National Defence / Défense nationale

SPRING 1998

Flight Comment

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Canada

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Victoria Cross

"Whilst flying with his Observer, Lt A.W. Hammond, M.C., – attacking hostile formations by bombs and machine gun fire, he was assailed at a height of 5,000 feet by eight enemy triplanes which dived at him from all directions, firing from their front guns. By skilful manoeuvring he enabled his observer to fire bursts at each machine in turn, shooting three of them down out of control. By this time Lt McLeod had received five wounds, and whilst continuing the engagement a bullet penetrated his petrol tank and set the machine afire. He then climbed out on to the left bottom plane, controlling his machine from the side of the fuselage, and by side-slipping steeply kept the flames to one side, thus enabling the observer to continue firing until the ground was reached.

The observer had been wounded six times when the machine crashed in "No Man's Land" and 2nd Lieutenant McLeod, notwithstanding his own wounds, dragged him away from the burning wreckage at great personal risk from heavy machine-gun fire from the enemy's lines. This very gallant pilot was again wounded by a bomb whilst engaged in this act of rescue, but he persevered until he had placed Lt Hammond in comparative safety, before falling himself from exhaustion and lack of blood." ◆

On the Cover:

Armstrong Whitworth F.K.8 B5773 of No.2 Squadron Royal Flying Corps in which Second Lieutenant A.A. McLeod won the Victoria Cross. His citation is printed above.

Painting by Mr. Roy Ahopelto

F.K.8

Dimensions: Span 43 ft 6 in; length 31 ft 5 in; height 10 ft 11 in.

Engine: 160 hp Beardmore

Max weight: 2,811 lb

Empty weight: 1,916 lb

Max speed Sea level: 95 mph 8,000 ft: 88 mph

Climb to 6,500 ft: 15.4 min 8,000 ft: 20 min 10,000 ft: 27.8 min

Service ceiling: 13,000 ft

Fuel capacity: 50 Imp gal

Endurance: 3 hr

Defensive armament
Forward-firing, synchronized Vickers machine-gun
Scarff mounted Lewis machine-gun

Flight Comment

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From the Editor

This quarter's theme is investigation, albeit with an emphasis on prevention. You'll find a useful flight safety message at the end of the lead article and proper witness interviewing techniques discussed in the second major article. Witness interviewing is conducted in all investigations into incidents or accidents. Good interviewing techniques are learned through study and practice – shooting from the hip will not suffice. A good interview should give the impression of (please excuse the oxymoron) structured spontaneity.

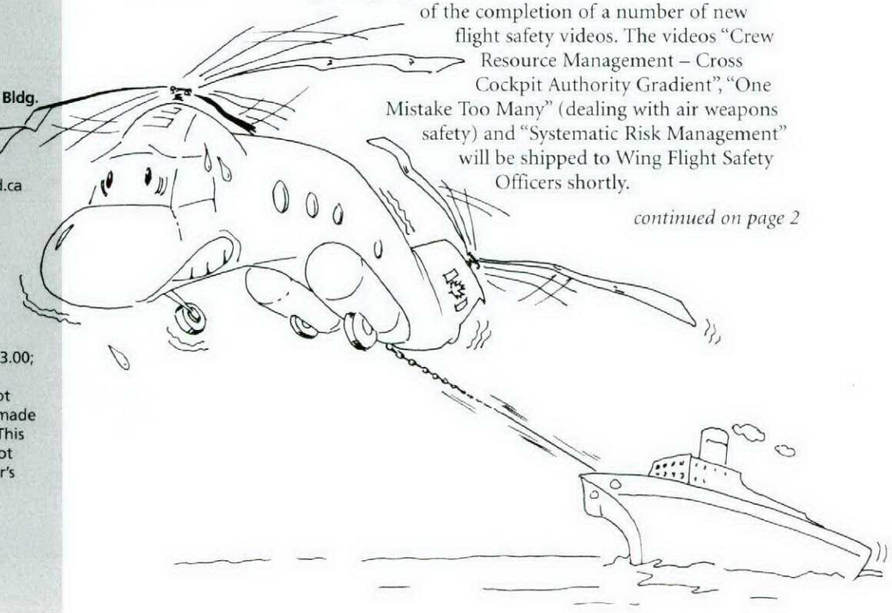
There is no doubt that most people find the subject of aircraft accident investigation a fascinating one. The best aviation minds, supported by budgets with very deep pockets, try to piece together a giant aluminum jigsaw puzzle while looking for that one vital piece of evidence that will solve the mystery. There is something intriguing about the whole process. However, there are two major drawbacks associated with an investigation. Firstly – an investigation is, by its very nature, TOO LATE. Secondly – we all intuitively know that for every accident there are a score of "but for the grace of God there go I" occurrences. So why do we devote so much time and resources to accident investigation?

