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Safety

A Corporate Safety Publication

Calcutating Errors

Go-Arounds

Fuel Conservation Strategies

Winglets Techonlogy

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Calculating ERRORS

By Linda Werfelman

Mistakes in determining takeoff parameters are frequent, a French study says, and methods of detecting them are not always effective.

Errors involving the entry of takeoff data into flight management systems, or other performance calculators, are frequent and occur regardless of aircraft types, equipment type and airline, according to a report released by the French civil aviation authority and accident investigation agency.

These errors typically are detected by use of the airline's operating modes or by "personal methods," such as mental calculations, said the report on the study by Loboratoire d'Anthorpologie Appliquee (LAA).

Half of the pilots surveyed at one of the two airlines that participated in the study said that they had experienced errors in parameters or configuration at takeoff, some of which involved the input of aircraft weight into the flight management system (FMS).

The study was prompted by two similar serious incidents – the first involving an Air France Airbus A340-300 at Charles de Gaulle Airport in Paris in July 2004 and the second involving a Corsairfly Boeing 747-400 at Orly Airport in Paris in December 2006.

"The common cause of these two events was the crew entering much lower than normal takeoff weights and values for associated parameters (thrust and speed)," the report said. "The effect in each case was an early rotation with a tail strike on the runway, followed by a return after dumping fuel. Beyond the damage to the aircraft, these takeoffs were undertaken with inadequate thrust and speed, which could have led to a loss of control of the aircraft."

Other similar incidents have occurred else-where in recent years. Typical incidents involve new-generation aircraft and errors in entering takeoff parameters that went undetected by flight crews, the report said.

The most serious event was the fatal Oct. 14, 2004, crash of an MK Airlines 747-200SF that tailed to gain altitude on takeoff from Halifax, Nova Scotia, Canada, because of the flight crews unknowing use of an incorrect aircraft weight when crewmembers calculated takeoff speeds and thrust settings. All seven crewmembers were killed in the crash and subsequent lire, and the airplane was destroyed.

The study, which was initiated after the Bureau d'Enquetes et d'Analyses (BEA) completed its investigation of the 2006 incident at Orly, was designed to review the "processes for errors specific to [lie flight phase prior to takeoff and to analyze the reasons why skilled and correctly trained crews were unable to detect them," the report said.

Manufacturer Definitions

Both Airbus and Boeing have published documents discussing takeoff speeds. Airbus characterizes takeoff speeds as a "key element of safety for takeoff" and cautions that "using erroneous values can lead to a tail strike, a takeoff rejected at high speed or a climb with reduced performance."

Errors in speed calculations frequently result from last-minute changes, time pressure or a heavy workload, and cross-checking calculations can be difficult because of the workload of the pilot flying during pushback and taxi, Airbus said.

The Boeing document said that, it input values are correct, other related errors can occur in several areas, including data conversion, selecting weight on a load sheet, selecting the table to be used in manual calculations or selecting high-lift flaps.

Procedural Analysis

The report included an analysis of procedures used to input and verify takeoff performance data for Air France 777s, A340s and 747s, and Corsairfly 747s; ergonomic inspections to identify conditions that can result in operating difficulties for flight crews; and a review of 10 incident reports that involved the use of inappropriate takeoff parameters.

The incident report reviews paid particular attention to methods to obtaining weight data, calculating takeoff speeds, inputting parameters into the FMS (when one existed) and displaying speeds.

For example, a crew must determine its fuel needs before the airplane is loaded and the weight is known; as a result, they may estimate the required fuel based on the forecast load data, with the last of the fuel being; added alter the final load has been determined, the report said. A variable in the function is the quality of communication between the flight crew and ground personnel. Procedures are not identical at all airports, and communication sometimes suffers, the report said.

An effective check of the amount of fuel in the airplane can be obtained by observing the FMS or a fuel gauge; the indicated quantity varies as fueling progresses. Gauge accuracy may improve when tanks contain little fuel, the report said, noting that the amount of on-board fuel can be estimated "by adding the fuel remaining to the quantity flowed."

Load sheet data include the aircraft basic weight; the load, which can be known only after embarkation has been completed; and the fuel quantity — the amount of fuel decided on by the flight crew.

"The time the load sheet becomes available is one of the main factors in variability," the re-port said. "Several versions of this document can follow one another; the forecast report some-times used tor the refueling decision is eventually replaced by a final version issued to the crew after the completion of embarkation."

Calculations

Takeoff weight (TOW) is one item included in calculations of takeoff parameters — calculations that are performed either manually or by computer and either by the flight crew or remotely, with ACARS (aircraft communications addressing and reporting system) transmission, for example.

Of the 10 incident reports examined in the study, [line described events involving a "major failure" that occurred during calculations, including two events in which the previous flights weight parameters were used. In another event, the manual used to calculate speed did not match the aircraft type. In six events, an incorrect weight was used in the calculations; for example, zero fuel weight (ZFW) instead of TOW was entered into ACARS or into a laptop computer, the report said.

"These failures highlight the ineffectiveness of controls on this function" the report said. "Even an input with cross-check doesn't guarantee the absence of an error, as one of the studied incidents shows: The captain calls out the value to be input and confirms the input made by the copilot. However, the captain doesn't read the appropriate value, so calls out an erroneous value and the verification of input is ineffective"

The report suggested that a more effective check might be a double calculation. However, the report said, "Not only must the calculation be done twice, but the selection of input data [must be performed twice] as well.

"In one of the incidents studied, the captain carried out a check of the calculation without confirming the TOW and so used the erroneous "TOW to check the speeds and hence obtained the same (erroneous) values as the copilot."

Input of FMS Data

Six of the 10 incidents involved airplanes equipped with an FMS. In one incident, a major failure was associated with the input of FMS data: A typing error associated with a late change that was made without a cross-check resulted in an incorrect entry of V1 (defined in the report as "decision speed").

"In the other five cases, the input speed values were erroneous," the report said. "The error arose from the parameter calculation function. ... During verification of the calculation, the input of these values is one of the steps where inconsistency of the values with the aircraft load and takeoff condition could be detected.

However, simple verification of a match between the elements input and the data shown on the card' does not allow the error to be detected."

Some FMSs calculate reference speeds — V1, Vr (rotation speed) and V2 (takeoff safely speed) — and the report suggested that these speeds could be displayed and used for comparisons when flight crews check the speed input function. Nevertheless, the report noted that two incidents involved airplanes equipped with this type of FMS, and the feature did not enable the flight crew to identify mistakes in speed calculations.

Four incidents involved airplanes without an FMS, and in these situations, the reference speeds displayed on the primary flight display (PFD) also are derived from the parameter calculation function) using either the takeoff card or a laptop screen.

Crews can verify that the correct speeds are being displayed by checking those numbers against those on the takeoff card, or by noting the relative position of the speed index and the redundancy of displays, the report said. However, in the four incidents in which the airplanes did not have an FMS, the presence of these elements did not aid in error detection, the report said.

Takeoff Parameters

The report identified five steps in the takeoff phase of flight: acceleration to V1 , callout of V1, acceleration to Vr, callout of Vr and rotation at Vr. lithe crew detects an anomaly before the airplane reaches V1, the takeoff can be rejected.

"V1 is a reference in the decision to continue or reject takeoff," the report said. "However, this reference comes from a calculated value, and in the event of an erroneous value, safety aspects either a possible stop before the end of the runway or continuation with an engine failure are no longer guaranteed."

In one of the incidents, the flight crew deter-mined that the aircraft's behavior was atypical and rejected the takeoff after V1 was displayed but before the airplane actually reached that speed, the report said.

In another incident, the pilot not flying (PNF) called out Vr just after the airplane had accelerated to VI. "The failure rises here from the erroneous link made by the PNF between the achievement of VI and the achievement of Vr" the report said. "This underlines the time pressure placed on the PNF as soon as he detects the signal indicating that Vr has been reached, as well as the inadequate control of this function."

Proposals for Improvement

Analysis of the 10 incidents included the identification of four types of "barriers" designed to prevent errors:

- Physical barriers, such as an aircraft "tail shoe" designed to mechanically protect the fuselage and physically prevent an unwanted event from occurring. Such systems typically present more disadvantages than advantages.

- Functional barriers, which are designed to limit input errors by enabling automated systems to perform basic checks. The report suggested that software controls could be strengthened — for example, software could be developed to check consistency between the V1, Vr and V2 values entered into the system.

- Symbolic barriers in procedures and guidance, which require "interpretive action" to achieve their goal. For example, the report cited the inclusion in all FMSs of a function for the calculation and presentation of reference speeds. The function currently is available only in some FMSs. Nevertheless, the report said that incidents have shown that "the simple presentation of reference speeds by the FMS does not constitute an effective symbolic barrier. Strengthening of this barrier could be considered by providing a warning message in the event of significant differences, or a display of these differences."

- Barriers in safety policy and user knowledge, which may be directed toward strengthening training for emergency situations and enhancing pilot familiarity with — and memory of— takeoff parameters. The results of these barriers are more difficult to measure than the results of other types of barriers.

Airline Survey

A survey of 19 captains and 11 first officers at Corsairfly found that 50 percent had experienced a takeoff that "was or could have been carried out with reduced safety margins because of erroneous parameters."

The most frequently reported errors occurred in two categories:

- Five errors inputting weights into the FMS. Two of the five errors were detected after takeoff, two others were detected before takeoff, and a description of the fifth error said that it was detected when the copilot "was reading speeds following a disagreement with the captain."

- Five errors inputting the runway in use into the FMS. All five were detected before takeoff, although one input error was discovered during of application of thrust at takeoff, with the appearance of the "verify INS [inertial navigation system] position" warning.

Other reported errors involved two cases of mistakes in configuration, two cases in which reference speeds were either miscalculated or not displayed on the PFD and one case of an erroneous thrust display.

When questioned about their "principal constraints ... from preparation until takeoff" 15 pilots cited time constraints, 12 cited interruptions and two cited the late delivery of the final load sheet to the cockpit.

Flight Observations

Observations of flight preparations showed that the flight crews' workload increased as departure time approached and that the captains activities were especially subject to interruption.

Observations also showed that flight crews arrived in the cockpit one hour to 2½ hours before takeoff, and that the final load sheet was delivered to them about 20 to 45 minutes before takeoff. Some crews calculated takeoff parameters before arriving in the cockpit. Others waited until after their arrival, and times varied from 16 minutes to one hour before takeoff.

In some cases, calculations were repeated; tor example, to account (or a tail wind and for wet runway conditions.

On one observed night, reference speeds were not input into the FMS, the report said.

"During this flight, reference speeds were calculated by the FMS [and] a card' was edited by the crew, hut speeds were not entered into the FMS," the report said. "During takeoff, the crew used the takeoff card to call out V1, which would have been called out by the equipment it the speeds had been entered, and Vr. This omission highlights the lack of robustness in the system that enables takeoff to be carried out without input of speeds into the FMS."

