities within each department, focusing on those that have significant safety considerations. Change management procedures are available for all employees and there are ready-made templates too.

Here are some key questions we consider when managing change:

Everyone, no matter what job they do, is responsible for managing change safely

HOW CRITICAL ARE SYSTEMS AND ACTIVITIES TO THE OPERATION?
In the planning and assessment of change, engagement and inclusion of the relevant people and organisations is very important. Following change, equipment and activities that are safety critical should be reviewed. This is to make sure that effectiveness can be assessed and modifications / corrective actions can be taken to mitigate any new safety risks.

HOW STABLE ARE THE SYSTEMS AND OPERATIONAL ENVIRONMENTS?
Changes can be a result of many things such as new destinations, fleet changes or business growth. Changes to the operational environment such as financial, political, regulatory, as well as physical environment can the level of safety. Even though some of these areas may not be under the company's direct control, there needs to be a plan to manage them.

HOW DID CRITICAL SYSTEMS PERFORM IN THE PAST?
As part of Safety Assurance activities, trend analyses should be used to track safety performance measures over time. This information is then used to plan future activities during change initiatives.

Safety promotion activities will always have a vital role at Emirates

HAZARD, RISK & SMS

Expert advice for your risk management process.

Images courtesy of Amalgamated Helicopters, Wairarapa, New Zealand

A controlled burn in rural Wairarapa

'HAZARD' IS ANYTHING with the potential to cause harm. The 'risk' associated with that hazard is assessed by looking at the probability of that harm happening, together with the severity of the consequences if it did happen.

Think of an uncapped bottle of bleach left out on the kitchen bench during the school holidays. It's an obvious hazard, and the probability of it causing harm is high because it's opened and within reach of small hands. The consequences are also severe – eyes being splashed with it, for instance, should the worst occur. So it is high-risk.

But if that same bottle of bleach is now firmly capped, on a high shelf, and in a locked cupboard, the risk is much lowered because – while the consequences of a child getting hold of it are still very undesirable – the probability of them doing so are almost nil.

The placing of the bleach high in a locked cupboard is the 'control', reducing the risk to as low as reasonably practicable.

And that, in a nutshell, is a risk management process – one of the fundamentals of a safety management system (SMS). Let's look at an aviation example. A maintenance engineer using an adjustable spanner may be a hazard. The risk of them doing that will be a combination of how probable it is, and its consequences for the airworthiness of the aircraft they're maintaining.

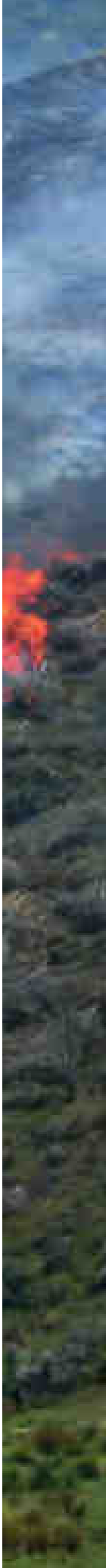
In a workshop lacking robust tool control, or appropriate tooling, the probability might be quite high.

But the following are all controls against the worst happening, aiming to lower the risk to as low as reasonably practicable:

- **Robust maintenance procedures, including strict tool control**
- **A positive safety culture throughout the organisation**
- **Properly trained engineers who understand the significance of using appropriate tools, who are supervised, and whose work is checked off by a superior.**

FIRST, THE HAZARD

It all starts with identifying the hazard. CAA safety management systems specialist Trevor Jellie offers the following advice to operators struggling with that first step.



Flying over dense woodland

"Hazards will be identified from 'walkaround' hazard surveys, occurrence reporting, internal audits, safety investigations, change management and management reviews.

"One of the most valuable sources of information is frontline staff who're actually 'doing the job'. For instance, the flight followers who identified weak points in a company's emergency response plan. And the ground crewman who identified on-site hazards with farmers before a spray job."

Trevor says experience has shown a staff get-together to brainstorm ideas is most effective if it's not attached to any other activity, like the monthly staff meeting where other agenda items are up for consideration. "In other words have a staff meeting dedicated to hazard brainstorming."

Too small a group of people identifying the hazards in an organisation can lead to a narrow focus on one area. For instance, those of the 'slips, bumps, and falls' worksite variety. Trevor advocates for as wide an approach as possible.

The benefit of casting a broad net for information is illustrated by a story from Brian Dravitzki, Senior Base Engineer of Helicopters (NZ), in New Plymouth.

"An offshore operator had an inflight event where a shop rag was left accidentally in a tail rotor drive train area during maintenance and the rag became entangled with the driveshaft causing considerable damage to the driveshaft and tail boom wiring.

"The heightened awareness and the possibility of that happening to us meant rags quickly became an identified hazard. We assessed the risk of FOD (foreign object debris) such as these causing issues in the future and immediately came up with a process to control the use and storage of rags, the same as our tool control process."

Trevor Jellie says a well-constructed register of hazards will include those associated with each type of operational activity. In heli ops, for instance, lifting, spraying, and passenger transport.

"There are also hazards related to ground activities, such as refuelling and loading of cargo. There are organisational hazards such as potential loss of key staff, and business hazards such as loss of insurance cover."

Trevor also says to successfully identify all the hazards in an organisation everyone needs to think beyond the obvious.

"Look for the more subtle dangers. For example, poor maintenance is obvious, but an overrun of a lifed component because the maintenance controller was overloaded by concurrent Part 145 commitments is not so obvious.

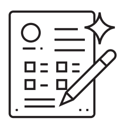
"Likewise, bad weather is an obvious hazard but pushing on through bad weather to get home at the end of a long,

IDEAS FOR EFFECTIVE HAZARD IDENTIFICATION:

Consider the complete cycle of each type of operation conducted. What hazards there could be from the beginning of the day when the pilot and aircraft are preparing to fly (pilot fatigue, improper fuelling) through all the activities of the day (poor weather decisions, time pressures) to the end of the day when pilot and helicopter are put to bed (rushed postflight check). The CAA's SMS team call this the 'day in the life' approach.

Brainstorm the collective knowledge in the organisation for 'what has bitten us in the past?' and 'what gave us a fright?'

