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Editorial

Controlled Flight into Terrain (CFIT) was a major threat to flight safety. The aviation industry reduced it with technological innovations and continuous flight crew training. Recently, loss of control in-flight (LOC-I) seems to overtake CFIT as a leading cause of fatal accidents and hull losses. This is the main topic of this issue.

We look first at Qantas A330-300 in-flight upset accident followed by a study of causes and remedies for loss of control in-flight.

The UK Aircraft Accident investigation Branch (AAIB), UK have completed the investigation on the crash of British Airways BA777 at Heathrow and have released the final report. We revisit this accident and look at the recommendations of AAIB.

Flight crew incapacitation is uncommon but it does occur and could contribute to loss of control in-flight. We have a brief note on this.

As always, we look forward to your feedback, suggestions and contributions which can be sent to our office address given in this page. Happy reading and many more safe landings.

Qantas A-330 - 300 In-flight upset

Adopted from ATSB Safety report A0-2008-070, Nov.2009

On October 7, 2008 at 0932 (local time), Qantas flight QF72, an Airbus A330-303 departed Singapore to Perth, Australia. Onboard the aircraft were 303 passengers, 9 cabin crew and 3 flight crew.

At around 1240, while in cruise, the aircraft experienced sudden and unexpected altitude change. This resulted in serious injuries to a crew member and 11 passengers. More than 100 others including 8 crew members received minor injuries.

The deck crew issued a mayday call and diverted the flight to Learmonth near the town of Exmouth about 1100 kilometers north of Perth. The captain was the PF for the flight.

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The departure and climb-out from Singapore was normal. By 1001, the aircraft was cruising at 37,000 ft (FL 370) in automatic flight mode with the autopilot no. 1 and autothrust systems engaged.

The weather was fine and clear and there was no turbulence during the flight. At about 1239, the first officer (FO) left the flight deck for a scheduled rest break. The second officer (SO) then occupied the right control seat.

At 1240, the autopilot disengaged and an associated ECAM warning message (AUTO FLT AP OFF) came. There were master caution chimes as well. The captain took manual control of the aircraft and attempted to engage autopilot 2 and then autopilot 1, but neither action was successful [The flight data recorder (FDR) showed that, during this period, the aircraft's altitude increased to 37,200 ft before returning to the assigned level].

The crew cleared the AUTO FLT message from the ECAM. Then came a NAV IR1 FAULT message on the ECAM. There were also aural stall warning indications. The airspeed and altitude indications on the captain's primary flight display (PFD) were also fluctuating.

Given the situation, the captain asked the SO to call the FO back to the flight deck.

At 1242, while the SO was asking a flight attendant over the cabin interphone to send the FO back to the flight deck, the aircraft abruptly pitched nose-down.

The captain applied back pressure on his sidestick to arrest the pitch-down movement. Though there was no immediate reaction, the aircraft responded to his control input and he commenced recovery to the assigned altitude. During the event, the aircraft pitched down to a maximum of about 8.4 deg. The crew felt the pitch-down to be very abrupt, but smooth. The aircraft motion was mainly in the pitch plane and the crew did not experience any roll motion. It was very unlike a turbulence response [FDR data showed that the aircraft had experienced a maximum g loading of -0.80*g* and had descended by 650ft during the event].

During the initial upset event, the SO activated the seatbelt sign to ON and made a public address for passengers and crew to return to their seats and fasten their seatbelts immediately.

After the aircraft returned to FL370, flight crew commenced actions to deal with multiple ECAM messages. They completed the required action to deal with the first message (NAV IR1 FAULT) by switching the captain's ATT HDG (attitude heading) switch from the NORM position to CAPT ON 3 position, and then cleared that message. The next message was PRIM 3 FAULT. The crew completed the required action by selecting the PRIM 3 off, waiting 5 seconds and then selecting it on again.

At 1245, shortly after the crew selected PRIM 3 back on, the aircraft commenced a second uncommanded pitch-down event. The captain had to again apply back pressure on his sidestick to arrest the pitch-down movement. The response was consistent with the first event and the aircraft reached a maximum Nose down pitch angle of about 3.5 deg. and the aircraft lost about 400ft. The flight crew's experience was similar in nature to the first event, though of a lesser magnitude and intensity.

The captain announced to the cabin for passengers and crew to remain seated with seatbelts fastened. The SO made another call on the cabin interphone to get the FO back to the flight deck.