The report said that theoretically, the final TOW should be used to calculate parameters —a provision that means the calculations cannot be performed until after the crew has received the final load sheet. In five of the 14 observed flights, however, the parameters were calculated before delivery of the load sheet.

There are two types of controls — checking input data and speed data, the report said. Crews typically assigned priority to one or another of these controls, but usually not to both, the report said, adding that there was no control based on a comparison of the final load sheet, the takeoff card or laptop information, and the FMS.

"The final load sheet is actually the reference source, whatever the airline and the equipment used," the report said. "Obtaining this document is the determining step that influences calculation and input of takeoff parameters into the FMS. Making these final data available late generates a great number of tasks to be carried out in a limited time and creates time pressure. To deal with this, airlines and crews adopt different operating methods."

Courtesy FSF Aero Safety World Magazine

Easy Does It

By Mark Lacagnina

TCAS resolution advisories require rapid – but not radical – response.

Recent reports of two accidents that resulted in serious injuries when the pilots performed excessive maneuvers during traffic-alert and collision avoidance system (TCAS) resolution advisories (RAs) suggest that while pilot educational efforts should continue to focus on the need to respond promptly and correctly to RAs, they also should emphasize that a gentle and smooth response is sufficient.

There is no need to panic when an RA is generated because enough time is available (o carry out the recommended maneuver with normal control inputs. "Limit the alterations of the flight path to the minimum extent necessary to comply with the RA," says the International Civil Aviation Organization (ICAO),' which requires "airborne collision avoidance system equipment" – that is, the RA-generating TCAS II equipment — aboard large turbine airplanes in international commercial operations., ICAO also recommends that all aircraft be equipped with TCAS.

A brief description of how TCAS works might help in understanding how the system is intended to be used. Basically, TCAS obtains information about other aircraft up to 30 nm (56 kill) away by transmitting interrogation signals that trigger replies from their altitude-encoding or selective-address transponders. The transponder replies yield information about the range, bearing and altitude of the other aircraft. From this information, TCAS computes the closest point of approach (CPA) for each aircraft, whether that point is within a programmed protected volume around the host aircraft and when the other aircraft, the intruder, will reach that point.

A traffic advisory (TA) is generated if the other aircraft will reach a CPA in the outer protected volume within a specific amount of time that varies from about 20 seconds below 1,000 ft to 48 seconds above Flight Level (FL) 200 (approximately 20,000 ft). A TA consists of an aural advisory — "traffic, traffic" — and a visual advisory, in which the symbol representing the intruder on the traffic display turns from white to amber.

A TA prompts the flight crew to use their traffic display as an aid in establishing visual contact with the intruder and to prepare themselves for a possible RA.

Five-Second Margin

An RA is generated if the intruder continues to closed and the CPA is projected to be within the inner protected volume of the hose aircraft. Alert lead times range from about 15 seconds at 1,000 ft to 35 seconds above FL 200. (No RAs are issued below 1,000 ft). The intruder's symbol turns red on the traffic display and an aural advisory to "climb," "descend" or "adjust vertical speed, adjust" is issued. Red and green arcs appear on the RA display, typically built into the vertical speed indicator (VSI), to show the climb or descent rates that should be achieved or avoided.

The RA alert time includes a margin of five seconds for crew response. "For TCAS to provide safe vertical separation, initial vertical speed response is expected within five seconds of when the RA is displayed," says US. Federal Aviation Administration Advisory Circular (AC) 120-55B, *Air Carrier Operational Approval and Use of TCAS II.*

"Satisfy RAs by disconnecting the autopilot, if necessary, using prompt, positive control inputs in the direction and with the magnitude TCAS advises," the AC says. "To achieve the required vertical rate (normally, 1,500 fpm climb or descent), first adjust the aircraft's pitch using the suggested guidelines [Table 1]. Then, refer to the VSI and make all necessary pitch adjustments to place the VSI in the green arc.

Recommended Initial Reaction to 'Climb' or 'Descend' RA	
Airspeed	Pitch Adjustment
0.80 Mach	2 degrees
250 KIAS below 10,000 ft	4 degrees
Approach below 200 KIAS	5 to 7 degrees

RA = traffic-alert and collision avoidance system resolution advisoty; KIAS= kt indicated airspeed

Source: U.S. Federal Aviation Administration

"Excursions from assigned altitude, when responding to an RA, typically should be no more than 300 to 500 ft to satisfy the conflict."

'Excessive Maneuver'

Table 1 shows that the recommended initial pitch adjustment is 5 to 7 degrees when airspeed is below 200 kt. On Oct. 3, 2005, a cabin crew member was seriously injured when a Embraer 170 was pitched 14 degrees nose-up in response to an RA.

The U.S. National Transportation Safety Board (NTSB) report on the accident is based on a limited investigation and provides relatively few details. The airplane was being operated by Shuttle America as United Express Flight 7627 from Montreal to Washington Dulles International Airport with 41 passengers, two cabin crewmembers and two flight crewmembers. The first officer was the pilot flying.

The 170 was southbound at 3,000 ft in visual meteorogical conditions (VMC) and about to turn right base for Runway 01R at Dulles when the airport traffic controller advised the flight crew of northbound traffic ahead at 2,500 ft. The controller told the Embraer crew to fly a southwesterly heading. "About the same time, the airplane's [TCAS] alerted the crew to the traffic and issued [an RA] to climb the airplane," the report said.

Recorded flight data indicate that the first officer increased the pitch attitude to 14 degrees nose-up, resulting in a peak vertical acceleration of +2.0 g – that is 2.0 times standard gravitational acceleration. NTSB said that the "excessive maneuver" was the probable cause of serious injuries, including a broken leg, sustained by a cabin crewmember. The 170 was not damaged.

The report said that if the first officer had followed pitch guidance on his primary flight display while responding to the RA, a vertical acceleration of only +0.75—1.25 g would have resulted.

Roller Coaster

Injuries were more numerous on Nov. 16, 2006, when a Boeing 757-200 was maneuvered excessively during an RA over the East China Sea.

The 757, operated by Far Eastern Air Transport as Flight EF306, was en route from Taipei, Taiwan, to Jejn Island, South Korea, according to the report by the Aviation Safety Council (ASC) of Taiwan.

The 757 departed from Taipei at 0041 coordinated universal time (UTC; 0841 local time) with 129 passengers, six cabin crewmembers and two flight crewmembers. The captain was the pilot flying.

The 757 was northbound in VMC at FL 390 and about 100 (185 km) from the destination at 0202 UTC when the flight crew was told by a controller at the Incheon (South Korea) Area Control Center to descend to FL 310. The 757 crew turned on the cabin seat belt sign before beginning the descent.

A Boeing 777 operated by Thai Airways was southbound at FL 340 on the same airway. TAs were generated aboard both aircraft when they were 12 nm (22 km) apart and 48 seconds from the projected CPA.

The 757 was descending through 34,052 ft at about 1.900 fpm when the TA was generated. Two seconds later, the controller said, "Far Eastern 308, stop, uh, immediately clear descend."

The controller explained to investigators that he had "lost awareness of the converging traffic for a minute" while he concentrated on identifying another aircraft on his radar display. When he returned his attention to the 757 and 777, he saw that they were about 13 nm (24 km) apart and that the 757 was at a higher altitude, and "instinctively" told the 757 crew to stop their descent.

While issuing that instruction, he saw that the 757s displayed altitude was 33,800, "so I thought that the urgent situation was over, and I instructed [the 757 crew] to descend more quickly." He also told the 777 crew to immediately turn to a heading of 270 degrees.

The report said that the controller had failed to use standard phraseology that required use of the term "correction" between the instruction to "stop" and the instruction to "descend." The controller also used the wrong call sign — 308, rather than 306.

Confusion Reigns

The 757 captain did not thoroughly understand the controllers radio transmission but believed that he had been told to "stop descent." He engaged the autopilot altitude-hold mode, and the 757 leveled at 33,800 ft. The report said that if the captain had continued the descent, there would have been no conflict.

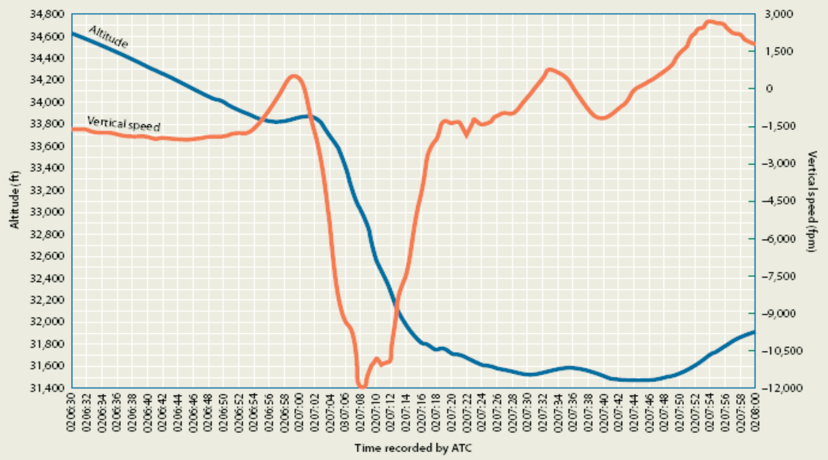
The captains attention then was drawn lo (he TA depicted on his traffic-display. "I noticed that the color of the traffic symbol turned from white to amber then red very quickly," he told investigators.

The TA changed to an RA to descend.

At the same time, a coordinated RA to climb was generated aboard the 777. The distance between the aircraft was 9 nm (17 km), and the projected time to CPA was 35 seconds. The 777 crew responded promptly and correctly to their RA.

The 757 first officer erroneously told the controller that they were responding to a "TCAS climb" RA. The controller did not understand the transmission and replied, "Roger, now descend. Descend." The first officer said, "Negative. We follow TCAS."

Boeing 757 Response to RA



RA = resolution advisory generated by traffic-alert and collison avoidance system; ATC = air traffic control

Source: Aviation Safety Council of Tawain

Figure 1

The report indicated that the 757 captain's initial response to the RA was in accordance with the TCAS manufacturers recommendation that "a prompt, smooth pitch change of 2 degrees to 6 decrees should be sufficient to resolve nearly all conflicts." The report said that a pitch change of 2 degrees would have resulted in a descent rate of about 1,600 fpm, which would have been adequate to resolve the conflict.

The captain told investigators, "When the RA aural tone 'descend, descend' was issued, I followed the TCAS red T-bar on the ADI [attitude director indicator) and pushed down the aircraft smoothly.

"Then, I looked outside [and saw] a flying object approaching rapidly in front of us. So, I pushed down the aircraft hard lo avoid the traffic."

'Bounced... and Dropped

Recorded flight data indicated that the 757's pitch angle changed from +4 degrees to -18 degrees in four seconds. "The maximum vertical acceleration [was] -l.06 g," the report said. Descent rate peaked at 12,000 fpm (Figure 1).

The report indicated that the captain's recovery also was excessive, resulting in a peak vertical acceleration of +2.58 g for two seconds as the 757 was leveled at FL 310.