Consider that what's happened to other operators 'could happen to us'.



Break down each organisational exercise to human, human-machine interface, and procedural tasks, and look for the hazards associated with each.

Undertake a trend analysis on what safety data has been collected. The amount of information might be small at the beginning of establishing an SMS but it could still be useful. A steady increase in occurrences will indicate, for instance, that a control is either weak or missing.

tough day indicates a hazard exists in pilot decision-making."

RECORDING THE HAZARD

Trevor Jellie says recording hazards must be simple, and every member of the organisation needs to be able to do it easily.

"One of the best hazard registers I've seen is a battered, well-used tablet carted everywhere by an operations manager. It has tabs for each type of operation, the base, and all the organisational stuff."

That operations manager is Jason 'JD' Diedrichs, of Amalgamated Helicopters in Wairarapa.

"We went online to give staff easy access to hazard identification," says JD. "We started out with general hazards then got more specific according to the task. If a pilot is going to a spray job, they can click on the appropriate tab and see each hazard, its associated risk, and the controls, for that job.

"We did have a paper hazard register but it was unwieldy, and it was hard getting staff to participate. This way is much easier and the staff are more forthcoming.

"We have all this information in hard copy document form as well, so if we lose connectivity for whatever reason, we have backup."

THEN, THE RISK

Noting a hazard and its associated risk in a folder or spreadsheet somewhere does not equate to controlling the impact of that risk.

"Some organisations I've seen pile their identified hazards into a register like it's a 'bucket'," says CAA safety management system specialist Simon Carter. "And then they rarely review the risks and stated controls. No one is monitoring properly what happens next.

"The risk associated with a hazard has to be assessed; then ranked (say, from intolerable to acceptable); controls to minimise the risk identified and put in place; and the effectiveness of those controls assessed."

JD says all his staff were involved in an initial brainstorming session to identify hazards, and they were also involved in the process of assigning risk.

"There were multiple benefits. We got some different ideas about just how much risk a hazard presented, but also, everyone was involved in improving safety.

"With some of the younger employees, they can disengage when it comes to talking about safety and SMS and hazards and risk, so the more we can involve them, make them responsible for a particular area of SMS, the more connected they'll be to what we're trying to do."

Having established the risk associated with a hazard, the next step is to nominate someone to be responsible (the 'owner' of the risk) for ensuring that controls are identified, developed, applied and assessed. That person should not always be the safety manager.

A safety manager should make sure risk owners are managing their area of responsibility, Simon Carter believes, but the safety manager is not Ms. or Mr. Fixit for every risk in the organisation.

"They can't necessarily be the owner of an operational risk, or a risk in the maintenance area – both may be completely out of their area of expertise."

Once someone is identified as the owner of the risk, they need to follow through with identifying and developing controls against that risk.

"They are expected to see through the lowering of the risk to as low as reasonably practicable, but in some organisations some risk owners are not actually doing that," says Simon. "If it's out of their area of expertise, they need to escalate it up the line to someone who can manage or reduce the risk. That needs to be done formally so it doesn't fall through the cracks."

That ties in with appropriate people being nominated as the owner of each risk in the first place. "The person who's accountable for accepting the stated risk controls must be someone who knows something about it, and who has the appropriate authority and resources to implement controls," says Simon.

NOW, THE CONTROLS

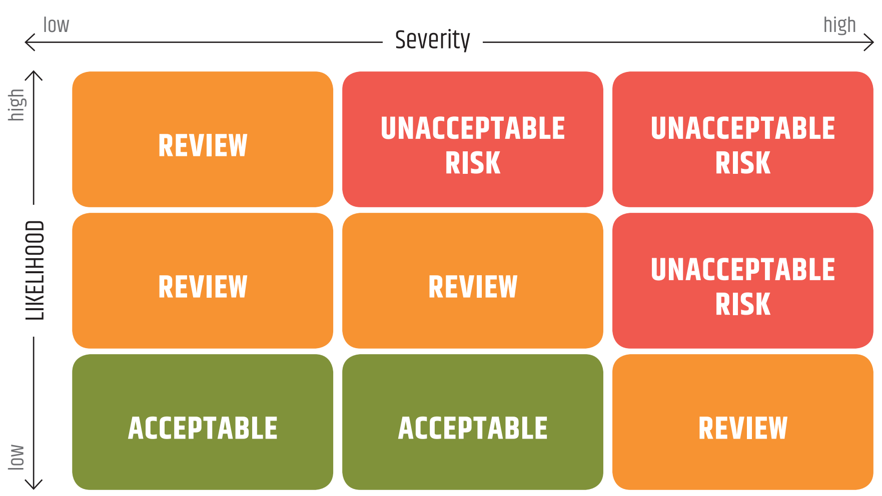
The controls stated in the risk register have to be specific, robust, and their effectiveness measurable. A control against using an adjustable spanner has to be something more than 'engineer awareness'.

Simon Carter believes the most effective thing an organisation can do is to establish a formal risk and control review program.