At 1248, the FO returned to the flight deck and took over from the SO in the right control seat. The SO moved to the third occupant seat. After discussing the situation, the crew decided that they needed to land the aircraft as soon as possible. They were not confident that further pitch-down events would not occur. They were also aware of some injuries in the cabin, but had no idea of the extent of injuries.

At 1249, the crew made a PAN8 emergency broadcast to ATC, advising that they had experienced 'flight control computer problems' and that some people had been injured. They requested a clearance to divert to and track direct to Learmonth, WA. Clearance to divert and commence descent was received from ATC.

Following the second upset event, the crew continued to review the ECAM messages and other flight deck indications. The IR1 FAULT light and the PRIM 3 FAULT light on the overhead panel were illuminated. There were no other fault lights illuminated. Messages associated with these faults were again displayed on the ECAM, along with several other messages. The crew reported that the messages were constantly scrolling, and they could not effectively interact with the ECAM to action and/or clear the messages. The crew reported that master caution chimes associated with the messages were regularly occurring, and they continued to receive aural stall warnings.

The captain reported that, following the first upset event, he was using the standby flight instruments and the FO's PFD because the speed and altitude indications on his PFD were fluctuating and he was unsure of the veracity of the other displayed information. After the second upset event, he had observed that the automatic elevator trim was not functioning and he had begun trimming the aircraft manually. He later disconnected the autothrust and flew the aircraft manually for the remainder of the flight. The flight crew spoke to a flight attendant by interphone to get further information on the extent of the injuries. The flight crew advised the cabin crew that, due to the nature of the situation, they did not want them to get out of their seats, but to use the cabin interphones to gather the information. At 1254, after receiving advice from the cabin of several serious injuries, the crew declared a MAYDAY and advised air traffic control they had multiple injures on board, including a broken leg and some cases of severe lacerations.

The crew continued attempts to further evaluate their situation and, at 1256, contacted the operator's maintenance watch unit, located in Sydney, by SATPHONE to seek assistance. There were several subsequent communications during the flight between the flight crew and maintenance watch, who advised that the various faults reported by the crew were confirmed by data link, but that they were not able to diagnose reasons for the faults. During one of the conversations, maintenance watch suggested that the crew could consider switching PRIM 3 off, and this action was carried out. This action did not appear to have any effect on the scrolling ECAM messages, or the erratic airspeed and altitude information.

The crew conducted a visual descent via a series of wide left orbits, maintaining aircraft speed below 330kts (maximum operating speed). They completed the approach checklist and conducted a flight control check above 10,000 ft. They were unable to enter an RNAV (GNSS) approach into the flight management computer; however, the aircraft was positioned at about 15 NM for a straight-in visual approach to runway 36. The precision approach path indicator (PAPI) was acquired at about 10 NM and the aircraft landed without further incident at Learmonth at 1350.

ATSB is conducting the investigation and to date it has identified two significant safety factors related to the pitch-down movements.

1. Immediately prior to the autopilot disconnect, the air data inertial reference unit (ADIRU) in position 1 started providing erroneous data (spikes) on many parameters to other aircraft systems. The other two ADIRUs continued to function correctly.

2. Some of the spikes in angle of attack data were not filtered by the flight control computers, and the computers subsequently commanded the pitch-down movements.

Loss of Control in Flight

Adopted from Skybrary article on Loss of Control, 2009

Loss of control in flight (LOC-I) has been one of the most significant causes of fatal aircraft accidents for many years. In the recent times, LOC-I has challenged CFIT and seem to replace it as the leading cause of fatal accidents and hull loss. IATA statistics for the five year period 2003-2008 reveals that 41% of all fatal accidents were due to LOC-I.

Loss of control usually occurs when the aircraft enters a flight regime which is outside its normal envelope, usually at a high rate surprising the flight crew involved.

As we will see in the following, the causes for LOC-I accidents are many and are at times interrelated. It could be due to pilots' interaction with aircraft systems or failure of the aircraft system itself like in the case of Qantas A330 accident described in the previous article. It could be induced by environment and atmospheric conditions such as wake turbulence, turbulence, icing, and wind shear.

Stall warning is one of the potential precursor to LOC-I. Stall warning is a critical system in providing a cue to the flight crew of the "undesired state" of the aircraft. The Colgan Air Bombardier crash at Buffalo last year is an example where pilot inappropriately responded to a stall warning resulting in LOC–I and the crash which killed 50 people.