"When the occurrence happened, some passengers were bounced up to the cabin ceiling and dropped onto seat backs, handrails or cabin equipment," the report said. Unsecured cabin equipment, including a duty-free cart that was being moved to the galley by cabin crewmembers, became projectiles.

Four passengers sustained serious injuries. One seated near the rear of the cabin "bounced up several times and suffered an intracranial hemorrhage," tile report said, noting that she also was struck by the duty-tree cart. A nearby passenger suffered broken ribs and hemothorax, an accumulation of blood in the chest cavity. A passenger returning from the lavatory to his seat "was bounced lip and also encountered impact by the duty-free cart"; his injuries included a compound fracture of the left humerus, or upper arm bone. A passenger seated near the front of the cabin "encountered an impact with the ceiling and seat arm"; her injuries included fractured ribs, a fractured clavicle and hemothorax.

"The other 10 injured passengers and six cabin crewmembers sustained minor injuries such as contusions, sprains and abrasions," the report said, noting that none of the injured passengers had their seat belts fastened.

After the accident, the crew declared an emergency arid landed on Jeju Island without further incident at 0228. Damage to the 757 consisted of three broken armrests and a punctured ceiling panel. No structural damage was found. Based on the findings of the accident investigation, the ASC recommended that "all operators review their training programs to ensure that they contain the necessary training for flight crews to recognize and respond effectively to TCAS advisories."

The report said that the training should include theory and simulator practice. "The flight crew should have an understanding of how TCAS works. This includes an understanding of the alert thresholds, expected response to TAs and RAs, proper use of TCAS-displayed information, phraseology and system limitations."

Courtesy FSF Aero Safety World Magazine

Go-Arounds:

A Problem for Certain Pilots?

"We must take all that we have learned from past mistakes and apply those experiences to shaping transportation in the future. Only then does each tragic accident become an investment in safety." Jim Hall, former NTSB Chairman

By Ladislav Mika & Thomas Fakoussa

Philosopher George Santayana said more than 90 years ago: "Those who cannot remember the past are condemned to repeat it." In keeping with this spirit, investigators offer recommendations aimed at preventing similar accidents. Why then do the same sort of accidents repeatedly occur? Some of the reasons are 1)Failure to recognize and identify the hazards correctly, 2) Failure to identify root causes in depth, 3) Failure to act appropriately to the causes, and 4) Failure to inform others in a more motivating way.

Few other industries have spent and spend as much money and effort pursing absolute safety as has the aviation industry. The modern airliner is a marvel of technology, often composed with multiple redundancies in its control and management systems, using space-age materials in its construction and complex computer controls to ensure the safe and orderly functioning of the whole. We require those who are part of the industry to be highly qualified professionals approved by the state. And yet we still lose aircraft in all-too-frequent accidents.

Again, the question is Why should this be the case?

Today we recognize that the major determinant of safety in the air will be the behavior of the human beings involved in the total task—from designers to operators at all levels. The past shortsighted defensive attitudes toward mishaps must now give way to a new attitude of acceptance and rational recognition that we, who are part of the aviation business, are all capable of making mistakes and contribute to the unacceptable accident rate. All this for no other reason but that we are all human, no matter what the nationality, no matter what the title or rank.

Analysis of hull-loss accidents shows that more than 70 percent of accidents result from flight crew errors. In approximately 41 percent of accidents, the crew deviated from basic operational procedures. From the very first flight, pilots are taught to aviate, navigate, and communicate. In that order. Pilots must be aware of the plane, the path, and the people (crew, passengers, air traffic controllers).

Albert Einstein said, "Problems cannot be solved at the same level of consciousness that created them." If Einstein was right, training has to do more than instruct and teach skills and knowledge: it has to create a level of consciousness that enables the trainee to recognize problems that will be met in the real working environment.

At the same time, training has to avoid imprinting certain attitudes that are problem creators themselves. Training, whether initial or recurrent, is one of the more traditional ways to reduce mistakes, by instilling disciplines that make rule breaking, or disregard of standard operating procedures (SOPs), less likely. Notably, many flying training schools now offer CRM and aviation psychology training as an integral part of the curriculum. The question that remains is Have the many forms of human factor training, particularly directed at the cockpit crew, achieved the expected outcome of knowledge transfer from the training school to the workplace?

Go-arounds

A look at the "go around" (GA) issue may shed some light on the question. But first let's define our term: The go-around—a procedure where a pilot aborts a landing on short final. It is intended to give pilots a safe way "out" in the event that something goes wrong during the landing phase. Go-around procedures are specified in SOPs, and pilots must be familiar with recommended procedures and brief the go-around in the pre-landing checklist. The GA differs considerably from the missed approach—the procedure to be followed if the approach cannot be continued.

The following examples give insight to these questions: If pilots get threatened with punishment for GAs (still valid for some airlines), what will the pilot do in a real flight situation? Why are decisions for GAs made so late? Why don't SOPs prevent wrong GA decisions? What can a cockpit design

CLASSIFICATION OF PILOT'S RELIABILITY

(Kolouch Jan M.D. 1985)

	Knowledge and Level of Professional Skills			
	BELOW AVERAGE	**AVERAGE**	**ABOVE AVERAGE**	
PREVAILING QUALITY OF SELF-EVALUATION (self-critique) for the professional activity (with respect to the awareness of risk)	Inappropriate to demands of type of flights and working positions	Appropriate to demands of type of flights and working position.	Level enabling excellent meeting of tasks at flying and in position with reserves to additional improvement.	Group's characteristic of the development control of risk.
SELF-ASSURANCE > is greater than **UNCERTAINTY**	**Group R_3 3%** *Presumable development:* "Accident," unable to pilot with self-discipline. Prevention: to find out related factors in time with help of psychophysiological expertise in cooperation with practical evaluation.	**Group R_2 9%** *Presumable development:* Unless he distances himself earlier through an air extraordinary vent there is a chance of team experience; at strong leading and regular flying probable movement to S2 group.	**Group R_1 3%** *Presumable development:* "Mr. Pilot" unless he, due to own indiscipline. Comes to an unsolvable air extraordinary event, upon strong control, continuous training and on basis of own and others' experience can be moved to S1 group.	▪ Hidden trend to neglect awareness. ▪ Prevailing subjective predicting of the situation development naïve optimism, underestimating no rational risk assessment. ▪ Risk of health development: increased probability of dependence on alcohol.
SELF-ASSURANCE = is equal to **UNCERTAINTY** (realistic self-critique)	**Group S_3 9%** *Presumable development:* Intended personal choice of an appropriate position of a slower type and less demanding corresponding to the abilities.	**Group S_2 52%** Individuals creating basis of all flying staff of the aviation company.	**Group S_1 9%** Individuals creating basis of all flying staff on the aviation company.	▪ Basic trends in behavior: disciplined in meeting the tasks, instructions, and rules. ▪ Subjective predicting of the situation development: rationalism, objective consideration of possible risks.
SELF-ASSURANCE < is lower than **UNCERTAINTY** (fear of risk) **S**=Reliable **R**= Risk **U**=Scrupulous	**Group U_3 3%** *Presumable development:* individuals having this type of reaction are soon excluded from flying; obvious tendency decompositions, enhanced rick of dependence development.	**Group U_2 9%** *Presumable development:* Increased ability of being excited provokes psychosomatic problems; movement to slower types can support the movement to a more positive group.	**Group U_1 3%** *Presumable development:* Hesitance, mistakes of delay when making decisions: relaxation procedures (self-training) can remove the problem: if he acquires self-assurance, he can be moved to S1 group upon regular flying.	▪ Hidden tendency to behavior: unaware negligence. ▪ Unable to control the situations for wariness oscillation, worse decision-making, possible compens acquiring self-assurance; by way of increased risk of attempts. ▪ Prevailing subjective predicating of situations: pessimism, risk, overestimating. ▪ Risk of health development: dependence on alcohol psychosomatic diseases.

do to support the pilot's decision? What is the influence of the pilot's self-esteem in GA decisions?
Example 1: A crew handling error that made the aircraft stall on approach to landing caused the July 3, 2001, TU-154 M crash at Irkutsk. The copilot, who was the pilot flying the aircraft at the time, had "inexplicably raised the angle of attack." The crew's actions were normal until they received an audio warning from the aircraft's flight control system that the angle of attack was too high. At that point the copilot turned the aircraft sharply and pulled back the control column too far, causing a stall and spin. As it entered what was to be a 22-second spin, the captain took control. Applying full power to all three engines, the aircraft and its systems were working properly at the time of impact. The aircraft hit the ground in a virtually flat attitude. All nine crew and 136 passengers on board were killed. The crew was in its highest stress during this final phase of the flight, while the approach was actually made in good weather.

Question: Why did the captain hesitate with his decision to stabilize the flight situation and to go around? Was it an economical issue and some form of punishment? (One added circle is 500 liters of fuel, which means approximately US$250 must be paid from the crew's pocket.)

Conventional wisdom holds that, in aviation, safety is first. Consequently, human behaviors and decision-making are considered to be totally safety oriented. However, all production systems—and aviation is no exception—generate a CHANGE of behavior under the imperative of economics. Therefore, to be efficient, people tend to operate at the edges of the system's safety area. A more realistic approach is to consider operational behavior and decision making as a compromise between production and safety. Efforts must focus on ways to change the system, rather than punish the individual.

Example 2: A fatal crash during final approach to Zurich Kloten Airport on Nov. 24, 2001, came just a month after a new noise-abatement procedure began forcing pilots to use a non-precision (VOR/DME) approach to the airport (flight was at night in poor weather in the snow).

The aircraft struck treetops and crashed on the extended centerline while attempting to land. Twenty-one of 28 passengers and three out of the crew of five died. The radio altimeter warned the crew when they reached 500 ft (150 m) and then 300 ft above ground level, but the crew had still not reported the airfield in sight. The captain, who was the pilot flying, called for a GA 1 second before impact.

Questions: Why was the Avro RJ 100 "too low" for that stage of its approach? Why did the 57-year-old captain—one of Crossair's most experienced captains—decide too late to go around? And what about the self-esteem of this captain?

Example 3: Cockpit design must be easy to digest for our sensory system. In today's airplanes, we use only three senses, the eyes, the ears, and touch or feeling. Most information in glass cockpits is given visually, so that the visual senses are overloaded with digital information. Information in the form of pictures is faster to digest, but less valid for awareness. The aural signals are sometimes easy to confuse, especially under stress. Most tactile information, like moving throttles, stickshakers, trim systems, etc., are being moved out of the hands of the pilots. In addition, training concentrates more on computers and the delayed output for reaction. Take the case of an A320 overrun in Warsaw after having landed in the middle of the runway. If body awareness would be part of modern training, a tailwind would be easy to feel even in a jumbo-sized airplane.

So the cockpit design has to support our senses and should not obstruct or mislead them. Also, the setting of a radioaltimeter in a non-precision approach in a mountainous area makes no sense. So why did the Zurich pilot use it for that kind of approach? That is the wrong use of a correct cockpit design.