Accidents attract attention and accidents are a measurable quantity. The success of our prevention program is expressed by our accident rate. Regrettably we measure success in negative terms i.e. what didn't happen. I acknowledge that it is impossible to state with certainty that the flight safety program has prevented x number of accidents in the last year, but clearly it has prevented some accidents. Who or what is the flight safety program?

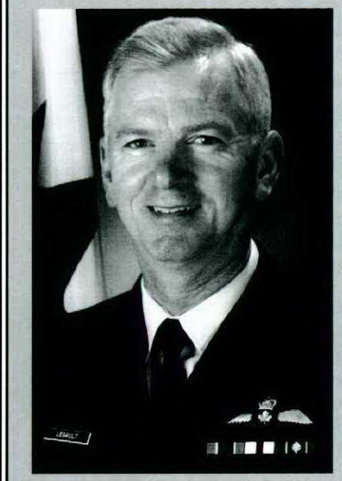
It's you. All those associated with flying operations, including flight safety officers and NCM's, with the really hard jobs at the Wing and unit level. **You** are doing the great work! But please don't relax and rest on your laurels – prevention is a dynamic and full time job. We need you to keep the investigators at bay.

Speaking of prevention DFS has received notification of the completion of a number of new flight safety videos. The videos "Crew Resource Management – Cross Cockpit Authority Gradient", "One Mistake Too Many" (dealing with air weapons safety) and "Systematic Risk Management" will be shipped to Wing Flight Safety Officers shortly.

continued on page 2



As I see it!



This is week five for me. It feels like I just jumped on board an aircraft already at cruising speed. I have yet to set up my "I love me wall" or rather my memory wall of a couple of KIOWA and GRIFFON pictures.

It is a good time to be joining the Flight Safety (FS) team. The dust is settling after the re-org and the recent moves of DFS in Ottawa and SSO FS at 1 CAD in Winnipeg. Another reason is that the Canadian Forces have had their safest year ever in their history: 3 accidents (of which only one was a write off) and no fatalities for a rate of 0.176, a reduction of 310 % on the 3-year average. Well done to you for this remarkable effort from the air force team and from those who support us. What next – do we simply touch wood and hope for the best over the current year or do we diligently set to work from our successes and learn even better lessons from our mishaps?

We are all in the business of preventing losses. The aim of the FS staff here is to manage an FS programme consistent with the maintenance of combat capability to prevent the unplanned loss of operational assets.

The number one priority for your FS personnel is to provide you, the decision-maker, whatever your level in the food chain, with safety advice to enable you to manage best your risks. The concentration of effort will therefore be aimed at identifying hazards and assessing risks before occurrences happen. This activity will be supported by an active safe behaviour programme that will be based on training, briefings, awards and promotion. This, I believe, is the key to bettering the 1997 statistics in 1998.

I see (I've had my vision) FS staff as a pro-active team of leaders whose FS advice is sought after by decision-makers for timely and judicious decision-making.

FS staff will provide timely and reliable advice to the chain of command, using the latest techniques and methods to locate and define management system weaknesses that caused or are likely to cause losses. They will achieve results, as experts in their field, by obtaining acceptance for their suggestions voluntarily from line supervisors without formerly taking the chain of command route. As a last resort, they will make recommendations to individuals in the chain of command, the decision-makers, who in turn will issue formal direction to action safety measures.

A discerning approach and the desire for continuous improvement will underscore FS initiatives. Open and frank communications will foster mutual understanding necessary for achieving our aims at lesser costs.

With a fully implemented risk management culture, a state-of-the-art information management tool and a highly visible team of FS specialists throughout the air force, we will achieve our FS vision. ◆

Glad to be aboard! Think Safe!

Colonel M. Legault DFS

From the Editor *continued from page 1*

One last thought on the subject of prevention. Ever tow a boat with a helicopter? When I was on my Labrador OTU I remember asking the instructor what the inclinometer that was mounted on the longitudinal axis of the aircraft was used for? He replied that it was used to set the correct aircraft attitude when towing a ship with the helicopter. I asked him when would we practice the procedure. The instructor said we were no longer in the ship towing business because someone had asked two questions. The first question was "where does the cable go if it breaks"? The second question was "what would happen to the helicopter if you lost an engine while engaged in a towing operation"? The answer to the first question was obvious and I must admit I chuckled and thought of the Coyote and Roadrunner as I answered the second question.

"When you lose your engine your flight path describes an arc as the tension on the line pulls your helicopter, probably beak first, into the water like a ten ton yellow lawn dart; and then the boat runs over what is left of you".

