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FLIGHT SAFETY

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FLIGHT SAFETY & QUALITY ASSURANCE

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Introduction

We hope that the previous issues were informative, useful and you enjoyed reading them. In this issue, apart from our regular features on accident analysis, we feature an article on Hypoxia which is based on an article in professional pilot, sent to us by Capt. Yacoub Al-Najjar, Manager, Ground training. Our thanks to Capt.Yacoub Al-Najjar.

We look forward to your feedback, suggestions and of course contribution to this newsletter in the form of articles, anecdotes, pictures, etc. which can be sent to the address given below.

A300 Vertical Stabilizer Failure

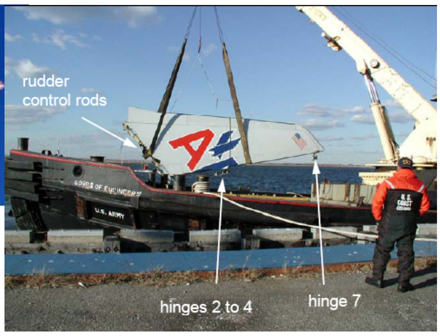
On November 12, 2001 morning, American Airlines flight 587, an Airbus A300-605R a scheduled passenger flight to Santo Domingo, Dominican Republic crashed into a residential area of Belle Harbor, New York shortly after takeoff from John F. Kennedy International airport (JFK), Jamaica, New York. All 260 people on board and 5 people on ground were killed. The airplane's vertical stabilizer and rudder had separated in flight and were found in Jamaica Bay, about a mile north of the main wreckage site. The airplane's engines had subsequently separated in flight and were found several blocks north and east of the main wreckage site. The airplane was destroyed by the impact and post crash fire. Flight 587 was operating under the provisions of CFR part 121 on an IFR flight plan. Visual meteorological conditions prevailed at the time of the accident.

The accident aircraft had arrived the previous night from San Jose, Costa Rica via Miami, Florida without any problem. Flight 587 was the first leg of one day round trip for the flight crew who arrived around 0630 and reported at departure gate at 0700. The airplane fuelling started at 0710 and finished at 0745. The airplane Fueler saw one of the pilots perform an exterior inspection of the airplane. He saw nothing unusual about the aircraft. Between 0730 & 0800 the captain reported that the number 2 pitch trim and yaw damper system would not engage. Two avionics technicians investigated the problem and performed an Auto Flight System (AFS) check, which indicated a fault with no.2 Flight Augmentation Computer. The CB was then reset and another AFS check performed, and no fault detected. In addition, Auto Land system check was performed and test did not detect any fault. CVR recording started at 0845:35.

Following is the sequence of events based on CVR and DFDR data that led to the accident. CVR indicated that at 0859:58, the aircraft was cleared for push back from the gate and at 0901:33, the ground controller provided the flight crew with taxi instructions to runway 31L and the first officer acknowledged this. A minute later, the captain told the first officer to check the rudders (the first officer was the flying pilot and the captain was the non-flying pilot). FDR data showed that the rudder pedal was deflected to maximum right and left and brought back to neutral after the check.

At 0906:53, the ground controller provided the pilots of Japan Air Lines (JAL) flight 47, a Boeing 747-400, with taxi instructions to runway 31L and at 0908:01 they were instructed to contact the local (tower) controller. At 0908:58, the ground controller instructed flight 587 pilots to follow JAL airplane and to contact local controller. The first officer acknowledged this. At 0911:58, the local controller cleared JAL airplane for takeoff. At 0911:36 the local controller cautioned the flight 587 pilots about wake turbulence and instructed them to taxi into position and hold for runway 31L. The first officer acknowledged this.

American Airline Airbus A300-605R



Separated Fin being recovered, control rods and hinges are marked on the photo

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Flight safety/aircraft accident links

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www.bst.gc.ca/en/index.asp
www.bfu-web.de
www.aaib.gov.uk/home/index.cfm
www.atsb.gov.au/

At 0913:05, JAL pilots were asked to fly the bridge climb and contact the departure controller at the New York Terminal Radar approach Control (TRACON). At 0913:21 the flight 587 captain said to the first officer, " You have the airplane".