Self-esteem

Then there is the question of the influence of the pilots' self-esteem in GA decision-making.

If we find that the same GA accidents occur in different cultures (also cockpit design culture) and in different companies but that a different behavior occurs, then the reason for the missing skills and the missing awareness is neither the SOP nor the cockpit design, but the personality of the pilots in this cockpit. If they are not acting as a well-oiled team and supporting each other in flying the GA, a crash becomes possible. If the pilots do not feel well, then their decisions are not good and that leads to wrong actions.

Any GA means that "I cannot achieve the required target, so I lose my face." If in addition to this basic psychological inhibition to attempt a GA early, the company has rules of reporting or punishing pilots for GAs, then the inhibition barriers are even higher. Initiating a GA should not be a question of "losing face"; for safety's sake it must be a mandatory procedure and pilots trained to overcome psychological barriers. So why is that not a part of the pilot's training?

Investigating GAs with mistakes is reactive, and investigating GAs without mistakes is proactive. During investigations, air safety investigators need to search out the pilots' feelings and their "self-esteem" in daily operations and in GA situations. Indeed, awareness training of how feeling and self-esteem may affect correct decision-making should be a focus of investigators.

But, if accident investigators are resistant to a behavioral change in accident investigation, why should pilots be asked to change? Why should manufacturers change their design? Why is everybody waiting for everybody else to change before they move a bit? Are these groups afraid of losing face? Would it be a GA for the investigators to start digging a lot deeper into the human factors of pilot training?

In a recent analysis of 120 accidents from ICAO statistics, two represented very clearly the basic problems of most GAs. The first showed manual skills and awareness problems. Accident investigators always ask for more training and more procedures after an accident. Is that a valid request? Not when the same sort of "wrong" pilot behavior also happens in companies with good procedures and with good pilot training. Situational awareness (SA) is a very personal thing. SA depends on one's state of mind on certain days and at certain locations and with certain tasks. So, situational awareness changes. But does pilot training include how to control one's own personal SA? No!

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The Science of Fatigue

Regulators see a large role for non-traditional methods of mitigating pilot fatigue and preventing fatigue-related accidents.

By Linda Werfelman

Moving toward a systems approach to preventing fatigue in aviation operations, the U.S. Federal Aviation Administration (FAA) says that, like other civil aviation authorities, it is going beyond traditional programs that limit the number of hours worked in favor of more comprehensive plans to help operators identify fatigue and mitigate its risks.

"While fatigue may not have been called out by name, it's been ... lurking in many of the accidents we've faced over the years," Acting FAA Administrator Robert A. Sturgell told a fatigue safety forum convened by the agency in June to consider "new ways to manage fatigue."

The FAA characterized the safely forum as an early step in its development of a new approach lo handling fatigue and its revision of existing policies, which have been in effect with relatively few changes for 50 years.

"Even with an outstanding safety record, we're not where we need to be when it comes to understanding and dealing with fatigue," Sturgell said.

The solution is not necessarily "adopting prescriptive criteria for fatigue risk abatement" he said, adding, "We need to address all levels of fatigue and put appropriate mitigations in place --mitigations that are proportionate to the risk."

Plans call for the proceedings of the symposium to be published in late 2003 in an effort lo widely disseminate information about fatigue and fatigue mitigation.

The FAAs plans – outlined in August, in response to safely recommendations by the U.S. National Transportation Safety Board (NTSB) – are to "educate the industry on the reality of fatigue and ways to effectively mitigate its dangers." The FAA said it would first develop guidance for fatigue management in ultra-long-range (ULR) operations flights longer than 16 hours and then apply that guidance to other flight profiles.

ULR fatigue-management guidance currently exists in the form of recommended guidelines published in 2005 by the ULR Crew Alertness Initiative, sponsored by Airbus, Boeing Commercial Airplanes and Flight Safety Foundation." In addition, the FAA said that data gathering will continue on the fatigue aspects of ULR flights and other flight operations, and that the new data will be essential in the development of fatigue guidance documents and standardized protocols for data gathering.

These standardized protocols will provide "reliable tools to validate air operators' fatigue management actions and also will give solid basis for policy guidance to tile industry," the FAA said.

The NTSB recommendations, issued alter investigations of several recent fatigue-related accidents and incidents — including a Pinnacle Airlines Bombardier CR1200LR runway overrun at Traverse City, Michigan, on April 12, 2007 — called on the FAA to "develop guidance, based on empirical and scientific evidence, for operators to establish fatigue management systems" and to "develop and use a methodology that will continually assess the effectiveness of fatigue management systems implemented by operators, including their ability to improve sleep and alertness, mitigate performance errors and prevent accidents and incidents."

The NTSB defines fatigue management systems as incorporating various fatigue-management strategies, including scheduling practices, attendance policies, education, medical screening and treatment, "personal responsibility during non-work periods," task/workload issues, rest environments, commuting policies, and/or napping policies.

According to the NTSB recommendations, the new guidance would supplement flight- and duty-time regulations — not replace them.

"Although scheduling practices and flight-arid duty-time limits still need to be addressed, the [recent fatigue-related accidents and incidents] have clearly shown that other issues contribute to human fatigue in aircraft operations and that a comprehensive approach that includes company policies and crewmember responsibilities is needed to effectively mitigate the hazards posed by fatigue in the aviation environment," the NTSB said in a letter conveying its safety recommendations to the FAA." The fatigue management system concept al-ready is in place in several civil aviation authorities, including New Zealand, where regulations were implemented in 1995 to require air carriers to either comply with traditional flight-and duty-time limitations or with a fatigue management system approved by the Civil Aviation Authority. The regulation establishes maxi-mum monthly and yearly flight hours for flight crewmembers and specifies that operators must not allow crewmembers lo fly if their condition could present a risk to flight safety. In addition, the International Civil Aviation Organization (ICAO) is developing a document that will discuss fatigue management systems and will prescribe them as an alternative to flight-and duty-time limits.

Fatigue risk management systems (FRMS) also are in place in some airlines.

One of the first airlines to adopt an FRMS was easyJet, which began the system as a research program to gather data on pilots' sleep and fatigue-related performance. The research effort led to revised work schedules, continuing data collection and research on fatigue risks, a procedure for crewmembers to report fatigue within a just culture, and a process tor investigating the role of fatigue in all incidents.

Often, an FRMS is one element of an airline's safety management system (SMS), and many of the FRMS components — such as a just safety culture and non-punitive safely reporting — are also integral parts of an SMS. This is the approach taken by Transport Canada (TC), which has published a series of reports on how a fatigue management system should be implemented and why.

"Managing fatigue-related risk under an SMS framework involves developing comprehensive defenses against the hazard of fatigue based on a formal assessment of risk," TC says. "Organizations can decide to do as much or as little as necessary to manage their own levels of risk. ... An effective ... fatigue risk management system should use multiple, overlapping and redundant defenses against a given hazard.

In a multi-layered system, an incident can occur only when all the defensive systems fail."

Best Practices' Attendance

The Pinnacle Airlines accident and other fatigue-related accidents and incidents illustrate the risks of fatigue, as well as the need for the industry to address fatigue related Factors in company policies and crewmember responsibilities, the NTSB said. Although industry and regulators often have relied on flight- and duty-time limits such as the FAAs current regulatory requirement that a two-member flight crew he limited to eight scheduled flight hours between mandatory rest periods' — the NTSB and others say that these limitations alone are not sufficient to mitigate the risks of fatigue.

Among other things, the NTSB has recommended that the industry develop a "best practices attendance policy" to allow flight crewmembers it decline assignments if they believe that they are impaired by insufficient sleep.

In the final report on the Pinnacle Airlines accident, the NTSB said that long duty days can result in pilot fatigue and degraded performance.

"Aviation accident data show that human performance-related airline accidents are more likely to happen when pilots work long days," the report said, citing a 1994 NTSB study that found that captains who had been awake longer than 12 hours made "significantly more errors" than those who had been awake for a shorter time period.

"Such errors included tailing to recognize and discontinue a flawed approach; pilots often exhibited a tendency to continue the approach, despite increasing evidence that it should be discontinued,"

Recent Fatigue Related Events

Among the recent accidents and incidents cited by the U.S. National Transportation Safety Board (NTSB) as examples that highlight the risks of human fatigue in airline operations are the following:

Feb. 13, 2008 -- An incident in which a Go! Bombardier CL-600 en route from Honolulu to Hilo, Hawaii, flew past the destination airport while still in cruise flight. Air traffic control (ATC) tried repeatedly to contact the crew but received no response for 18 minutes as the airplane, operated by Mesa Airlines, flew 26 nm (48 km) past Hilo. Then the crew contacted ATC, complied with instructions for their return to Hilo and safely landed the airplane. The three flight crewmembers and 40 passengers deplaned safely.

A preliminary investigation found that "both pilots unintentionally fell asleep during cruise flight," the NTSB said in a safety recommendation letter to the U.S. Federal Aviation Administration (FAA). Although the crew had been on duty less than 4.5 hours when the incident occurred, "the pilots were on the third day of a trip schedule that involved repeated early start times and demanding sequences of numerous short flight segments," the NTSB said. In addition, the NTSB said, one pilot was diagnosed after the incident with obstructive sleep apnea, which can result in poor sleep quality, excessive daytime fatigue and, for some people, memory problems.

April 12, 2007 -- An accident in which a Pinnacle Airlines Bombardier CRJ200LR ran off the end of the landing runway at Cherry Capital Airport in Traverse City, Michigan, U.S. The airplane was substantially damaged, but none of the 49 passengers and three crewmembers was injured in the crash.

Feb. 18, 2007 -- An accident in which a Delta Connection Embraer ERJ-170, operated by Shuttle America, ran off the end of a runway at Cleveland Hopkins International Airport while landing in a snowstorm. None of the 75 people in the airplane suffered serious injury, but the airplane was substantially damaged. The NTSB said that the probable cause of the accident was the flight crew's failure to conduct a missed approach "when visual cues for the runway were not distinct and identifiable."

"The captain had been suffering from intermittent insomnia during the months preceding the accident/the NTSB said, noting that the captain told investigators that, at the time of the accident, he had been awake for 31 of the preceding 32 hours. The captain said that, although he told other crewmembers about his fatigue, he did not remove himself from duty or tell his company because he believed that he would have been fired.

"As a result, he placed himself, his crew and his passengers in a dangerous situation that could have been avoided," the NTSB said. "Shuttle America had an official attendance policy that allowed pilots to remove themselves from duty because of fatigue, but ... in practice, the administration of this policy did not permit flight crewmembers to call in as fatigued without fear of reprisals."

Oct. 19, 2004 -- An accident in which a Corporate Airlines BAE Systems Jetstream 32 crashed short of the landing runway in Kirksville, Missouri, U.S. The crash occurred as the pilots — at the end of a 14.5-hour duty day — were con-ducting a nonprecision approach in nighttime instrument meteorological conditions. Thirteen of the 15 people in the airplane were killed, and two received serious injuries. The NTSB said that the probable cause of the accident was "the pilots' failure to follow established procedures and properly conduct the approach and to adhere to established division of duties." Their fatigue "likely contributed to their degraded performance," the NTSB said.

the report said. "Research and accident history also show that fatigue can cause pilots to make risky, impulsive decisions; become fixated on one aspect of a situation; and react slowly to warnings or signs. ... Additionally, research shows that people who are fatigued become less able to consider options and are more likely to become fixated on a course of action or a desired outcome."