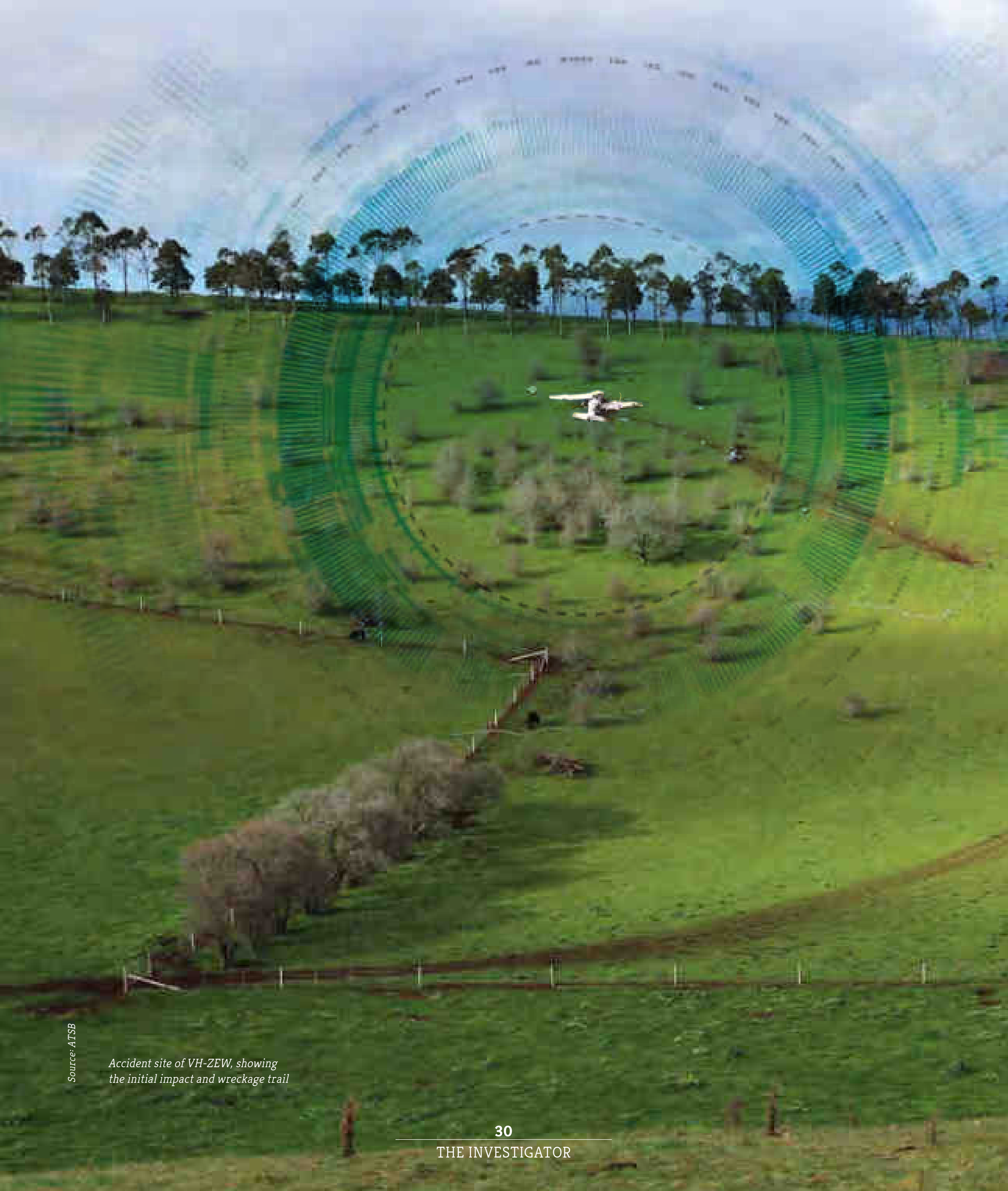
"A formal meeting can be set at regular intervals, or in smaller organizations it could be just a 'let's get around the table'. Such a review looks at each risk with a really critical eye – the less tolerable the risk, the more closely it, and the effectiveness of its controls, is looked at.

"But a low risk should be examined carefully too. You need to consider, 'is this rating still really appropriate? If not, could reality bite me?"

Article courtesy of New Zealand CAA Vector publication and Amalgamated Helicopters



There are many ways an organization can assess risk. Here is one: a simple risk matrix. Each organization, however, should do what works for them.



Source: ATSB

Accident site of VH-ZEW, showing the initial impact and wreckage trail

INVESTIGATING OUR FUTURE

The Australian Transport Safety Bureau outlines the work it is doing to be future-ready.

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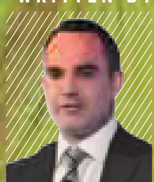


NAT NAGY,
Executive Director
Transport Safety
Australian
Transport Safety
Bureau (ATSB)

THE TRANSPORT SECTOR is changing at a rapid rate. More passengers are flying today than ever before and when they board an aircraft, it is increasingly likely to be one designed with advanced automation, state-of-the-art technology and digital connectivity. This kind of 'disruptive technology' challenges not only the aviation industry, but safety investigators in all modes of transport.

There are complex and critical questions in relation to how safety investigation agencies are anticipating and preparing for these challenges. How do we anticipate the types of hazards and risks that are likely to be contributing factors to a serious incident or accident in the near future? We need to better utilize data to become more predictive. We also need to understand what an investigation organization will look like in the future. What are the skill sets we should be recruiting as investigators? Should we continue to recruit pilots as investigators, or should we be looking wider at systems engineers or data coders?

The Australian Transport Safety Bureau (ATSB) recognizes accident investigation methodology as applied by today's investigators won't necessarily meet States' expectations in 5, 10 and 20 years' time. When examining the aviation operating environment, the ATSB considers the kind of expertise we will need, the type and amount of data we will need to store and analyze to become more predictive, and how we will communicate critical safety issues to the industry, regulators and the public. The ATSB will evolve, as all accident investigation agencies must, to continue to be a relevant and integral part of the safety system, identifying the safety issues of tomorrow.

Since the inception of manned flight, aviation has been a dynamic mode of transport – continually evolving to become safer, to carry a greater number of passengers and heavier tonnage of cargo, to become environmentally cleaner and more efficient. For example, the flight data recorder, invented by David Warren AO, transformed aviation accident investigations when it was first introduced in the 1950s, and over the decades since, its design has evolved to be more durable and collect more data over longer periods. Flight data recorders today have four times the capacity of the original magnetic tape flight recorders; they can survive high intensity flame for more than 30 minutes, can operate even after water immersion for 30 days at pressures equivalent to a depth of 20,000 feet. These and other changes are significant and they help us do our work to improve transport safety and ultimately save lives.

Many of the safety changes and improvements are a testament to the work of dedicated accident investigators such as those in ISASI. The ATSB's investigation into a 2010 incident – an in-flight uncontained engine failure on an Airbus A380 824 – found that a number of oil feed stub pipes were manufactured with thin wall sections that did not conform to the design specifications (See Figure 1). The investigation led to a number of relatively small but significant changes: identification and replacement or management of non-conforming oil feed stub pipes, an engine control software update and changes to the engine manufacturer's quality management system.