At 0913:28, the local controller cleared flight 587 for takeoff, and the captain acknowledged. At 0913:35, the first officer asked the captain" you happy with that [separation] distance?". Three seconds later the captain replied, "We'll be alright once we get rolling. He is suppose to be five miles by the time we get airborne, that is the idea.". The first officer replied "so you're happy."

The NTSB's airplane performance study indicated that flight 587 started its take off roll at 0913:51 and lifted off at 0914:29, which was about 1minute and 40 seconds after JAL airplane. At 0914:43, local controller instructed flight 587 to turn left, fly the bridge climb, and contact New York TRACON. Five seconds later the captain acknowledged this. Radar data indicated that the aircraft climbed to 500 ft above msl and then entered a climbing left turn to a heading of 220 deg. At 0915, the captain made initial contact with the departure controller, informing that the airplane was at 1300 ft msl and climbing to 5000 ft msl. Five seconds later, the departure controller instructed flight 587 to climb to and maintain 13,000 ft. msl, and the captain acknowledged this 5 seconds later. At 0915:29, the CVR recorded the captain's statement "clean machine" indicating the gear, flaps and slats have all been retracted.

At 0915:35, flight 587 was climbing through 1,700 ft msl with its wings almost level. A second later, the departure controller instructed flight 587 to turn left and proceed direct to WAVEY navigation intersection (located around 30 miles southeast of JFK). At 0915:41, the captain acknowledged the instruction. The controller did not receive any further transmissions from flight 587.

As per FDR data at 0915:36, there was a 0.04 g drop in the longitudinal and 0.3g drop in vertical g and a shift of 0.07g lateral load factor to the left. The airplane performance study indicated that these excursions were consistent with a wake turbulence encounter. For the next 5 seconds, FDR recorded movement of control column, control wheel and rudder pedals. During the wake turbulence encounter, the airplane pitch angle increased from 9 deg. to 11.5 deg, decreased to 10 deg. and again increased to 11 deg. The bank angle moved from almost level to 17 deg. Left wing down which is consistent with the turn to WAVEY navigation intersection. At 0915:44.7 the captain stated " little wake turbulence, huh" to which the first officer responded in affirmative. At 0915:48.2, first officer indicated that he wanted the airspeed to be set at 250 Kts which was the max. speed for flight below 10,000ft msl. At this point aircraft was at 2300 ft msl.

At 0915:51, the load factor began excursions similar to the earlier ones consistent with wake turbulence encounter. At 0915:58.4, the vertical stabilizer right rear attachment fitting fractured and the vertical stabilizer separated immediately afterward. At 0915:58.5, the CVR recorded a loud bang. FDR data showed that at the time of attachment failure the rudder was around 11 deg. right and sideslip was around 12 deg. right. At 0916: 07.5 CVR recorded first officer saying " What the hell are we into .. We are struck in it." At 0916:12.8 the captain said, " get out of it, get out of it". The CVR recording ended two seconds later.

The National Transportation Safety Board (NTSB), USA which investigated the accident determines the probable cause (s) of this accident as follows: The in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design that were created by the first officer's unnecessary and excessive rudder pedal inputs. Contributing to these rudder pedal inputs were characteristics of the Airbus A300-600 rudder system design and elements of the American Airlines Advanced Aircraft Maneuvering Program.

As part of the investigation NASA scientists conducts analysis & various tests on the failed components to ascertain the loads that were responsible for the failure. They inferred that while the structure was capable of withstanding the loads as per the design, the actual loads had exceeded this and hence the failure. Among the pilot community, such was the impact of this accident that some pilots gave up flying Airbus aircraft and joined airlines operating Boeings and other aircraft ,even though, it involved conversion training and joining a new airline. Some pilots ensured that their families did not travel in Airbus. The public debate was also strong and opined that the NTSB investigation was influenced and biased.

Risk management for pilots

based on Chuck Matheson's article of the same title in AVweb and other articles on the subject

Most accidents are an outcome of a chain of events or factors that contribute to the accident. Majority of all aircraft accidents are attributed to pilot error. If any of the events in the chain was broken or stopped the accident could have been prevented. In the following, few tools are given which help in management of risks associated with every flight.