Eliminating a cause will not necessarily significantly reduce the number of LOC-I accidents or avoiding operating in environment that induce aircraft upset is not always possible.

Following are typical scenarios leading to LOC-I.

- When the trailing edge wing flaps are lowered during final approach the freight aircraft rapidly pitches up and stalls with no height to achieve a recovery – misleading of the holds prior to flight not detected.

- When fumes of uncertain origin (but with no evidence of on board fire) begin to be emitted from the air conditioning system during the cruise, the pilots fail to don their oxygen masks before both becoming partially incapacitated and as a result end up mismanaging the autopilot inputs so that the aircraft enters a steep dive from which, in their debilitated condition, they cannot recover.

- Whilst using a quiet time in the cruise to investigate a minor INS fault which involves changing the selected INS system, the pilots fail to note that their planned action will cause autopilot disconnection and when it does, they fail to hear the disconnect alert. Since they are both heads down, they then fail to notice a slowly increasing bank angle and heading change until the attitude of the aircraft is extreme and recovery is not achieved.

- Pitch control is lost en route and the aircraft crashes. The cause is subsequently found to have been maintenance error during a routine 'heavy' maintenance input two days earlier

- Severe weather is entered at night during the cruise with the autopilot engaged and the rate of airframe ice build up is not monitored with the result that there is a sudden autopilot disconnect into uncontrolled flight from which recovery is not achieved before terrain impact.

- After the sudden onset of abnormal engine vibration on a twin engine jet transport, thrust on the wrong engine is reduced but as the aircraft then begins a descent, the vibration reduces anyway and it appears to the pilots that their action has had the expected effect. On final approach, thrust is required again as flaps and landing gear are lowered and increased thrust on the faulty engine is selected, resulting in premature descent into the terrain below when no usable thrust is available.

- After take off in a multi engine transport aircraft, the PF copilot calls for 'landing gear up' but the PNF selects flaps up instead and neither pilot notices. As the flaps reach the 'up' position, the trigger criteria for stall warning changes and a warning is generated. Instead of immediately following the prescribed recovery drill, the pilots begin discussing why the warning has occurred and a full stall occurs for which there is insufficient recovery height above the rising terrain below.

The causes of LOC-I, whether transitory or terminal, are many and include:

- Loss of Situational awareness through distraction or complacency.
- Low level wind shear or higher level CAT.
- Structural or multiple power plant damage caused by, for example, by a bird strike, exposure to severe turbulence, or collision with another aircraft.
- Intended or unintended mishandling of the aircraft.
- Attempted flight with total load or load distribution outside of safe limits.
- Unintentional mismanagement of aircraft pressurizations systems.
- An attempt to take off without ensuring that critical parts of the airframe are (or will be at rotation) free of both frozen deposits and previously applied ground de/anti-icing fluids.
- The effects of high levels of airframe ice accumulation or a significant loss of power on all engines attributable to engine icing.
- Attempting to maneuver an aircraft outside its capabilities to resolve a prior problem (including mis-navigation).
- Inflight fire
- Fuel exhaustion or starvation
- False instrument readings displayed to the flight crew
- Wake turbulence, especially if recommended spacing is not maintained
- Malicious interference

It is useful to categorize airborne loss of control occurrences and one way to do this is as follows. The categories chosen are not necessarily independent of each other in all instances.

<u>Significant systems/or systems control failure</u>

A significant systems or systems control failure, which interferes with normal flight management and/or directly with aircraft control may lead to loss of control. This would include multiple engine failure, loss of correct function or control of a significant element of the flying controls, especially asymmetric spoilers/slats/flaps/thrust reversers, major electrical failure and loss or malfunction of critical flight instrument displays.

Structural failure and/or loss of power

The secondary result of structural failure and/or loss of power arising from a range of circumstances including mid air collision, explosive decompression fire on board or a wing fire, and contaminated or otherwise abnormal engine fuel feed may all lead to loss of control.

Crew incapacitation such that neither pilot is able to maintain control of the aircraft may lead to loss of control. This would include SFF in the flight deck and malfunction or incorrect control of the pressurization system. It might also occasionally include the consequences of deterioration in the physical or mental condition of just one of the pilots.