When accident investigators questioned how widespread fatigue was among Pinnacle pilots, the FAA principle operations inspector who oversaw Pinnacle operations estimated that 60 to 70 percent of company pilots who submitted event reports through the aviation safety action program (ASAP) cited fatigue as a factor in the event.

The report said that scientific studies indicate that people "typically underestimate their level of fatigue, especially when [hey are busy." For example, the report quoted the Pinnacle pilots as saying that they had not realized how tired they were until the airplane was established in cruise — a phase of flight in which workload typically is low. The report theorized that, if they had recognized the extent of their fatigue earlier, the accident pilots might have invoked a Pinnacle policy that allowed flight crew-members to remove themselves from trips because of fatigue.

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Can They Talk the Talk?

By Elizabeth Mathews and Alan Gill

Passengers listening in on radio communications on a domestic flight in the United States a couple of years ago heard the following exchange between the pilot and the Jacksonville (Florida, U.S.) Center controller:

Pilot: "Jacksonville Control. United XXX. Can we reduce speed to xxx knots?"

Controller: "United XXX. Jacksonville Control. Only if you want to join the back of the pack."

Pilot: "Okay. We'll pin our ears back then."

Controller: "You don't need to do that. Just maintain current speed."

This exchange in interesting from both a linguistic and an operational point of view, and illustrates how the International Civil Aviation Organization (ICAO) language proficiency standards and recommended practices (SARPs) apply to speakers of English as a first language.

ICAO's language proficiency requirement call for all flight crewmembers, air traffic controllers and aeronautical station operators involved in international operations, regardless of their first language, to demonstrate at least "operational" proficiency in English by March 2011. ICAO defines six levels of competence in English, ranging from "pre-elementary" Level 1 to "expert" Level 6; the "operational" level is Level 4.

Specifically, the brief radio exchange above highlights the following:

- The requirement for civil aviation authorities to distinguish between license holders who demonstrate ICAO Level 6 English proficiency and those who demonstrate lower levels of proficiency;
- The heightened importance of adherence to ICAO phraseology in the context of strengthened ICAO language proficiency requirements;
- The concurrent and inevitable need for plain language, even in routine situations; and,
- The particular responsibility of Level 6 speakers to be aware of the challenges of international radio communications and to deliberately and conscientiously use plain language.

Regulating Language

The ICAO language proficiency requirements regulate language used in radio communication — cither the national language spoken by controllers on the ground, or English. For this article, we will locus on English proficiency testing. Although the contexts may be different, ICAO member states in which English is a national language are required to implement language proficiency assessments to ensure compliance in ways similar to stales that do not have English as a national language.

Pilots and controllers who demonstrate Level 6 proficiency at their initial testing are exempt from further tests. Those who demonstrate operational Level 4 proficiency or "extended" Level 5 proficiency must undergo periodic retesting, and those with proficiency at Levels 1, 2 and 3 are expected to continue English -language studies.

A Challenge

A challenge for civil aviation authorities, particularly in states with English as a national language, is to determine which applicants require recurrent testing and which quality as expert Level 6 speakers. ICAO does not automatically exempt "native speakers" from assessment, for reasons that make sense in the global context of ICAO standards.

Globally, more people speak English as a second or third language than as a first or "native" language. Multilingualism is the global norm, and monolingual English speakers, that is, people who speak only English, are a minority.

Determining native — or "first-language" — English ability in bilingual or multilingual speakers can be so problematic that, outside of monolingual situations, the term "native language" becomes meaningless. For example, many people who acquire English as a second, third or fourth language speak it as proficiently as if it were their only language. In addition, the widespread use of English in places such as India or Singapore adds further complexity to any attempt to determine native language proficiency.

ICAO standards do not, in fact, refer to native speakers. Instead, they discuss Level 6 proficiency, which can describe either monolingual English speakers or people who speak English as one of their languages. In either case, civil aviation authorities must have a procedure to distinguish between those who demonstrate Level 6 English proficiency and are exempt from further testing, and those at lower proficiency levels who require recurrent testing or English language training.

The New Zealand Example

For example, the Civil Aviation Authority (CAA) of New Zealand has implement a comprehensive English-as-a-first-language assessment system with separate procedures to assess ICAO Level 6 English language proficiency.

Since March 5, 2008, applicants for New Zealand airplane and helicopter pilot licenses, as well as air traffic controller and flight service operator licenses — including existing license holders who apply for a different license — have been required to demonstrate at least Level 4 proficiency endorsement is included on their license. The language assessments are conducted by Aviation Services Limited, the CAA's designate examination provider.

Two types of English language proficiency assessments are used.

One is the formal language evaluation (FLE), an assessment conducted over the telephone of pronunciation, structure, vocabulary, fluency and comprehension, followed by a brief telephone interview with a rater; during the interview, comprehension and interactions are evaluated. Each FLE is recorded and subsequently rated by two qualified language teachers who have received training on ICAO's language proficiency requirements and are familiar with aviation contexts and terminology.

The other assessment is the Level 6 Proficiency Demonstration (L6PD), a 10-minute telephone assessment designed to allow most New Zealand applicants who speak English as a first language lo demonstrate Level 6 proficiency. It confirms that expert English speakers can meet all ICAO Level 6 language criteria — pronunciation, structure, vocabulary, fluency, comprehension and interactions — on a variety of familiar and unfamiliar topics but does not test technical knowledge or phraseology.

Because the 1.6['1) is intended for pilots who are confident of their ability to communicate at Level 6, the only scoring outcomes arc "Level 6" or "not determined" A "not determined" assessment may be a result of responses that were too short, contained long pauses or were not relevant to the topic. An applicant who receives a "not determined" assessment may not re-take the L6PD but must subsequently undergo an FLE to prove his or her proficiency. In some cases, an applicant with low Level 6 proficiency might fail an L6PD but subsequently be assessed at Level 6 in an FLE, in which more evidence is gathered.

The L6PD was developed by a team led by an associate professor of applied language studies and linguistics at a New Zealand university and includes various scenarios intended to elicit responses from applicants. These responses are assessed — by a rater selected from the same group that assesses FLFs — to develop a picture of the applicants overall language proficiency.

Both the FLE and the L6PD cover the language required to communicate about common, concrete, aviation-related situations or tasks, including complications or unexpected events. The aviation context is appropriate tor a range of applicants from private pilots to experienced air transport pilots.

Linguistic Analysis

Returning, to the radio exchange over Florida, it is probable that both speakers were demonstrating Level 6 English proficiency. However, as the dialogue illustrates, expert speakers of English do not always exhibit the standards of care and communicative professionalism that tile job demands.

ICAO Document 9835, *Manual on the Implementation of ICAO Language Proficiency Requirements*, prescribes a standardized linguistic method of analyzing radio communications.

Using the aeronautical communicative language functions to analyze this brief exchange highlights two important points that enhance our understanding of the requirements of radio communications, especially in international communications.

First, even in relatively routine, non-emergency situations — "Can we reduce speed?" — there is very often a need to communicate information that is more subtle than ICAO phraseology alone may allow. In this case, the controllers response to the request to reduce speed is a conditional "yes but ..." — that is, "Yes, you can reduce speed, but I will need to vector you around to rejoin the flight path behind the aircraft following, you."

There is no published ICAO phraseology that permits the "negotiation" that this pilot and controller engage in. It is not realistic to expect phraseologies to cover every conceivable situation. The need tor natural, or plain, language occurs not infrequently during normal flight operations. In-fact, the SARPs have always made clear that ICAO phraseologies are intended to be representative and not exhaustive.

Second, the pilot and controller both resorted to idiomatic expressions — "join the back of the pack" and "pin our ears back" — probably as a kind of shorthand. Another phenomenon also may be present. In normal use, language allows humans to connect and establish relationships with one another. Playful use of language is friendly and helps build relationships.

In this case, it was clear that the pilot and the controller understood each other's idiomatic expressions. However, idioms, like humor, do not translate well across language barriers. ICAO Level 4 proficiency descriptors do not include the more advanced ability to understand idiomatic expressions. In international communications, with Level 6 pilots potentially sharing the airspace with pilots who speck English at Level 4, such language is not acceptable. Idiomatic expressions or any clever use of language hinders communication

Natural Advantage

Pilots and controllers who speak English as a first language have a significant natural advantage because they do not normally require lengthy language training to earn or maintain a pilot certificate. In contract, many of their international colleagues without English as a first or national language must make an extensive effort to learn English to Level 4 proficiency.

Similarly, airlines and air navigation service providers in nations with English as the dominant national language are not experiencing the same organizationally substantial language training requirements that face airlines and air navigation service providers in other nations. While there are currently there are currently no reasonable alternatives to English as the international language for radio communications, and while the ability to speak English with at least level 4 proficiency is essential, it also should be recognized that an unequal distribution of training requirements inevitably results; this calls for a generous and thoughtful response from the industry and from individuals.

The first and easiest way for the industry lo support global compliance with ICAO language SARPs is to strengthen individual, organizational and national adherence to ICAO phraseology.

In many parts of the world, pilots and controllers are required to complete a test on ICAO phraseology as a licensing requirement. All pilots living international routes, regardless of their first language, should demonstrate proficiency with ICAO phraseology. Nations with published phraseology that differs from ICAO phraseology should carefully review communication procedures lo align as closely as possible with ICAO phraseology.

Linguistic Awareness

Pilots and controllers also must become aware communications and learn strategies that take those challenges into account. Basically, strict adherence to SARPs and guidance in ICAO documents is all that is required. Aviation professionals with Level 6 English proficiency are responsible tor setting high standards for themselves in adhering strictly to ICAO phraseology whenever possible, and using plain language carefully and thoughtfully when ICAO phraseology is not adequate. ICAO guidance materials provide information intended to heighten awareness of the possible pitfalls of communicating across language barriers.

The English-speaking aviation world can undertake several measures to support global compliance with ICAO language standards, including collaborating to make aviation English material widely available. However, three simple measures – adhering to ICAO phraseology, using plain language with brevity and clarity, and developing a respectful awareness of the challenges of communicating across language barriers – are the least they can do.

Courtesy FSF Aero Safety World Magazine

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The second accident showed, again, that most pilots get into a stressed, nonrational state of mind when performing GAs (with and also without engine failure). They very often hit the wrong button or make the wrong motoric movements on the controls. Mentally they make wrong decisions. So, it seems that pilots during GAs are mentally blocked (by hormones), which can only happen if they consider GAs as a challenging or frightening task. Secondly, it looks as if pilots are not able to do several things at the same time. This is a general and global problem of most men. If pilots are told all the time during training to concentrate on one thing/one task, then it should not be astonishing that multitasking, like a GA, later causes a problem for them.