My instructor asked me what was the lesson to be learned from all this. Aside from the obvious one – don't tow ships – I was unsure of what he meant. He said never to be afraid to ask "why" and "what if". Although everyone had their hearts in the right place when they thought up the ship towing procedure nobody stopped to ask "why" and "what if". Think about that the next time someone asks you to do something a bit out of the ordinary. ◆

Drama In Real Life

Having just received our clearance from ATC we began descent out of Flight Level 200 for 7000 feet in the turn to a heading of 070. The weather that day required an IFR approach to landing with thick stratus layers up to 19,000 feet. My partner and I were relaxed and in good spirits having just put the Tutor through an hour of rigorous aerobatics and cloud chasing, or snowmobiling as we liked to call it. So relaxed in fact we completely forgot to carry out the Pre-Descent Check. But radar vectors to an ILS was the easy way home and beer call was on our minds.

As we descended into the murkiness of the thick cloud we made the transition to instrument flying and my partner at the controls began the task of flying the dials all the way home. The only problem was those dials just didn't look quite right. I could feel it in the seat of my pants that something didn't jive. At the same time the silence in the cockpit was broken as ATC inquired "Hotel 99 confirm heading 070?".

Almost simultaneously I came to the sickening realization that we had toppled our gyros and were flying off erroneous information. To make matters worse it appeared my partner was having trouble fighting the vertigo and was starting to pull us into a spiral dive. "I have control" I shouted and immediately leveled the aircraft using the partial panel procedures that we had practiced so often in training. Finally it seemed we had things under control and with my ego and my ticket to protect I immediately hit the transmit button and as calmly as possible said "Hotel 99 would like the no-compass PAR if it's not too much trouble".

We carried on and landed without further incident. Our complacency didn't get us this time but it taught us a very valuable lesson: CHECKS AND CHECKLISTS ARE THERE FOR A REASON - DON'T FORGET TO USE THEM! ◆

by Capt Chris Wright

Aircraft Mishap Witness Interviewing

In 1990 there were 64 class "A," 17 class "B," and 176 class "C" mishaps and 2178 hazard reports that were investigated by Navy and Marine Corps commands. In almost every case, at least one person saw the incident take place or events leading up to it. The investigating officers later interviewed those witnesses to find out what happened. When you consider how many interviews are conducted every year, it becomes obvious that we need to know how to get the most out of witnesses and be aware of the shortcomings in witness interviews. Currently, Flight surgeons are our only source of trained interviewers; other potential members of aircraft mishap boards (AMBs) also need to be informed of proper techniques.

The Nature of Memory

According to Elizabeth F. Loftus, a psychologist at the University of Washington, recollections not only fade with time but also become increasingly susceptible to alteration by subsequent information or subtle cues, including questions posed by investigators. In recalling a complex event, such as a crime or an accident, witnesses can often make serious mistakes, substituting one item for another, confusing which side they saw something happen on, mistaking colors, and even placing non-existent items at the scene, even something as conspicuous as a barn. Such distortions can cause a ripple effect leading to wholesale contamination of the original memory, which may make recalling what really occurred impossible.

Psychologist Martin Safer of the Catholic University of America in Washington has shown that eyewitnesses can recall significantly more details when questioned several times within the first 48 hours of a crime (mishap) instead of in just one sitting. He said findings challenge the assumption that witnesses can recall all (of the events) the first time around. This emphasizes two critical elements in witness interviewing: (1) get a statement immediately after the mishap and (2) have the witness repeat their statement, preferably three times (see "Talk, talk, listen, talk" in the "WITNESS INTERVIEWING – THE COOKBOOK APPROACH" section).

OK, so what is the purpose of this mini-psychology lesson? Simply this, to make you as a potential interviewer aware of the following: (1) that your key witness may or may not be able to tell you exactly what happened; (2) that the same witness may give a different story when questioned in subsequent interviews; (3) do not be surprised if different witnesses come up with different versions of the same event; (4) and given the above, your witness is not necessarily lying or trying to hide something.

Memory Enhancing Techniques

In 1984 psychologists Gieselman, Fisher and Holland developed an interview procedure called "The Cognitive Interview." (1, 2) This was a set of instructions designed to (1) encourage the witness to reinstate to context of the original event, and (2) to search through the memory, by using a variety of retrieval routes. The intention is to make the witness more aware of the circumstances surrounding the event to facilitate a more accurate recollection. Four basic principles include: (1) event-interview similarity; (2) focussed retrieval; (3) extensive retrieval and (4) witness-compatible questioning.

1. Event-interview similarity. A witness's recall of a mishap is enhanced when the psychological environment of the interview is similar to the environment of the original event.