GLOBAL POSITION TRACKING

More recently, in the course of our assistance to the Malaysian Ministry of Transport in support of the missing Malaysia Airlines flight MH370, the ATSB recommended that States ensure that sufficient mechanisms are in place to ensure a rapid detection of, and appropriate response to, the loss of aircraft position or contact throughout all areas of operation. The ATSB also recommended that aircraft operators, aircraft manufacturers, and aircraft equipment manufacturers investigate ways to provide high-rate and/or automatically triggered global position tracking in existing and future fleets. States and industry are taking action to respond to these recommendations.

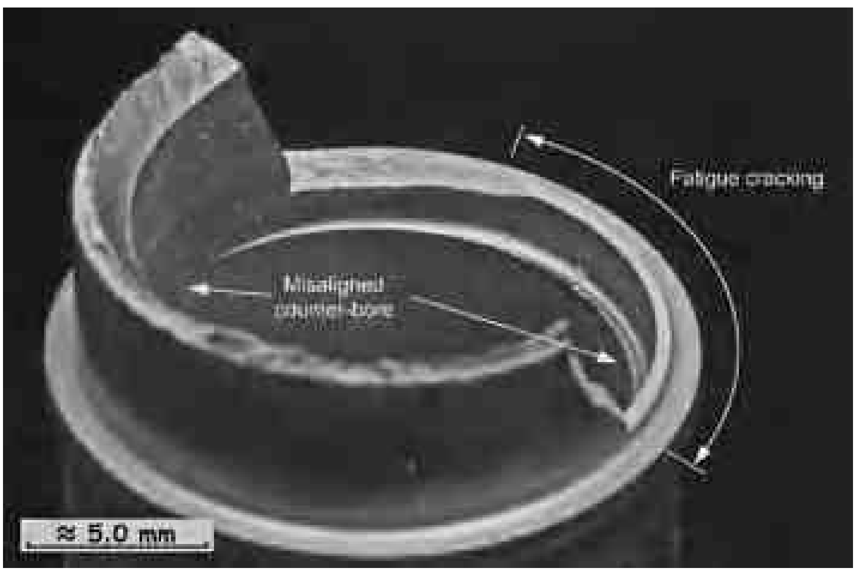


Figure 1: AO-2010-089 Oil feed pipe

"Flight data recorders today have four times the capacity of the original magnetic tape flight recorders; they can survive high intensity flame for more than 30 minutes, can operate even after water immersion for 30 days at pressures equivalent to a depth of 20,000 feet"

Change is the only constant in the aviation industry and not new to this group or to any aviation investigation agency – it is central to what we do. But we can ill afford to be complacent about the future. As leaders in aviation safety, we must predict the challenges ahead to ensure we remain relevant and continue to improve safety.

The changes of the past, while significant, have largely been gradual and iterative. What we are seeing now, across many sectors, is a shift towards more sudden, disruptive change. 'Disruptive innovation' is the buzzword of our generation, and for good reason. Innovations such as the 'sharing economy' (think Uber and Airbnb) are disruptive in that they are transforming the way people utilize resources. This isn't limited to holiday and personal travel – there are a number of share economy businesses in the aviation sector (or seeking to enter it) including Uber Elevate, Airpooler and Uberjets. These companies are innovating quickly and are fundamentally changing the way the aviation sector operates. Traditional aviation companies and regulators are finding it challenging to keep up with these changes while potential customers are changing their activities to adjust. These and other disruptive innovations will influence the world and the future of aviation safety.

We need to prepare for increasingly unfamiliar environments with disruptive innovation—a rapidly changing transport environment. The ATSB is preparing for the future by preparing a vision for 2025. Our vision is "to drive safety action in a rapidly changing transport environment."

In this paper, I will provide examples of the key changes and trends we see emerging that demonstrate why we expect the future to rapidly change. I will also pose some challenging questions we should all be asking ourselves, and outline what the ATSB is doing to try to answer those questions.

AUTOMATION

Automation is not new to the aviation sector. Autopilots have been used for decades and even technologies such as ADS-C and terrestrial ADS-B have now been in use for some time across the globe. However, automation continues to advance and is no longer confined to the biggest, latest, state-of-the-art aircraft, airports and other aviation systems. We're seeing the effects of increased automation throughout the aviation sector now. This year the ATSB released two investigation reports identifying pilot interaction with automated technology as a contributing factor to the accident.

In the first incident, two Beech Aircraft Corp. B200 aircraft were involved in a near collision (See Figure 2). Difficulties in operating the GPS/autopilot resulted in the pilot of one of the aircraft experiencing an unexpected reduction in the level of supporting flight automation, and a significant increase in workload, while attempting to conduct RNAV (GNSS) approaches into the airport. This increased workload affected both the pilot's ability to follow established tracks such as the published approach and missed approach, and his ability to communicate his position accurately to other aircraft and the air traffic controller.

In the second incident, a Cessna 172 collided with terrain with fatal injuries to the pilot (See Figure 3). Our investigation found that the aircraft impacted terrain in a level, slight right wing low attitude. That indicated that the pilot likely stopped the aircraft's descent and started to initiate a maneuver to avoid the terrain. It is likely that the pilot manually manipulated the controls while the autopilot was engaged in a vertical mode. As a consequence, the autopilot re trimmed the aircraft against pilot inputs, inducing a nose-down mistrim situation, which led to a rapid descent. The aircraft's low operating height above the ground, due to the extent and base of the cloud, along with rising terrain in front of the aircraft, provided the pilot with insufficient time to diagnose, react, and recover before the ground impact.

There was no advice, limitation, or warning in the aircraft pilot operating handbook or avionics manual to indicate that if a force is applied to the control column while the autopilot is engaged, that the aircraft's autopilot system will trim against the control column force, and possibly lead to a significant out of trim situation. Training requirements for autopilot systems was rudimentary at the recreational pilot licence (RPL) level due to stipulated operational limitations for its use. At the time of the accident there was no regulatory requirement for pilots to demonstrate autopilot competency at the RPL level.

Both accidents demonstrate that pilots need to have a thorough understanding of all systems on board their aircraft and have the skill to provide redundancy when those systems fail or their performance is degraded.

Aircraft manufacturer plans and industry demand suggests that automation is likely to continue to advance throughout the aviation sector. This increases the likelihood of systemic factors related to the design and operation of automated systems arising. The challenge for investigators will be ensuring we can and do identify those factors. We will need the appropriate tools and expertise. As the level of automation increases, our investigation of human factors may shift from the capability of the pilot to the person who coded the system that operates the aircraft.