The basic problem as a root cause for the late decisions is the competitive spirit of pilots or men in general, who do not wish to admit a mistake or misjudgment. Losing one's face still seems to be a major topic not just of the Asiatic world. So, the accident investigator needs to look for the "feelings" of pilots in GA situations with and without mistakes. Pilot training has to include the training of the correct feelings as a basis for correct decisions, which are the foundations for correct actions.

Courtesy ISASI Forum

Runway Deficit

Reduced Thrust Set for Takeoff

The flight crew began the takeoff from Runway 05R at Auckland (New Zealand) International Airport the afternoon of March 22, 2007, believing that the full length —3,230 m (10,598 ft) — was available. Flaps and engine thrust had been set accordingly. "During the takeoff, they saw work vehicles in the distance on the runway and, realizing something was amiss, immediately applied full engine thrust and got airborne," said the report by the New Zealand Transport Accident Investigation Commission (TAIC). The 777 passed 92 ft over the vehicles.

The aircraft had arrived in Auckland about two hours earlier on a flight from Sydney, Australia. Before departing from Sydney, the crew read a notice to airmen (NOTAM) advising that available takeoff and landing distance on Run-way 05R had been reduced to 2,320 m (7,612 ft) due to work in progress on the eastern portion of the runway. The crew therefore planned to conduct a reduced-length landing at Auckland.

The NOTAM also said that, with 45 minutes' prior notice, the full length of the runway would be made available temporarily for long-haul international aircraft. As the 777 neared Auckland, the full length of the runway was made available for the departure of an aircraft bound for Singapore. "For traffic sequencing, the aerodrome controller held the Singapore-bound aircraft at the runway holding point and cleared the [777] pilots to land their aircraft first," the report said. "Because the full length of the runway was temporarily available, the aerodrome controller advised the pilots that the full length of the runway was available for their landing." The crew landed the 777 and taxied to the gate.

There were 357 passengers and 18 crew-members aboard for the return flight to Sydney. The airport ground controller told the crew to taxi to Runway 05R and to hold on Taxiway A 10 for departure. The crew did not request clearance to back-taxi on the western runway extension, which would have added 393 m (1,289 ft) to the available takeoff distance. To ensure that the crew knew about the reduced runway length, the controller said, "Confirm you will depart from alpha ten reduced length?" The crew confirmed that they would begin the takeoff from A 10, believing that the full length of the runway was available and misunderstanding the controller's reference to "reduced length" as meaning the western runway extension that they were not planning to use.

"The first officer was the pilot flying, and the pilots set the thrust that they had determined was necessary for a reduced-thrust departure using the full length of the runway from intersection A10," the report said. An N1 fan speed — set-ting of 86.4 percent and a flaps 5 setting were used. The proper settings for the reduced takeoff distance were 94.6 percent N1 and flaps 20.

The 777 was about halfway down the runway when the pilots saw the work vehicles, which included a rubber-removal truck and the airport safety officers utility vehicle. The captain immediately applied takeoff/go-around thrust 104.8 percent N1. "The recorded airspeed at the time was 149 knots" the report said. "Within 4 seconds, the aircraft accelerated to the pilots' predetermined takeoff decision speed (V1) of 161 knots. The first officer later said that immediately after reaching V1, the captain called 'rotate' when the rotation speed (VR) of 163 knots was achieved. The aircraft became airborne approximately 190 m [623 ft) before the end of the reduced runway and climbed away steeply." The crew landed the aircraft in Sydney about three hours later.

The pilots told investigators that because the full runway length was available for their landing, they believed that it also was available for takeoff. They said that this belief was reinforced by the words "active runway mode normal operations" at the beginning of the automatic terminal information service (ATIS) broadcasts they had received. The report said that these words meant only that the approach threshold of Runway 05R was not displaced. The pilots said that they had overlooked information provided later in the ATIS broadcasts about the reduced runway length.

The report noted that the ATIS broadcasts for Auckland were twice the length recommended by the International Civil Aviation Organization (ICAO) and were cluttered with noncritical "permanent" information. Among recommendations based on the findings of the incident investigation, TAIC said that the New Zealand Civil Aviation Authority should "ensure that ATIS broadcasts... have clear word and sentence structures, are unambiguous, never imply that things are normal when they are not, contain no permanent information and conform as closely as possible to ICAO-recommended standards."

European Ramp Checks Find Increase in Safety Deficiencies

The rate of 'major' deficiency findings in 2005 was highest for aircraft based in the ICAO Western and Central African Region and the Eastern and Southern African Region.

By Rick Darby

Ramp inspections of aircraft European airports turned up a higher rate of deficiency findings per inspection in 2005 than in the previous year but a lower rate of "major" deficiency findings per inspection. The inspections were carried out under the Safety Assessment of Foreign Aircraft (SAFA) program, a combined effort of the European Civil Aviation Conference (ECAC) and Joint Aviation Authorities.

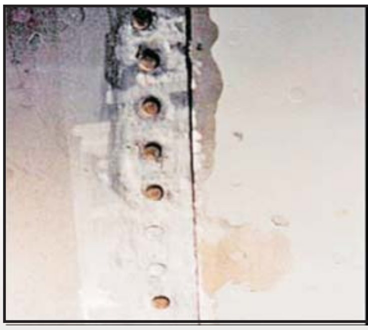
Deficiency findings per inspection averaged 1.56 in 2005, compared with 1.49 in 2004 and 1.24 for the 2000-2005 period (Table 1). From a peak rate of 2.83 in 1996, the rate had declined steadily until 2004.

The rate of findings per item inspected, which ECAC says "might give a better understanding," has also trended up recently. "For every 100 [SAFA] checklist items inspected, on average 3.0 findings were established in the years up to 2003," ECAC said. , "In 2004, this increased to 4.6 findings per 100 items inspected and further increased in 2005 to 4.7 findings per 100 items inspected."

A checklist comprising 54 items is used for the inspections. Although the criteria for passing inspections are standardized, not all items are checked in each inspection.

Findings were categorized according to their severity: Category 1 represented "minor" findings, Category 2 "significant" findings and Category 3 "major" findings, based on the degree of deviation from International Civil Aviation Organization (ICAO) standards in Annex I, Annex 6 and Annex 8. The rate of Category 3 findings per inspection fell form 0.24 in 2004 to 0.22 in 2005 (Table 1). (Rates have been rounded for this article.) The 2005 rate was still higher than the 2000-2005 average of 0.18 and higher than in any of the four years before 2004. ECAC also reported the rates for combined Category 2 and 3 findings per inspected item in four areas: the flight deck, the passenger cabin, the general condition of the aircraft and the cargo compartment. Each area included three inspection items.

On the flight deck, the highest deficiency rate — 0.13 findings per inspected item — involved documentation, particularly the flight operations manual. ECAC said that "frequent" findings included "no approval by the State [nation] of [the] operator, content of the manual does not meet the ICAO standards, [and] the manual is not up to date or has been drafted by another airline." Equipment — for example, the lack of a terrain awareness and warning system — was second. Deficiencies related to the minimum equipment list were third.



'Major' Deficiency Findings: A Two-Year Rising Trend

Results of Safety Assessment of Foreign Aircraft Program, 2000-2005

		Number of Findings				Rate of Findings per Inspection			
Year	Number of Inspections	Category 1 (Minor)	Category 2 (Significant)	Category 3 (Major)	Total	Category 1 (Minor)	Category 2 (Significant)	Category 3 (Major)	All Categories
2000	2,394	1,274	1,035	278	2,587	0.53	0.43	0.12	1.08
2001	2,706	1,258	1,221	389	2,868	0.47	0.45	0.14	1.06
2002	3,234	1,384	1,219	461	3,064	0.43	0.38	0.14	0.95
2003	3,414	1,212	1,439	591	3,242	0.36	0.42	0.17	0.95
2004	4,568	2,349	3,375	1,075	6,799	0.51	0.74	0.24	1.49
2005	5,457	3,437	3,873	1,182	8,492	0.63	0.71	0.22	1.56
Total	21,773	10,914	12,162	3,976	27,052	0.50	0.56	0.18	1.24

Rates have been rounded.

Source: European Civil Aviation Conference and Joint Aviation Authorities

Table 1

In the passenger cabin, "emergency exits, lighting and marking, torches [flashlights]" had the highest deficiency rate, at 0.06 findings per inspected item. "The findings mainly concerned emergency exit lights which were not functioning properly; torches which were not available, in poor condition or not available in sufficient quantity; and non-installation or inadequate functioning of floor proximity (emergency) escape path marking systems." "Access to emergency exits," with findings such as obstruction by catering boxes, luggage and cargo, had nearly an equal rate. "Cabin attendant's station and crew rest area," which was largely concerned with whether required harnesses were in place and seats folded correctly, was third in the rate of deficiency findings per inspected item. "Wheels, tires and brakes" topped the list of findings in general aircraft condition inspections, with a rate of 0.04 deficiencies per inspected item.

ECAC cited "tires worn beyond limits, cuts in the tire, leakage of hydraulic fluid in landing gear areas [and] brakes worn beyond limits." The next-highest rate was for leakage of hydraulic fluid from areas other than the landing gear and leakage of oil, fuel and water. The lowest rate for the three inspection items was for deficiencies related to the powerplants and pylons.

In the cargo compartment, "safety of cargo on board" had the highest deficiency rate, at 0.11. "In several cases, it was established that cargo... was not properly secured," ECAC said. "Heavy items (such as spare wheels) were not restrained, which might lead to damage of the aircraft in case of rapid acceleration/deceleration. In other cases, barrier nets were either not installed or in poor condition. Cargo containers and pallets were in poor condition. Locks to secure the containers were not in the proper position or unserviceable." Findings related to "dangerous goods" and the "general condition" of the cargo compartment had the second and third highest rates, respectively.

Findings of a SAFA inspection can lead, depending on the seriousness of the deviations, to several actions. The aircraft commander is asked to address the deficiencies brought to his or her attention. Occasionally, if the inspectors have cause to believe the commander does not intend to take the necessary measures, the authorities ground the aircraft until the corrections are made. In other

Highest, Lowest Rates of 'Major' Deficiencies Vary by Factor of Five

Safety Assessment of Foreign Aircraft Program, Deficiencies by ICAO Region, 2005

		Number of Findings				Rate of Findings per Inspection			
ICAO Region	No. of Inspections	Category 1 (Minor)	Category 2 (Significant)	Category 3 (Major)	Total Findings	Category 1 (Minor)	Category 2 (Significant)	Category 3 (Major)	All Categories
APAC	145	106	101	43	250	0.73	0.70	0.30	1.72
ESAF	92	80	123	69	272	0.87	1.34	0.75	2.96
EUR/NAT	4,505	2,664	3,058	832	6,554	0.59	0.68	0.18	1.45
MID	368	283	345	154	782	0.77	0.94	0.42	2.13
NACC	214	143	99	29	271	0.67	0.46	0.14	1.24
SAM	83	101	71	17	189	1.22	0.86	0.20	2.28
WACAF	50	60	76	38	174	1.20	1.52	0.76	3.48

APAC= Asian and Pacific ESAF=Eastern and Southern African EUR/NAT= European and North Atlantic ICAO=International Civil Aviation Organization
MID=Middle East NACC=North American, Central American and Caribbean SAM=South American WACAF=Western and Central African

The ICAO region shown is based on the state of registration of the aircraft inspected.