Proper risk assessment and management begins much before the flight - sometimes days before the flight and continues throughout the flight until the aircraft lands and the engines are shut down.

First it is the pilot who is the crucial element. Let us look at the familiar acronym **I.M.S.A.F.E,** which is an assessment of the condition of the pilot before flight.

I = Illness – Do you have any illness, a cold or a severe allergy that would inhibit your decision making abilities or motor skills? – If so, you probably should not be flying.

M = Medication – Are you under medication – prescribed or non-prescribed? Prescribed medication needs to be cleared by your Aviation Medical Examiner (AME). While non-prescribed medication may not cause any adverse side effects when you are on ground – may cause adverse side effects at altitude. This medication also has to be cleared my AME.

S = STRESS – Are you under any kind of stress? Are you going through a serious family problem, is someone seriously ill at home? Did you have a serious argument or a rift that is still bothering you? If so, you should not be flying as your mind will not be focused on the tasks at hand.

A = ALCOHOL – How long has it been since you had your last drink? Remember **the Eight-hour bottle-to-throttle rule. In addition, don't forget the 0.04% blood alcohol content**. Even though it might be longer than eight hours since your last drink, depending on how much and what you drank, your blood alcohol may still be higher than 0.04%. The major effect of alcohol is on brain, eyes and the inner ear – three crucial organs to a pilot i.e. it severely affects your decision making, vision, co-ordination and motor activity.

Studies on the effects of alcohol on pilot performance has shown that under the influence of alcohol

- there is impairment to the pilot's ability to fly on ILS approach or to fly IFR and even routine VFR flight tasks.
- the number of serious errors committed by pilots dramatically increases at or above concentrations of 0.04% blood alcohol.

Even low levels of the order of 0.025% blood alcohol have shown degradation in pilot performance. Use of alcohol and drugs by pilots is regulated by FAR 91.17. which stipulates the above underlined items and forbids pilots under the influence of alcohol or drugs that adversely affect flight safety.

F = FATIGUE – Were you up early and worked all day and now plan a long flight? Did you have a proper sleep or was disturbed about a concern? Are you really as sharp as you could be? In a long-haul flight fatigue is a major safety concern.

E = EMOTIONS/EATING – Did you have a fight with your boss or at home? When was the last time you ate? If you it was quite sometime since you had your last bite and planning a long flight – watch out. A combination of low on hydration and low blood-sugar levels can result in very poor performance.

PAVE YOUR WAY

Having taken care of the pilot with I.M.S.A.F.E let us now look at other important factors, i.e. the aircraft, weather, and the reason the pilot is flying?! These can be summed up in another acronym **P.A.V.E.**

P= Pilot. In what shape are you really in? Have you checked with I.M.S.A.F.E. Are you current and proficient? When was the last time you flew in actual IMC?

A=Aircraft. Are you using the right aircraft for the trip? Are you upto speed on aircraft performance and limitations and have checked them? What about weight and c.g. balance? Does all the required equipment work? Even if a piece of equipment is not required by regulation, would it make your life a lot easier if it worked?

V=Vironment, meaning Environment. What is the weather forecast to be? What about ceiling and visibility? How does the actual weather compare to the forecast? Is it better or worse? Will you be flying into improving or worsening conditions? If you are flying over mountainous terrain will the ceilings be comfortable level above minimum enroute altitude? Where is the freezing level? How about crosswinds? Do not forget that the demonstrated crosswind capability is for dry runway and will reduce significantly for a wet runway. Did you check all the enroute NOTAMs for any airspace restrictions and TFRs?

E=External pressures. Why are you making this trip? External pressures can place a huge demand on us to make a trip. Pilots being goal-oriented, allowing external pressures to be placed on them would make them take risks that may not be taken otherwise. Plan ahead, built in extra time for ground speed. Do not keep pushing on the reserves. No one thing causes an accident; it usually takes chain of events. The events that create this chain have cumulative effect.

TAKE CARE IN FLIGHT

Having gone through the risk management checklist, we are airborne. We have to take C.A.R.E of the flight.