BIG DATA AND COMPLEX SYSTEMS

Many systems in the aviation sector, be they for manufacturing, maintenance scheduling, navigation or all manner of other things, are increasingly relying on complex digital codes and algorithms. Other transport modes are experiencing this same trend and as a multi-modal investigation agency, the ATSB is able to share safety lessons and experiences from these other sectors.

In a recent rail investigation (See Figure 4), the ATSB determined that the computer system controlling movements of rail tracks was not operating as expected due to design errors in the system's coding. Track maintenance workers were put at risk because the safety control they expected to be in place was not actioned. We identified a safety message—it is critical that system designers ensure that the functionality and performance requirements needed to meet

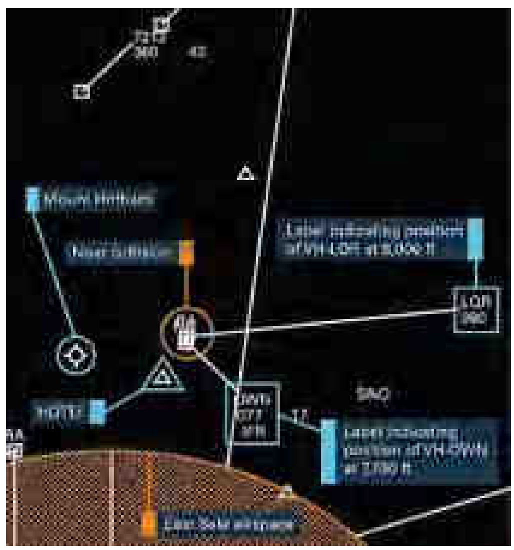


Figure 2: AO-2015-108 Radar data showing near-collision

all operational scenarios are incorporated within the design. It is also important that effective check and test processes are developed to fully validate system functionality. This is an important message for all transport modes including aviation, as systems become more technically complex.

Associated with the emergence of complex systems, is the creation of 'big data'. Ninety per cent of digital data was created over the two years 2014 and 2015 and the rate of data creation is increasing. Transport systems, including aviation, are generating high volumes of data relating to routes, fuel efficiency, customer interactions, and maintenance. By collecting accurate, rapid and comprehensive information, the aviation sector can improve productivity and efficiency.

REMOTELY PILOTED TECHNOLOGY

Another emerging technology is remotely piloted aircraft systems (RPAS). The ATSB is closely monitoring the growth in this sector as it presents an emerging and insufficiently understood transport safety risk.

Data about the number of RPAS (See Figure 5) operating in Australia is limited. Australia's civil aviation regulator certifies RPAS operators but not all RPAS need to be certified. To estimate the total number of RPAS, we combine the regulator's data with Google trends shopping data. We use this estimate to help predict occurrences.

Data about occurrences such as collisions and near-encounters is somewhat better. The ATSB receives occurrence reports from a wide range of aviation stakeholders. At the time of writing this paper, the ATSB has received many reports about RPAS occurrences but no reports of collisions between RPAS and manned aircraft in Australia. Over half of all RPAS occurrences from January 2012 to June 2017 involved near encounters with manned aircraft. The next most common type of occurrence involved collisions with terrain, almost half of which resulted from a loss of control of the RPAS.

A key challenge for investigation agencies regarding RPAS is collecting and analysing data that will help us predict future occurrences. As data about RPAS is difficult to collect, this could be an opportunity for agencies to cooperate and share data internationally to form a more complete picture.

Figure 3: Accident site and wreckage of Cessna 172S Skyhawk SP, VH-ZEW

WHAT NEXT?

Now that we've given some thought to what our future looks like, we need to ask ourselves some difficult questions such as:

INVESTIGATIONS

What will we investigate?
How will we investigate?
Why will we choose to investigate some occurrences and not others?

DATA

How will we collect and manage data?
What data do we need to do our job well?
How will we use data to inform our other work?

COMMUNICATION

Who will be our audience?
How will they want to engage?
What information will we want and need to share?

OUR RESOURCES

How will we be funded?
Who will we work with?
What technology and resources will we need to do our work?

OUR PEOPLE

What expertise do we need?
What will our workforce look like?
How will we engage people to conduct work?

WHAT IS THE ATSB DOING?

This year the ATSB has embarked on a major project to challenge ourselves to ensure we are prepared for the future. We have chosen to focus on the medium term and what our vision is for 2025. This vision will be a declaration of our intended purpose and aspirations. It will guide our strategies over the coming years, help us communicate with our stakeholders about our purpose and value, and allow us to check if we are on track for achieving what we intend.

An important part of this process has been entering into conversations with a wide variety of stakeholders. We are talking to our staff—experts in their fields—about what they see as the emerging opportunities and challenges. We are talking to our government colleagues—policy makers, regulators and others—about how to best work together to improve safety. We are talking to people in the transport industry about how the ATSB can best add value and support the work they already do. We are talking to the Minister about what he and the Australian Government expect from our agency. By asking and listening we have learned a great deal and their input has been integral to developing our vision.

Our vision is "to drive safety action in a rapidly changing transport environment." This acknowledges the fast pace of change and our important role in identifying safety issues and influencing improvements. As with all vision statements, it is an aspirational target, supported by goals and

Figure 5: An example of an RPAS - the Pulse Aerospace Vapor 55

strategies. These goals and strategies center on ensuring the ATSB remains relevant and uses resources in the best way to achieve safety improvements.

One of our aspirational goals is to be Australia's national transport safety investigator. As we are a multimodal investigation agency, covering aviation, marine and rail, you could argue that we have already achieved this goal. However we need to strategically consider where we can best add value to the transport sector. We currently focus on passenger transport across these three modes, but our expertise could potentially also assist in protecting economic interests by focusing on freight movements and damage to public infrastructure. We could potentially also lend our expertise to other transport modes such as heavy vehicles. For example, a recent accident north of Sydney involved a truck and six cars and resulted in two fatalities and multiple injuries.