Flight management or control error

Loss of control may occur as a result of a flight management or control error or inappropriate intervention by or under the supervision of one or both of the pilots. This would include incorrect aircraft performance calculations, unintentional pilot mismanagement of critical systems including engines autopilot and fuel transfer, fuel exhaustion, pre-flight fuel loading, pilot disorientation under IMC or night VMC conditions and unintended operation outside the requirements of the AFM. It particularly also includes inappropriate or absent responses or inattention to otherwise relatively minor abnormalities which would not normally prejudice the safety of an aircraft.

Environmental factors

Environmental factors external to the aircraft which interfere with normal use of engines, flight controls or critical flight instruments or lead to their capability being exceeded or cause other serious damage, can lead to loss of control.

This would include

- Ice accretion on the airframe or sensors before take off or during flight,
- microburst /severe windshear,
- severe wake vortex,
- severe air turbulence,
- effects of ice ingestion or ice accretion within the engines
- effect on multiple engine function of passage through volcanic ash
- an encounter with flocking birds resulting in bird strike.
- the effects of damage caused by FOD of any origin which did not become apparent until after V1.

Aircraft Load or loading is or becomes contrary to the limits of the allowable flight envelope or any restrictions on what can be loaded have been breached.

Loss of control can occur if the aircraft load is out of the allowable flight envelope or is mistrimmed because the actual loading of the aircraft is not as documented. This would include in flight load shift and fuel transfer effects as well as other pre-flight mis-loading scenarios including the loading of any items which should not be carried.

Malicious interference

Sadly, there have been incidents in recent years when Malicious Interference with a flight by persons on board, unaccompanied explosives or external attack led to loss of control because of loss of aircraft structural integrity or direct interference with aircraft control.

The factors that contribute to LOC-I are:

–Distraction

– Adverse weather

–complacency

– Inadequate SOPs for effective flight management

–Insufficient height above terrain for recovery

–Lack of awareness of or competence in procedures for recovery from unusual aircraft attitudes

– Inappropriate flight control inputs in response to a sudden awareness of an abnormal bank

–Awareness of an abnormal bank angle

The effects of LOC may include:

–Discomfort or injury to the occupants prior to recovery to controlled flight.

–Structural damage to, or total loss of, the aircraft.

– Fatal or serious injury to occupants due to terrain impact and/or post impact fire.

–The effects of loss of control depend on the ability of the pilots to recover from the situation. This, in turn, depends on:

- The nature of the upset causing loss of control;
- The experience and ability of the pilots; and,
- The height of the aircraft being adequate.

LOC-I prevention

Extended and recurrent training of the crew is the only defense against LOC-I. The training should be specifically aimed at

* Multi crew pilot training which stresses the need for an effective monitoring role for PNF (nowadays called by some the "Pilot Monitoring" (PM) to reflect a key focus of their duties) and any other members of the flight crew.

* Pilot training which stresses the need to avoid distraction from the primary task of managing or flying the aircraft, especially when dealing with in-flight Abnormal or emergence conditions

* Pilot training and procedures which ensure that the necessary responses to imminent loss of control alerts such as stall ident/warning, bank angle and negative windshear are followed promptly and fully.

* More attention to recovery from unusual attitudes for larger aircraft operating without a visual horizon reference is also needed, since a significant proportion of LOC-I accidents could have been prevented if recognition of an abnormal aircraft attitude had been followed promptly by the optimum recovery action.

* Continued training emphasis on VFR pilots planning and conducting their flight to stay in VMC.

Solutions

Some of the solutions for prevention of LOC-I are

- Aircraft Unusual Attitude Recovery Training in all the Full Flight Simulator Type Conversion and Recurrent Training programmes

- More time devoted to training multi crew pilots for the monitoring role

–Better pre-departure access for GA pilots from small aerodromes or private strips to the latest en route weather information

– increase use of online methods

- A mandate to fit bank angle alerting systems to all multi engine aircraft

Additional References:

1. " Stall warnings ", STEADES report , IATA, Issue 3, 2009.