Source: European Civil Aviation Conference and Joint Aviation Authorities

Table 2

Low fuel situations awareness

By: Frederic MARANI
Manager; Safety Strategy Development
Prodcut Integrity, Airbus

1 Introduction

One easily understands that lack of fuel may seriously impair the safety of a flight. Monitoring the fuel status all along a mission is therefore one of the critical tasks of the crew. The challenge of this monitoring is that fuel status may be adversely affected by a very wide variety of factors. This article will briefly review the factors affecting fuel status, and will then stress:

- ➔ The importance of fuel checks, developed to ensure timely detection of a low fuel situation

- ➔ The limits in the use of the FMS in Fuel On Board projections under degraded conditions This article is a complement to the presentation titled "Detecting and managing situations of low usable fuel" given during the 14th Flight Safety Conference in Barcelona on October 2007.

2 Fuel status variables

The factors affecting the fuel status may be sorted out in two classes.

- ➔ Those linked with the operating context such as :
  - Delays induced by ground operations factors at departure airport
  - Air Traffic Control constraints modifying the scheduled flight plan
  - Meteorological factors
  - Congestion at the destination airport leading to holding or diverting.
- ➔ And those linked with the aircraft like :
  - Airplane ageing: mainly the engines, but also the airframe and nacelles
  - Airplane flying under conditions of the Minimum Equipment List (MEL) or Configuration Deviation List (CDL)
  - Aircraft speed not in accordance with the scheduled flight plan
  - Overweight compared to flight plan but also
  - In-flight failures with an effect on fuel consumption
  - In-flight failures with an effect on the fuel available for the mission (e.g. fuel leaks leading to fuel being trapped).

3 Standard Operating Procedures (SOPs)

Because of the variety of causes that may lead to a low fuel situation, and in view of the configuration of the fuel system, several means must be used to maximise the chance of an early detection.

According to the SOPs for the cruise phase, 3 types of check have to be performed when over flying a waypoint, or every 30 minutes:

1. **Fuel On Board**
2. **FMS Fuel prediction**
3. **Fuel On Board/Fuel Used**

The above checks need to be performed as well each time a FUEL IMBALANCE procedure is necessary, and they should be performed before applying the Fuel Imbalance procedure.

Note: *On the A300-600/A310/A320family/A330/A340 and A380 aircraft, FUEL IMBALANCE detection is available as an "advisory" message associated with the Fuel System page on the System Display. On the A340-500/600 and A380, it triggers as well an amber caution appearing on the ECAM.*

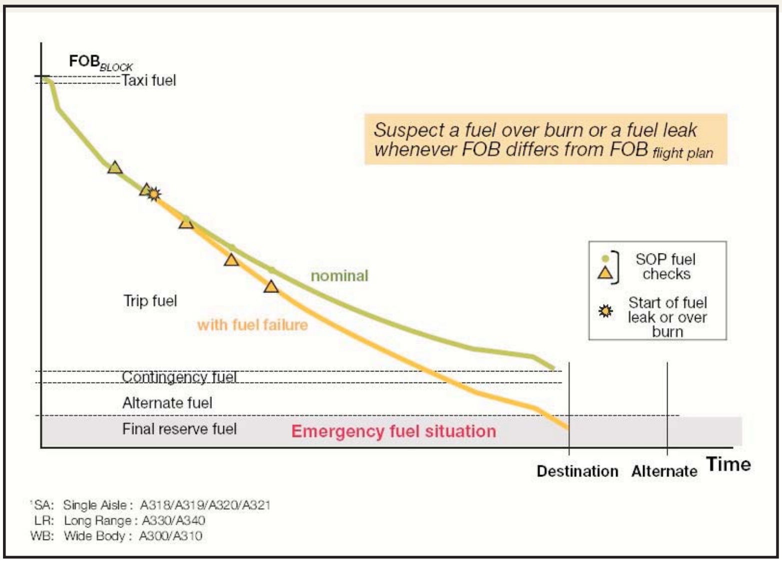
No such alarm is available on the A320 family for the time being.

3.1 First check: Fuel On Board

Cruise SOP FCOM 3.03.15 P1 (SA/LR) FCOM 2.03.15 P1 (WB):
"Check Fuel on Board (ECAM)… and compare with the computer flight plan or the FCOM In-Cruise Quick-Check Table."

Any marked difference in FOB quantity compared to the flight plan prediction may reveal either:

- ➔ A fuel over-burn, which may be explained by:
  - ➢ Some significant deviations from the initial flight plan, due for instance to restrictions from Air Traffic Control, degradations of meteorological conditions, engine failure
  - ➢ An airplane configuration degradation, due for instance to an aerodynamic drag increase coming from flight control surfaces permanently deflected, a landing gear or gear doors partially extended, ice accretion.
- ➔ An external fuel leakage



3.2 Second check: FMS Fuel prediction

Cruise SOP FCOM 3.03.15 P1 (SA/LR) FCOM 2.03.15 P1 (WB):
"Check… fuel prediction (FMGC) and compare to the computer flight plan or the FCOM In-Cruise Quick-Check Table."

The FMS is able to make FOB predictions at point along the flight plan: waypoints, destination (DEST EFOB) or alternates. It considers the entered flight plan and assumes a nominal aircraft (potentially customized to monitored performance level through individual PERF factor) i.e. without failure.

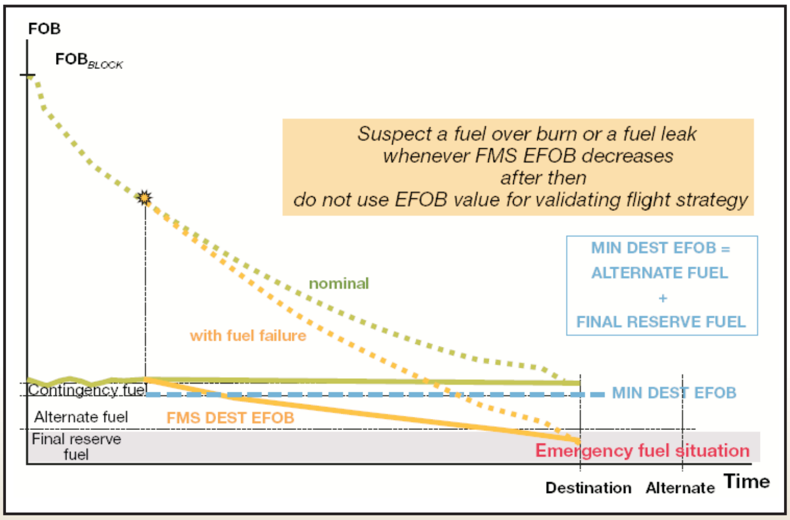
It is updated permanently from the measured FOB and from modifications of the flight plan entered into the FMS, if any. In nominal conditions, without flight plan update, DEST EFOB should not show any marked evolution throughout the flight.

Hence, in case of fuel over-burn due, for instance, to a drag increase, DEST EFOB will decrease permanently at the same rate the actual FOB is drifting away from the initial flight plan prediction. The same behaviour would happen for a fuel leak.

Decreasing DEST EFOB indication is a sign of degrading fuel situation.

For the above-mentioned reasons, it also means that the displayed DEST EFOB value cannot be used to anticipate the fuel status at destination. The same is true for all other EFOB projections, like at waypoints or alternates.

Note: DEST EFOB displayed on FMS pages turn to amber if it becomes ower than the sum of Alternate and Final reserves fuel entered in the FMS: it indicates that contingency fuel and extra fuel reserves are no more available.



3.3 Third check: Fuel On Board/Fuel Used

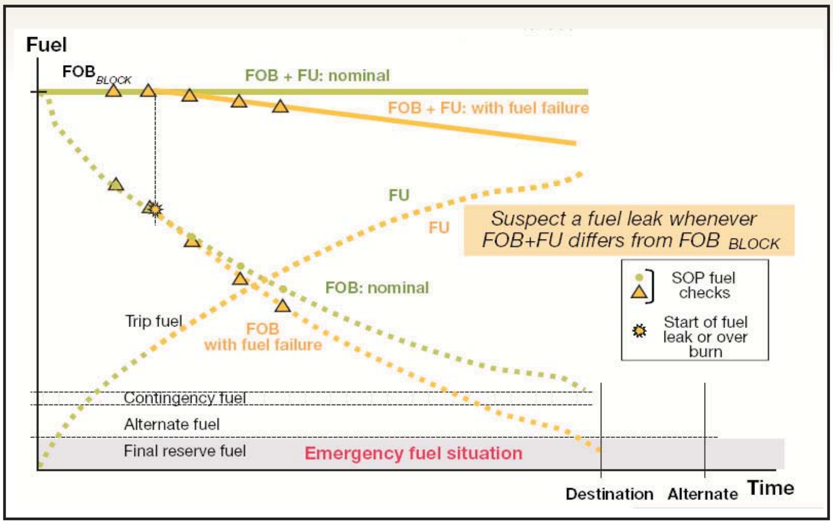
Cruise SOP FCOM 3.03.15 P1 (SA/LR) FCOM 2.03.15 P1 (WB):
"Check that the sum of the Fuel On Board and the Fuel Used is consistent with the Fuel On Board at departure… If the sum is either unusually smaller than the FOB at departure, or if it decreases, suspect a fuel leak."

A higher sum may provide the indication of a frozen fuel quantity parameter leading to a wrong FOB data.

Indeed, an unexpected engine fuel flow level may be caused by:

- A fuel leak, downstream of the Flow Meter, sometimes confirmed by:
- Fuel spray visible from the cabin coming from engine or pylon
- Fuel smell in the cabin

parameter leading to a wrong FOB data.



Note: The amber caution F. USED/FOB DISAGREE exists basically on the A340-500/600 and A380. On the A330 and A340-200/300, they have to be activated, provided the aircraft are equipped with the following minimum standards: FCMC 9.0 and FWC K5-5 (A330) or L8-0 (A340). This caution does not replace the SOP check, but may allow an earlier detection of a fuel leak.

Indeed, an unexpected engine fuel flow level may be caused by:

- ➔ A fuel leak, downstream of the Flow Meter, sometimes confirmed by:
  - ➢ Fuel spray visible from the cabin coming from engine or pylon
  - ➢ Fuel smell in the cabin
- ➔ But also a fuel over-burn associated with a failure impacting the aircraft aerodynamics or engine performance with the following possible indications:
  - ➢ Step or steep increase of engine control parameter
  - ➢ Difficulty to maintain ceiling or Mach number
  - ➢ Time or distance increase during step climbs
  - ➢ Aircraft asymmetry along roll or yaw axis visible sometimes only through compensation by control surfaces
  - ➢ Noise, buffet vibrations.