This stretch of road has been the site of several serious accidents and an investigation into the accident could potentially identify some systemic contributing factors. The investigation techniques and expertise are largely transferable and could lead to improvements in road safety and a reduction in fatalities. While these options require extensive consideration by the agency and the government, we are committed to think more strategically about what our role as Australia's national transport safety investigator does and should mean, especially in the context of future change.

Another goal for 2025 is to expose the critical safety issues that others don't. There are many relevant stakeholders in each of our modes – including industry operators, private operators, regulators, policy owners, research bodies, police and coroners. All of these stakeholders have some interest in improving safety and take action to identify issues and take action. Many of them have investigation capabilities and can identify safety issues in minor and routine occurrences.

If they do this work, there may be no need for the ATSB to be involved. Replicating the work of these stakeholders would be inefficient and unlikely to lead to further safety improvements. Instead, we should use our position as the independent no blame investigator to investigate and research those issues that others can't or won't. We are in a unique position to raise the standard of investigations, conduct detailed technical work and advocate for serious systemic change.

For example, the ATSB investigated a collision with terrain involving a Robinson R44 helicopter. We also conducted statistical analysis of helicopter accidents that occurred in Australia and the United States between 1993 and 2013 and identified a significantly higher proportion of post impact fires involving R44s than for other similar helicopter types. That analysis also identified that, despite the introduction of requirements for newly certificated helicopters to have an improved crash-resistant fuel system (CRFS) some 20 years previously, several helicopter types were still being manufactured without a CRFS and that many of the existing civil helicopter fleet were similarly not fitted with a CRFS. The ATSB issued a safety recommendation about the risks involved in not having a CRFS. As a result, Australia's civil aviation regulator, and other international regulators, took action to ensure owners and operators made these improvements. The ATSB's investigation and research led to safety improvements that otherwise would not have happened. This is the kind of work we should prioritize into the future.

CONCLUSION

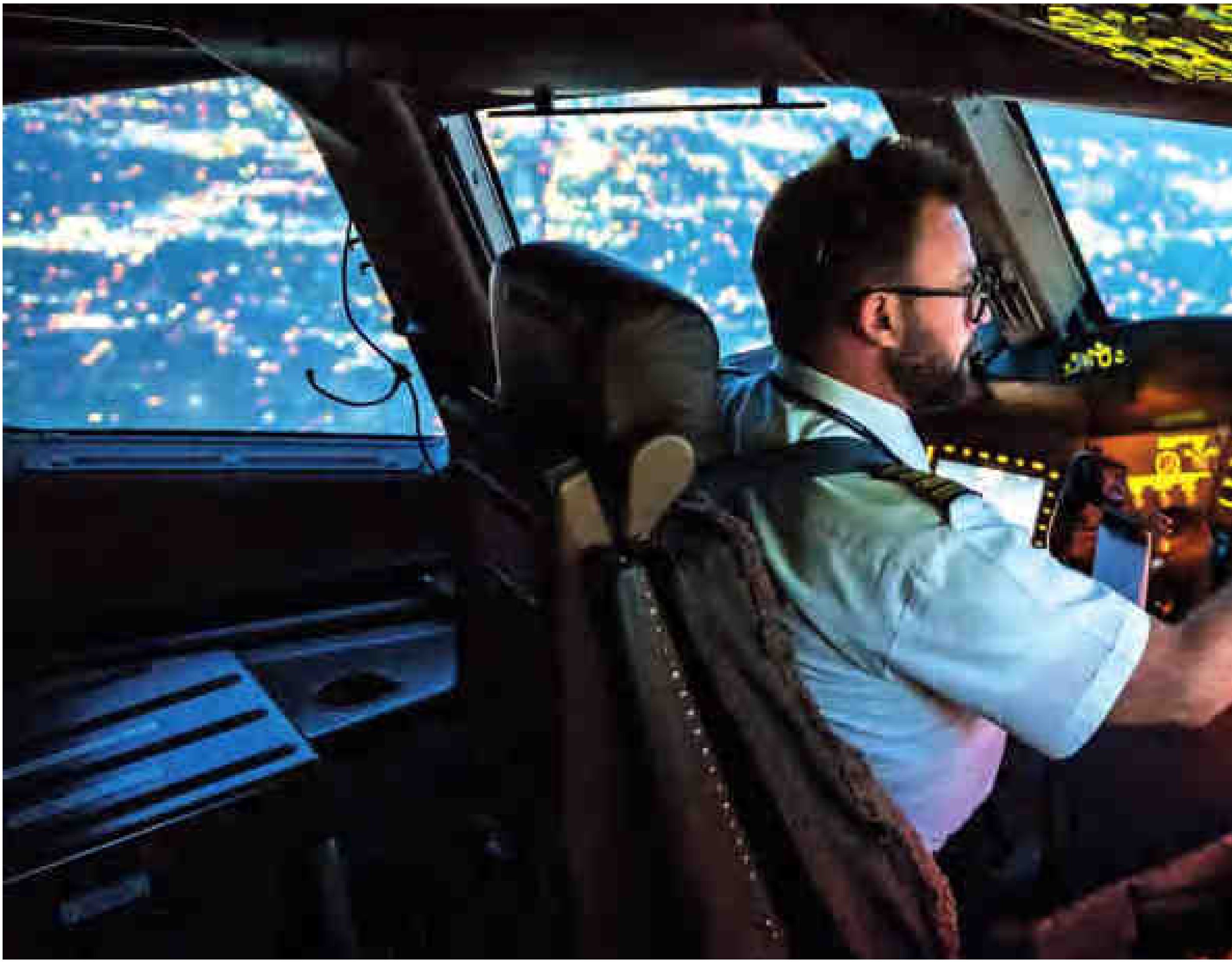
Our collective future lies in a rapidly changing transport environment and the ATSB will continue to drive safety action. We have a great deal of research and strategic planning ahead to determine what our future direction should be, but the process so far has been fruitful and we are better placed to continue being an integral part of the safety system.

Article courtesy of ISASI Forum publication

Figure 4: Ballarat Railway Station

THE AUTHOR:

NAT NAGY has been involved in the transport industry since 1996 in a diverse range of operational and leadership roles. His background includes a career as a commercial pilot, air traffic controller and several strategic leadership and transformation roles. Most recently, Mr Nagy was a Business Change Manager for Airservices Australia where he delivered a program of technological, organizational and cultural change. Nagy now leads the operational division of the ATSB across the rail, aviation and marine domains and has a core focus on the improvement of transport safety across all industries.