BA Boeing 777 crash Investigation - Final report

Dr.M.S.Rajamurthy

On January 17, 2008, at 1243 hrs (UTC), British Airways flight BA038, a Boeing 777-236 (G-YMM) from Beijing, China to London, undershot RWY 27L at London Heathrow Airport and struck the ground, about 1,000ft short of the paved runway surface, just inside the airfield boundary fence. The aircraft stopped on the very beginning of the paved surface of RWY 27L. During the short ground roll the right main landing gear separated from the wing and the left main landing gear went through the wing root. A significant amount of fuel leaked from the aircraft but there was no fire. An emergency evacuation via the slides was supervised by the cabin crew and all occupants left the aircraft. Of the 152 onboard, 8 passengers received minor injuries and one was seriously injured. Four crew members had minor injuries.

AAIB, UK investigated this accident with participation from NTSB, FAA, Boeing and engine manufacturer Rolls Royce. Recently, it completed the investigation and released the final report. In the July 2009 issue of Flight Safety we had discussed in detail this accident and the findings detailed in the Interim reports.

The investigation identified the following probable causal factors that led to the fuel flow restrictions:

- Accreted ice from within the fuel system 1 released, causing a restriction to the engine fuel flow at the face of the FOHE, on both of the engines.
- Ice had formed within the fuel system, from water that occurred naturally in the fuel, whilst the aircraft operated with low fuel flows over a long period and the localized fuel temperatures were in an area described as the 'sticky range'.
- The Fuel Oil Heat Exchanger (FOHE), although compliant with the applicable certification requirements, was shown to be susceptible to restriction when presented with soft ice in a high concentration, with a fuel temperature that is below -10°C and a fuel flow above flight idle.
- Certification requirements, with which the aircraft and engine fuel systems had to comply, did not take account of this phenomenon as the risk was unrecognized at that time.

Following are the safety recommendations made by AAIB, UK to FAA, EASA, Boeing and Rolls Royce.

<u>FAA & EASA actions:</u>

– In conjunction with Boeing and Rolls Royce, introduce interim measures for the Boeing 777, powered by Trent 800 engines, to reduce the risk of ice formed from water in aviation turbine fuel causing a restriction in the fuel feed system.

– To take immediate action to consider the implications of the findings of this investigation on other certificated airframe / engine combinations.

– To review the current certification requirements to ensure that aircraft and engine fuel systems are tolerant to the potential build up and sudden release of ice in the fuel feed systems.

– To conduct a study into the feasibility of expanding the use of anti ice additives in aviation turbine fuel on

– To jointly conduct research into ice formation in aviation turbine fuels and ice accumulation and subsequent release mechanisms within aircraft and engine fuel systems.

– review the requirements for landing gear failures to include the effects of landing on different types of surface.

– consider mandating design changes that are introduced as a result of recommendation 2009-028, developed to prevent ice from causing a restriction to the fuel flow at the FOHE on Boeing 777 aircraft powered by Rolls-Royce Trent 800 engines.

– review the qualification testing requirements applied by manufacturers to cabin fittings, to allow for dynamic flexing of fuselage and cabin structure.

– EASA introduce a requirement to record, on a DFDR, the operational position of each engine fuel metering device where practicable.

– FAA amend their requirements for landing gear emergency loading conditions to include combinations of side loads.

– FAA require that Boeing modify the design, for the Boeing 777, of the indirect ceiling light assemblies, their associated attachments, and their immediate surroundings to ensure that the fluorescent tubes, or their fragments, will be retained in a survivable impact.

<u>Boeing actions:</u>

– To notify all 777 operators of the necessity to operate the fuel control switch to cutoff prior to operation of the fire handle, for both the fire drill & evacuation drill, and ensure that all versions of its checklists, including electronic and placarded versions of the drill, are consistent with this procedure.

– To jointly with Rolls Royce review the aircraft & engine fuel system design for the Boeing 777, powered by Rolls Royce Trent 800 engines, to develop changes which prevent ice from causing a restriction to the fuel flow at the fuel oil heat exchanger.

– To minimize the amount of buffering of data, prior to its being recorded on a QAR, on all Boeing 777 aircraft.

– To apply the modified design of the B777-200LR main landing gear drag brace, or an equivalent measure, to prevent fuel tank rupture, on future Boeing 777 models and continuing production of existing models of the type.

<u>References</u>:

1. Report on the accident to Boeing 777-236ER, G-YMMM, at London Heathrow Airport on 17 January 2008, Air Accident report 1/2010, AAIB, UK, 2010

CREW INCAPACITATION

Dr.M.S.Rajamurthy

In the article on Loss of Control, crew incapacitation is cited as one of the casual factors. In the July 2009 issue of Flight Safety, we had discussed about the crew incapacitation incident on a Continental B777 flight from Brussels to Newark.