C =Consequences. As the flight proceeds things are constantly changing. Pilots have to evaluate these changes and have to predict the consequences they are going to have on the safe outcome of the flight. As the flight progresses, the pilot gets more and more fatigued. The aircraft is also changing its state– it is lighter with fuel consumption and may be there is a maintenance problem. The environment is also changing—may be for the better or worse, visibility may be deteriorating, ceiling may be dropping and winds might pick up.

A=Alternatives. As the flight progresses, always be thinking of alternatives in case something out of the ordinary or unexpected occurs. What if suddenly a passenger becomes sick or your destination airport– is closed because of a disabled aircraft on the runway? Do you have enough fuel to hold until the runway is reopened or divert to another airport? What if weather further deteriorates than you expected? Flying into to worse weather because you are almost at the destination could lead to a CFIT proving to be disastrous. As your flight is closer to the destination, your available options decrease: you have less fuel and less range and are more fatigued. The bottom line here is to try to think of all possibilities and suitable alternatives before you depart.

R=Reality. Don't deny that things are deteriorating. Accept the reality and develop alternate plan. If things are going as per the plan and the aircraft is developing some problem, accept the reality, develop and execute a plan and then reassess the situation. Don't just sit there and do nothing. This will really seal your fate.

E=External Pressures. External pressures play a key role in the successful outcome of a flight. In fact, it is the most significant of all risk factors. External pressures make pilots ignore all other risk factors. We have these two guys in our head, the conservative and the confidant. When the conservative tells you ought to land and wait, the confidant says you can make it, go ahead. Ignore the confidant and listen to the conservative as it is safer.

The number –one job as a pilot is RISK MANAGEMENT. This task never stops. Use P.A.V.E. checklist prior to flight and then use C.A.R.E. checklist while in flight. Pay attention to your gut feeling and instinct. As long as you are still flying, there is always hope.

Threat of Hypoxia

*(Adopted from RARE AIR countering the threat of Hypoxia by Brent Holman & Sandi Scott-Holman – an article in **Professional Pilot Oct.2005 issue***

On Oct 25, 1999 shortly after 0900, a chartered Learjet 35(N47BA) took off from Orlando Florida for Dallas, Texas with two professional pilots and four passengers including golfer Payne Stewart. At 0921, N47BA checked in with Jacksonville center and reported climbing through 9500ft on the way to its assigned altitude of 14,000 ft. N47BA was next cleared to FL260 and then up to FL390. The crew acknowledged both altitude changes. Six minutes after clearing N47BA to FL390, the controller assigned the aircraft a new radio frequency but this time the pilots failed to respond. In the next 4.5 minutes the pilots were called 5 more times, but there was no response. At around 1000, an F16 fighter from Eglin AFB was vectored close to N47BA which reported no visible damage to the aircraft. The fighter pilot said that the cabin windows appeared dark and the entire right cockpit windshield was opaque as if ice or condensation covered the inside. The fighter left at 1012 and was replaced an hour later by a pair of F16s from Oklahoma Air National Guard (ANG). The lead pilot informed that they were not seeing anything inside. He said "it could be just a dark cockpit though…he is not reacting, moving or anything like that ..He should be able to see us by now." At around 1139 the brace of F16s left. Eleven minutes later, a pair of F16s from North Dakota ANG – was vectored in and the Eglin AFB fighters rejoined sooner. Again, the fighters reported that the Learjet's cockpit windows appeared to be iced over. At 1211, N47BA began a descending right turn, which developed into a high-speed spiral dive that ended explosively in a cultivated field.

NTSB investigation attributed the accident to crew incapacitation due to their failure to receive supplemental oxygen after a loss of cabin pressurization, for undetermined reasons. Due to lack of oxygen, the pilots were rendered incapable of flying their aircraft, which proceeded on autopilot until the fuel supply ran out.

Hypoxia is defined as oxygen starvation severe enough to cause impairment. Pilots experience this when flying at high cabin altitudes, where they could be subjected to a reduction I the partial pressure of oxygen, insufficient transportation of oxygen, or a physical inability to process oxygen. Acute hypoxia produces impaired judgment, loss of motor coordination and other symptoms characteristic of drunkenness. Flight at high altitudes and the corresponding reduction of oxygen could also exacerbate existing medical conditions such as heart disease and poor blood circulation. Tobacco & alcohol use could speed the onset of hypoxia.