STAYING AHEAD OF THE GAME

A safe and successful flight relies on everybody aiming to win.

WRITTEN BY

CAPTAIN
TONY WRIDE

IN MOST SPORTS, a team or an individual is successful if they have trained and practiced well and studied their opponents' strengths and weaknesses before making a plan to win. The world of aviation is little different, as a safe and successful flight relies on everybody aiming to win. In order to win all potential safety threats need to be identified. Then measures should be put in place to mitigate those threats. Everybody needs to be ahead of the game.

A term often used in the aviation industry is Threat and Error Management (TEM) and this is what I will be focusing on in this third and final Airmanship article. Whilst primarily focusing on the flight crew the principles apply to all areas of the operation because effective TEM throughout all departments will contribute to keeping the flight safe and winning!

THE AVIATION WINNING TEAM

A bit like the focus in a football team might be on the star center forward, all too often in aviation the attention is on the pilots. However, the 'winning team' is not just the pilots but also a whole host of people that support them just like the center forward needs the other team players to support him.

If the baggage handlers and ramp staff load the aircraft incorrectly then the out of trim condition could cause an incident or accident

"A bit like the focus in a football team might be on the star center forward, all too often in aviation the attention is on the pilots. However, the 'winning team' is not just the pilots but also a whole host of people that support them just like the center forward needs the other team players to support him"

The aviation team is huge and the following are just some of the team members; Check in staff, security staff, baggage handlers, ramp staff, engineers, fuel company staff, caterers, Air Traffic Controllers (ATC), crew control, Operations, Airline management, cabin crew, pilots, and many more. Sometimes, pilots forget that they need many other people to do their jobs correctly so that the aircraft is safe. Looking at the previous list consider how important each job is. For example, if the baggage handlers and ramp staff load the aircraft incorrectly then the out of trim condition could cause an incident or accident. If the security team is not vigilant then a dangerous object could get onto the aircraft and if the engineer forgets to secure an access panel after working on the aircraft a serious problem could result.

EFFECTIVE TRAINING OF THE TEAM

Regardless of where you work in aviation, effective training is important to enable an individual, or a team, to manage threats and errors. Some examples of this are the pilots training in the simulator, the cabin crew training for various fire scenarios, and everyone's training on dangerous goods. Just like a football team the better trained we are then the better the team will perform and have the best chance of winning!

Air Traffic Controllers are a vital part of the aviation team

Training is effectively getting you ahead of the game because it is giving you the required skills to tackle the different threats that may be present in your particular environment. Hopefully, having been given training on particular threats you will also become more threat aware and be able to identify new threats before they cause a problem.

THREAT AND ERROR MANAGEMENT ON A FLIGHT

As an example of TEM let us take a flight from the UAE to Bangkok and look into some (not all) of the key TEM points. As a pilot, you know in advance that you have the flight and prior to reporting you may have already looked at the weather, the

airfield brief, and any special information pertinent to the route and the airport. Based on the information you will formulate a series of plans to mitigate any identified threats such as enroute and arrival thunderstorm activity, and the potential difficulty in understanding ATC communications in particular areas.

Once you have the relevant flight plan with weather and NOTAM information you will identify further threats, like taxiway closures, unserviceable navigation aids, and diversion airport suitability. Based on the available information the crew will formulate plans to mitigate the threats such as taking additional fuel or nominating a more suitable alternate.

On the aircraft prior to departure the crew should include in their brief the identified threats for the departure and how they will deal with an emergency which may include loading the hold and return runway into the FMGC secondary route. Other threats that may affect the departure include taxiway hot spots, closed taxiways, and the effect of high temperature on aircraft performance.

In the cruise, the crew should brief on how they will deal with the various critical emergencies like an engine failure or a pressurization problem, and confirm the enroute diversion airfield suitability.

Possibly the most critical phase of a flight is the arrival and therefore it is extremely important to be 'ahead of the game' and prepare to win! There are numerous threats that might be considered. Some of them on our flight to Bangkok are high terrain, adverse weather, possible delay and holding, difficulty in understanding ATC clearances, ILS DME at the other end of the runway, wet runway landing performance, a go around might be affected by weather, and diversion fuel minimum might need to be adjusted for weather enroute to a diversion airport.

Another area of the approach that can cause problems is energy management. Unstable approaches and go-arounds due to not meeting the stability criteria are nearly always a result of poor energy management. This threat can be mitigated by use of height/distance/speed gates that the crew are aiming to meet to ensure that the later stage of the approach is not rushed and the aircraft energy is not excessive. Similarly, being prepared for a reduced track miles scenario and what will be required to regain the profile is getting ahead of the game.

Having landed safely you may think that you have won the game but unfortunately it's not over yet and there's some extra time still remaining! Taxying into your stand also has some potential threats and issues such as taxiway incursions, entering the wrong taxiway, are not uncommon! Like the taxy out scenario, the crew should be aware of the potential threats. One of the most common threats is distraction where, rather than focusing on the primary task of following the cleared taxy route, the crew are engaged in shutting down an engine, completing a checklist, or completing some paperwork. Additional threats are other aircraft maneuvering on the taxiways and vehicles maneuvering on the ramp.

AIRMANSHIP?

Given all the previous information it is obvious that effective application of Threat and Error Management will help to keep a pilot ahead of the game and help him or her to keep the aircraft safe. Therefore, Threat and Error Management is an airmanship skill, which should be practiced and refined. Prior knowledge of possible dangers or problems gives one a tactical advantage and in aviation, this is definitely true.

PROVIDING BETTER CARE

The history of the Air Crash Victims Families Federation International organisation

WRITTEN BY

PILAR VERA,
Chairperson ACVFFI

IN THE YEAR 2000, Hans Ephraimson, President of the Victims Association of the United States attended an ECAC (European Civil Aviation Conference) Workshop in Tallinn, Estonia. A new page in Family Assistance was turned at this event when ICAO decided to support the publication of Circular 285, a guidance document on assistance to air accident victims and their families, following Resolution A32-7 of the ICAO Assembly.