Flight Crew Incapacitation results in the inability of a member of a flight crew to carry out their normal duties because of the onset during flight of the effects of physiological factors. Incapacitation can happen to a crew of any age and during any phase of flight.

Crew incapacitation can be either total or partial/subtle. In total incapacitation the crew flying the aircraft ceases to function. It could range from unconsciousness to death.

In Partial or subtle incapacitation the pilot flying the aircraft remains conscious but is partially incapacitated from some mental or emotional reason. This form is more dangerous it occurs more frequently and is more difficult to detect. The cause of subtle incapacitation can be due to preoccupation with personal problems, hypoglycemia (poor judgment and performance), increased sensitivity to vertigo, etc.

Incapacitation may occur due to:

- hypoxia associated with an absence of normal pressurization system function at altitudes above 10,000 ft.
- Smoke, Fire or Fumes (SFF) associated with an in-flight fire or with contamination of the air conditioning system.
- Food poisoning
- Falling asleep.
- A medical condition such as a heart attack, stroke or seizure or transient mental abnormality.
- A malicious or hostile act such as assault by an unruly passenger, terrorist action or small arms fire.

In the multi-crew case, incapacitation may be obvious immediately, become progressively evident, or escape notice altogether until an unexpected absence of response or action occurs.

When both pilots of a multi crew aircraft are incapacitated then the safety of the flight is severely compromised and could lead to loss of control (*Helios Airways B 737 crash - see Feb 2007 issue of Flight Safety*). A subtle incapacitation of one of two pilots may present a similar risk, especially at low level and particularly if it occurs during a precision approach in low visibility procedures.

Availability of appropriate SOPs and recurrent training is the key to avoiding serious problems from the incapacitation of one pilot in a multi crew aircraft.

Correct use of both the aircraft pressurization system and, if necessary, emergency oxygen supplies will both prevent Hypoxia and protect the crew from the effects of Smoke and Fumes. Therapeutic Oxygen supplies can also alleviate the condition of a crew member or passenger suffering a medical condition.

Staggering crew meal times and ensuring that each pilot eats different meals both prior to and during flight, will reduce the chance of both pilots becoming incapacitated due food poisoning.

Intentional sleep whilst on the flight deck may be relevant on long haul flights but can only take place if an appropriate SOP exists and is applied.

Loss of communication is the first indication that a controller might get of total flight crew incapacitation. Having tried all means to contact the aircraft, without radio contact it is extremely difficult for a controller to ascertain what is happening on an aircraft. If the aircraft's autopilot is engaged then it will likely follow the flight plan route to destination (*Helios Airways B737 crash)*. Conforming with standard Loss of communication procedures, military aircraft can be tasked to intercept the aircraft and inspect it visually but there is little that a controller can do other than ensuring the safety of surrounding traffic by maintaining separation.

References:

1. " Crew Incapacitation ", Skybrary.
2. Operations Policy Manual, Kuwait Airways Corporation.

PHOTO OF THE MONTH

747-8 TAKES TO THE SKY

On February 8, Boeing 747-8 Freighter took to the sky at 12:39 p.m. local time from Paine Field in Everett and landed at Paine Field at 4:18 p.m. It underwent tests for basic handling qualities and engine performance. The airplane reached a cruising altitude of 17,000 ft and a speed of up to 230 knots. Two more test airplanes will join it in the coming month.

The 747-8 Freighter is the new, high-capacity 747 that will give cargo operators the lowest operating costs and best economics of any freighter.

The Confidential Aviation Hazard Reporting System (CAHRS) provides a means of reporting hazards and risks in the aviation system before there is loss of life, injury or damage. It is open to anyone who wishes to submit a hazard report or safety deficiencies confidentially and non-punitively. Reports help to identify deficiencies and provide safety enhancement in areas of aviation. CAHRS forms can be collected at different location of KAC (i.e. Flight Dispatch) Premises. CAHRS form can be downloaded from the Operations dept. section of our site **www.ourkac.com.** Completed forms can be dropped in FS&QA allocated box at Flight Dispatch or e-mailed to kwioeku@kuwaitairways.com or faxed to +965-24749823 or mail to Flight Safety and Quality Assurance office, Operations Department, P.O. Box 394, Safat 13004, Kuwait Airways, Kuwait.