Pilots typically experience **"hypoxic" hypoxia** when the flow of oxygen to the blood is reduced due to high altitude, gradual or rapid depressurization, or physical factors. **Histotoxic hypoxia** occurs when the tissues are unable to process oxygen, such as carbon monoxide poisoning. Alcohol, chewing tobacco and certain narcotics also restrict the ability of blood and tissue cells to use oxygen. **Stagnant hypoxia** is oxygen deficiency due to poor circulation or a low rate of blood flow through the circulatory system and occurs mainly when sitting motionless for long periods. Pilots have experienced stagnant hypoxia when subject to high 'g' forces during maneuvering. Airline passengers on transoceanic flights experience stagnant hypoxia. **Hypemic hypoxia** is defined as a reduction in the blood's ability to carry oxygen, due to loss of Hemoglobin or Red Blood cells (RBC) and could be triggered by hemorrhaging due to injury or anemia.

FAA has mandated high-altitude physiology training for all part 121 and 135 cockpit and cabin crews who plan to operate above FL250. This is based on the assumption that part 91 civil pilots fly in the "physiological zone" – the airspace from sea level to around 12,000 feet.

In addition, NTSB(USA) recommended high-altitude physiology training for all pilots flying in aircraft with service ceilings of 18,000 feet or higher, although it says problems associated with high altitude exposure often begins well below this altitude.

Mayo clinic a pioneer in high-altitude chamber and supplementary oxygen masks have recently brought out Hypoxia Awareness Training System (HATS) – a portable computer-based device that simulates a gradual increase in aircraft's cabin altitude and the resulting onset of hypoxia. Pilots go through the tests as a paired crew, in order to observe the debilitating effects of hypoxia on their flying partner and improve their own recognition of hypoxic behavior. During the tests, the pilots are asked to complete tasks of varying complexity as the simulated altitude is increased, while observers gauge their reactions. HATS also records the entire event with a video camera, the product of which can be incorporated into a comprehensive subject debriefing session. According to FAA, altitude chamber flights is the safest and most reliable tool for preparing pilots for high-altitude flight. FAA's rapid decompression profile typically takes the subject from a cabin altitude of 8000 feet to 18,000 feet in 3 to 5 seconds.

The N47BA Learjet crash underlines the devastating effect hypoxia can have when the flight crew fails to recognize its onset and act accordingly. Dr.Stepanek, an aerospace medicine specialist at Mayo, who spearheaded the development of HATS says that "It's crucial for the pilots to be able to recognize the symptoms of hypoxia as quickly as possible. Unfortunately, pilots often attempt to diagnose a pressurization problem instead of immediate donning masks upon receiving a cabin altitude alert!". In each flight the cabin crew while instructing the passengers on safety mention that one should put on the oxygen mask first and then help others. Flight Crew apparently seem to forget this!

Incident summary

Flight KU205, sector KWI-ISB (A300) during cruise at FL330, after changing freq. from LAHORE 124.1 to CHERAT CTL 125.6, TCAS gave TA and then RA warning. AP was manually disconnected and avoidance action was taken. AIRMIS reported by radio to CHERAT CTL. The air traffic incident was referred to the Pakistan Civil Aviation Authority (PCAA) by Kuwait DGCA. PCAA investigation found that PIA 284 was on co track G235 at FL370. The CPA projected at 1600 ft vertical separation due to untimely descent clearance to PIA284 by CHERAT CONTROL. Both aircraft had followed resolution advisory and minimum vertical separation attained during the maneuver was 1300ft on radar. The hundred feet vertical separation indicated on ACAS of KAC205 was projected and not actual separation at the time of resolution advisory. PCAA has recommended safety measures to Military headquarters for implementation at CHERAT control zone.

Web watch

www.asa2fly.com — provides info on pilot training, various software tools for training etc.
www.kaccrew.com — a site of KAC cabin crew with good links to important aviation sites, an interesting site, must see.

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. Completed forms can be dropped in FS&QA allocated box at Flight Dispatch or e-mailed to kwioe@kuwaitairways.com or faxed to 00965-4749823 or mail to Flight Safety and Quality Assurance office, Operations Department, P.O. Box 394, Safat 13004, Kuwait Airways –Kuwait.