In 2011, the NTSB hosted the first International Conference of Air Accident Victims and their Families in Washington, when Ms. Deborah Hersman was the NTSB Chair. At this event I witnessed for myself the advances in family assistance that had taken place during the time since the tragedy in Madrid (Spain) on August 20th, 2008, when an MD82 aircraft of the now defunct airline Spanair crashed during take-off at Adolfo Suarez Madrid-Barajas airport. There were 154 deceased and 18 survivors from this accident. The response to the tragedy was chaotic and consequently, the suffering was increased for the 172 families who lost our relatives on this very sad day.

At this time we received the support of the Governments of the United States and Spain and the NTSB and ICAO to update Circular 285, which had been in existence for 10 years (2001-2011). Until then, this was the only guidance on the provision of assistance to air accident victims and their families at international level.

During the Conference, it was decided that Circular 285 would become "ICAO Policy on assistance to air accident victims and their families" under the responsibility of the General Secretary. In addition, it was decided to introduce a Recommendation to Annex 9, Rec 8.46, which led to the inclusion of Family Asssitance in the ICAO Universal Safety Oversight Audit Programme (USOAP).

Task Force 285, established under the aegis of ICAO, was formed by representatives of 37 States, the NTSB, International organizations such as IFALPA, IFATCA, etc. and the Air Crash Victims Family Group (ACVFG) with Hans Ephraimson and myself. Mr. Victor M. Aguado who was the Representative of Spain in ICAO, was the President of the Task Force. In a short time, there was consensus on the wording of Document 9998 which describes ICAO Policy on Assistance to Air Accident Victims and their Families.

I had the privilege of representing the air accident victims at the ICAO Council which was held on March 1st, 2013, this was the first time that accident victims and their families were represented in this forum. Finally, ICAO Doc. 9998 was adopted unanimously by the 36 states represented in the Council, and the document was then ratified by the 38th ICAO General Assembly which was held in September - October 2013. Ms. Hersman, the NTSB Chair, and Ms. Pastor, Spanish Minister of Transport attended, in addition to Hans Ephraimson as Chief of ACVFG, and myself as the Deputy Chief.

The achievements listed in this article happened within recent international civil aviation history and it is a reflection on the air accident victims struggle to improve the assistance provided to people who are touched by the tragedy of an aircraft accident in any part of the world. Because, in the end, all air disasters have similar stages of hurt and grief and our goal is to make the pain of losing loved ones more bearable through sharing knowledge and experiences.

Hans Ephraimson (front row, second left), ICAO leaders, global transportation officials and victims' family advocates following the introduction of ICAO's "Policy on Assistance to Aircraft Victims and Their Families"

Aircraft accident victims associations are like bubbles, they are established when an accident happens and they disappear when investigations, both judicial and social, are completed and there are compensations. The hardest part is surviving as a non-profit association, working generously for the common good, no matter what country an accident has occurred in or what the nationalities of the victims were.

Therefore, the Federation will continue to exist whether we can be together under the same umbrella, in accordance with the saying: whether you walk alone then you finish fast, whether you walk together you go farther. Also with the help of the governments of our countries, through a loyal collaboration before the occurrence of air accidents and not later, when the tragedy has already occurred and the pain nests in the hearts of the victims who have suffered.

The death of Hans in October 2013 at 93 years of age was a serious setback for the members of the ACVFG. In his farewell, after the historic picture above, he made me promise that we would finish what we started together in 2010 and that I would never stop working for the goals we shared and that is what I have been doing since he left.

Therefore, in July 2015 we founded in Madrid the Air Crash Victims' Families Federation International - ACVFFI - with the participation of these Associations; Spanish AVJK5022, HIOP-AF447 of Germany and ACAA ED202 from Pakistan. The Federation is registered in the Register of Associations of the Spanish Ministry of the Interior. I had the honor of being elected as Chairperson, a position that has been renewed annually from then until today.

In February 2016, for the first time in its history, the ICAO Council recognized an International Federation of Air Accident Victims as an international organization to be invited to its events. So continuity in that organization is guaranteed, as long as ACVFFI continues to operate as it has been doing so far, placing itself at the level of International Organizations such as IATA, IFALPA, IFATCA, CANSO, etc. with a voice on the international scene which provides the vision of the people who suffer the consequences of an aircraft accident.

At the 39th ICAO General Assembly held in September 2016, we presented 3 Working Papers related to the investigation and prevention of air accidents and assistance to victims so that recommendation 8.46 of Annex 9 becomes a Standard and finally, the creation in ICAO of a Database of safety recommendations addressed, or not, to the said organization.

Much progress has been made but we must keep working hard from ACVFFI for the benefit of society in general and of aircraft users in particular. Putting at the service of the common good the experiences suffered by the people who make it up, sharing knowledge, working and also the pain. In addition to promoting in our countries of origin all possible improvements in favor of aviation safety, research, and prevention of air accidents, passenger rights, assistance to victims, recognition of the best practices with respect to insurers regarding the victims, etc. Ultimately, following the path that began in 2000 and has continued until today.

Making ACVFFI known in all international forums will allow other Victims Associations or people committed to the project to register as members, in addition to contributing in solidarity to achieve the objectives we defend.

On the ACVFFI website - www.aircrashvictims.com - you can find the information and how to join.

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GENERAL CIVIL AVIATION AUTHORITY

United Arab Emirates

CALL SIGN SIMILARITY - A SAFETY THREAT

Flight Crew Can Avoid Call Sign Confusion

- Use correct RTF procedures and discipline at all times.
- Use full RTF call signs at all times, unless call sign abbreviation has been introduced by ATC.
- Do not clip transmissions.
- Always use headsets during times of high RTF loading.
- Do not use readback for confirmation if in doubt about an ATC instruction.
- Positively confirm instructions with ATC if any doubt exists between flight crew members.
- Advise ATC if two or more aircraft with similar call signs are observed on the same frequency.
- Advise ATC if it is suspected that another aircraft has taken a clearance not intended for it.
- Advise ATC if it is suspected that another aircraft has misinterpreted an instruction.
- Always question unexpected instructions for any particular stage of flight.
- At critical stages of flight actively monitor ATC instructions and compliance with them.

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