Important note:
A fuel leak downstream of the Flow Meter will not be detected through this check. It will, however, be revealed through an excessive fuel flow on one of the engines.

4 Fuel On Board versus available fuel

The three checks described above all assume that the FOB is available to fly the aircraft. This may not always be the case as some fuel may be trapped or transferring too slowly due to an anomaly in the transfer sequence such as:

- ➔ Non operating transfer device (blocked or clogged transfer valve etc…)
- ➔ Ruptured or cracked transfer line in a fuel tank.

These situations may be detected through:

- ➔ A faulty equipment message on the Fuel page of the System Display
- ➔ A developing fuel imbalance when one of the wing tanks is affected
- ➔ A deviation in the fuel transfer sequence.

5 Conclusion

The FOB, Fuel prediction and FOB/FU checks in cruise provide powerful means for detecting an abnormal fuel situation. These checks, included in the cruise phase SOPs, should be adhered to without exceeding the indicated interval of 30 minutes.

These checks should be performed as well after detection of an abnormal fuel status. They will allow, after the corrective measures have been taken, to ensure that the procedures applied have reached the expected results.

It is also important to bear in mind that:

- ➔ FMS EFOB predictions do not take into account non-nominal aircraft conditions (except engine failures once confirmed in the FMS) and have to be corrected to take into account the consequences of excessive fuel consumption or fuel leaks.
- ➔ FOB/FU checks will not detect fuel leaks or excessive fuel burn downstream of the Flow Meter and should therefore be complemented by engine fuel flow checks.

With the rising price of fuel, there is a high chance for extra fuel reserves to be more and more challenged: in this evolving context, it is certainly worth developing crew awareness in terms of fuel monitoring to maintain a high level of safety in aircraft operation.

Courtesy Airbus Safety First

In-flight Depressurization

Crew Conducts Emergency Descent

Soon after departing from Dublin, Ireland, at 1241 local time on Aug. 18,2005, for a flight to Shannon International Airport, the flight crew observed an "ENG I BLEED LOW TEMP" warning on the electronic centralized aircraft monitor (ECAM). "The ECAM actions were carried out, but the indication remained," said the report by the Irish Air Accident Investigation Unit (AAIU).

As the aircraft climbed through 10,000 ft, the captain noticed that cabin altitude was an unusually high 4,900 ft. He decided to continue the flight at 10,000 ft rather than climb to 16,000 ft, as planned. The aircraft was landed without further incident at 1317.

A postflight report (PER) generated by the aircraft maintenance computer indicated a no. I engine bleed problem and a cross-bleed problem. "There was no reference on the PER to a pressurization problem," the AAIU report said. A test of the bleed management computer for the no. I engine revealed a fault that subsequently had been cleared. Nevertheless, the bleed management computer was replaced.

After the engine bleed, cross-bleed and pressurization systems were checked by engineers, the aircraft was released for service. "The engine bleed and pressurization systems were again checked by the flight crew, and all indications were normal, with the aircraft pressurizing normally," the report said.

The aircraft then departed from Shannon, at an unspecified time, with 237 occupants for a scheduled flight to New York. While climbing to cruise altitude, the crew observed cabin altitude increasing through 7,500 ft and reduced the rate of climb. As the aircraft was being leveled at Flight Level (FL) 350 (approximately 35,000 ft) over the Atlantic Ocean, cabin altitude increased through 8,500 ft. The crew changed the pressurization mode from automatic to manual but were unable to control cabin altitude. At about 1515, they requested and received clearance from air traffic control (ATC) to descend and return to Shannon.

Cabin pressure then increased to nearly 10,000 ft, and an ECAM warning was generated. The crew donned their oxygen masks, declared PAN and conducted an emergency descent to 10,000 ft. "On completion of the checklists, the flight crew conducted a full [analysis] of the situation and, having considered all options, including burning off fuel, etc., decided to prepare for an overweight landing at Shannon and to land as soon as possible," the report said.

The crew requested and received vectors from ATC for a long final approach to Runway 24, and landed the aircraft uneventfully at 1623. "Neither the passengers nor the crew reported any ill effects," the report said.

Engineers visually inspected the cabin pressure outflow valve and found no abnormalities. Then they inspected the aft cargo door seal, which has been replaced two days before the incident flight by the airline's maintenance contractor in Dublin. The report said they found that the door seal had been installed "inside out and upside down," preventing inflation of the seal by pressurized air in the cargo hold. Pressurized air normally enters through 2-mm (0.1-in) holes in one side of the seal; because of the incorrect installation of the seal in the incident aircraft, the holes faced the outside of the aircraft. This resulted in a pressurization leak through the unsealed cargo door.

On Health

IT TAKES ONLY 20 SECONDS TO STAY HEALTHY

Your best defense against germs that cause colds, flu, and other illnesses is to wash your hands several times throughout the day.
That includes:

- Before and after eating
- Before and after handling food, especially raw meat and fish
- After shaking hands with someone
- After caring for someone who is ill
- After sneezing, coughing, or blowing your nose
- After changing a diaper
- After folding laundry
- After petting or playing with an animal
- After changing a litter box
- After working or playing outdoors

Use hot water and soap, and scrub briskly for at least 20 seconds, or about the time it takes to sing "Happy Birthday."

WHITTLE YOUR MIDDLE

Cutting down on the size of your middle can reduce your risk of heart disease. In a study of nearly 45,000 women published in The Journal of the American Medical Association, it was found that persons whose waist-to-hip ration (waist circumference in inches divided by hip circumference) was 0.88 were at more than three times the risk for heart disease compared to women whose waist-to-hip ration was less than 0.72.

AMERICAN DIET

Are we eating better than we used to? Here is a comparison of present day eating habits with those of 1970 for various food types:

- Sugar (lb/yr): up from 120 to 155
- Beef (lb/yr): down from 80 to 64
- Chicken (lb/yr): up from 28 to 52
- Fish (lb/yr): up from 12 to 15
- Soda (gal/yr): up from 25 to 57
- Bottled water (gal/yr): up from 0 to 13
- Coffee (gal/yr): down 28 to 24
- Fruit juice (gal/yr): up from 6 to 9
- Eggs (per person): down from 310 to 247
- Oats (lbs/yr): up from 5 to 7
- Vegetables (lbs/yr): up from 90 to 135
- Fresh fruits (lbs/yr): up from 90 to 134
- Total fats (lbs/yr): up from 53 to 66
- Whole milk (gal/yr): down from 25 to 8
- Skim milk (gal/yr): up from 1 to 4
- Cheese (lbs/yr): up from 12 to 28

HEART ATTACK FIRST-AID

If you believe you are having a heart attack, chew and swallow one adult aspirin tablet (325 milligrams) immediately while you seek medical help. If you only have baby aspirins (82 mg) chew four of them.

GALLOWAY ON TRAINING

Jeff Galloway, former Olympic distance runner and author, lists the "10 things runners do to mess up their races and workouts."

1. Opening your stride. He suggests picking up your speed by shorting your stride and staying light on your feet.
2. Not resting enough. Go easy for a day or so after a long or hard run.
3. Resting too much. Even after a marathon, don't stop running. Just take it easy for several weeks.
4. Overdressing. You should feel slightly chilled when you start running on a cool day.
5. Not having a goal. Even a small goal will prompt you to run on days you'd rather not.
6. Aiming too high. Choose a goal within your reach.
7. Going solo. Having friends to share your race experience will make it even better.
8. Eating too much or not enough. Eat a little before a long race to keep blood sugar from crashing; don't eat so much that you become sick. Galloway recommends 250 calories an hour or so before you run.
9. Starting too fast. Start out 10 to 20 seconds per mile slower than your goal pace. Then pick up the pace by running 20 to 30 seconds per mile faster during the last miles of the race.

10. Telling yourself you can't. "When you're tired or stressed," says Galloway, "'can't' is an easy word to say. Say instead, 'I can.'"

KEEP ON TALKIN'

Off the hook: A new Danish study is the latest to find no link between cell phones and cancer. It looked at 420,000 people who used cell phones for 7 to 21 years and found no extra cases of brain, eye, or salivary gland tumors or leukemia among them, compared to the general population.

CANCER-INTERVENTION DIET

Moderate reductions in dietary fat intake do not significantly reduce a person's risk of breast, colon and prostate cancer say researchers with the Centers for Disease Control (CDC) in Atlanta.

Our willingness to pass up an occasional greasy hamburger or a second helping of ice cream just isn't getting the job done, says Dr. Tim Byers, who headed the CDC's study of diet and cancer trends in more than 13,000 persons over a 17-year period. "We did not see any big effect from the small dietary changes that are under way in this country," he says.

What cancer prevention experts are calling for is a far more purposeful diet. In fact, a "cancer-intervention" diet is now being tested by the National Cancer Institute (NCI). Specifically, here is what it includes:

- Five to eight servings a day of fruits and vegetables.
- Approximately 35 grams a day of dietary fiber.
- No more than 20 percent of total calories a day from fat (the equivalent of the fat in a 6-ounce pork chop*.)

In particular, the NCI study hopes to learn whether these dietary modifications can reduce the occurrence of precancerous polyps in the colon.

** Assuming an individual consumes 2000 calories a day.*

STROKE CLUES

Immediate medical attention is the best treatment for stroke, the number three cause of death in the United States.

Most often, strokes occur in persons over the age of 65. The symptoms, often slight, may be ignored or assumed to be part of growing old. But missing the clues could prove fatal.

The American Heart Association lists the following warning signs of stroke:

- Sudden weakness or numbness of the face, arm and leg on one side of the body.
- Loss of speech, or trouble talking or understanding speech.
- Dimness or loss of vision, particularly on only one eye.
- Unexplained dizziness, unsteadiness or sudden falls.

Even if these symptoms are only temporary – lasting a few minutes or a few hours – they could be a transient ischemic attack (TIA) or "little stroke." Proper medical attention may help prevent a major stroke.

Courtesy Aviation Medical Bulletin

... continued from page 14

'Company Resistance'

In its final report on another runway excursion accident in which fatigue was cited as a (actor, the NTSB reviewed 5,200 reports by air carrier pilots involving fatigue-related events. The reports, filed with the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS) from 1996 to 2006, included discussions of 30 incidents in which pilots called in sick or fatigued."

The outcomes of those calls varied. "Some of the air carrier pilots reported using such programs successfully, whereas other pilots reported that they hesitated to use such programs because of fear of retribution" the NTSB report said. "In addition, other pilots reported that they attempted to call in as fatigued but encountered company resistance."

The report cited as an example a February 2006 ASRS report in which a regional jet captain said that, after three consecutive early-report times, she and her first officer were "sort of robotic and tired." The first officer added, "I even called scheduling and spoke to a supervisor (twice), asking him to take me oft the rest of the trip because I was so exhausted. He tried to work that out but said we were short-staffed. ...I told him that I wouldn't call in fatigued be-cause they didn't have the staffing."

Courtesy FSF Aero Safety World Magazine