2. Focussed retrieval. A key role of the interviewer is to help the witness maintain concentration. The most common "DON'T" is to interrupt a witness while they are narrating the event. It is imperative NOT to interrupt, but to let the witness continue unimpeded. The interviewer must encourage the witness to make the extra effort to think about the events (see "NON-AIRCREW WITNESSES.")

3. Extensive retrieval. The more attempts at a narrative recollection a witness gives, the more they will recall. Occasionally, the witness will want to stop after the first, unsuccessful attempt. Again, the interviewer must continue to encourage the witness to keep trying.

4. Witness-compatible questioning. Just as we are all different, we store events in our memory differently. Each person has their own key to unlock their memory. The effective interviewer tries to tailor their questions for each witness. This can be accomplish in a variety of ways, including using their vocabulary (even if technically incorrect, as long as you understand what they mean). For example, a witness says, 'I saw this jet come over those trees when the big propeller came off and it crashed into that field." Translated that really means "I saw this helicopter come over those trees when the main rotor blade impacted the fuselage, broke apart, and it crashed into that field." Trying to correct a witness is fruitless because not only will you probably confuse the witness, but also possibly intimidate them from making any further statement for fear of appearing foolish.

In addition to the general memory retrieval principles mentioned, this procedure includes other memory retrieval aids. If you can get a partial response, e.g., sight, sound, or location, then ask additional specific questions. Again, this interplay with the witness should only occur after they have been afforded the opportunity to give their narrative unimpeded.

Witness Interviewing – The Cookbook Approach

Now that you recognize the problems in witness interviews, and ways to improve witness recall, here are several techniques, DO's and DON'Ts, to improve the chances of getting the real story from your witnesses.

The Initial Interview (Mishap Aircrew)

First, wait until any necessary medical attention is administered before you begin your interview. The health and safety of the aircrew is more important than getting a statement. For reasons that should be obvious, this must be a one-on-one interview. Forcing a witness to appear before a board of officers may not sound intimidating until you put yourself in the interrogee's spot and begin to second guess your actions. It takes away from the friendly, reassuring words, "Nothing you say to me can be used against you in a court of law." The concept of privilege is enhanced by the established reputation of confidentiality our Flight Surgeons have. Additionally, Flight Surgeons (just as all doctors learn how to pry the symptoms from uncooperative patients) are taught how to interview aircrew in a post-mishap.

Unfortunately, not all mishaps occur where a Flight Surgeon is readily available that is the point of informing all potential AMB members on the proper interview procedures. Assure you have an operable tape recorder and plenty of tape. Find a private place, and take the phone off the hook or disconnect it. You do not want any interruptions during the witness's narrative. Inform the witness of the concept of privilege, and that you want to tape their statement. Let them see the tape recorder. Again, you want to ensure the witness there is nothing secretive about your investigation. Ask the witness to start describing everything they can remember from the moment they first came to work until they arrived at the hospital, clinic, Sheriff's office, etc.

Talk, Talk, Listen, Talk.

"Talk." Have the witness narrate the entire sequence uninterrupted. (Note: you may choose to remain in the room or leave them alone, whichever you feel the witness will be more comfortable with. Sometimes, the witness will feel pressured if you are looking over their shoulder," but this is not always the case.)

"Talk." Explain to the witness that you would like for them to repeat the entire sequence again, if they thought of something else they wanted to add. Maybe they are concerned that they might not say the same things, ensure them that it is normal to get some events out of order, or remember them differently each time they think about it, and that you (both you and the witness) will review it again to resolve any differences.

"Listen." Sit with the witness and listen to both sequences. If you were not present during the original taping, take notes on any specifics you are interested in that were not covered (if you are present, take notes while the witness is giving their narrative).

"Talk." Ask the witness to complete any details they might have remembered while they listened to their own statements. Then, and only then may you ask your questions.

Thank your witness for their assistance and let them know that you may want to ask them some additional questions later.

Simulator Technique

This technique is used to realistically recreate the events that lead to the mishap that will help in determining aircrew response including potential maintenance and material problems. This technique has proved very beneficial in previous mishap investigations.

Set up the simulator to recreate the environment where the mishap occurred (airfield, ship, etc.). A visually aided simulator is best, but not a requirement. Let the aircrew fly the event as they remember in real time. Your function is to observe their actions and take notes on how they interact as a crew (if applicable) and note when or where they say things started happening. During the second run, freeze the simulator when the aircrew wants to explain what was going on, describe their thought processes, etc. Next, refly the event real-time injecting the failures at the proper time as described by the aircrew. Make additional runs as necessary to complete details or answer any questions the AMB may have.

For those aircraft types that do not have simulators, conduct a talk-through while sitting in an aircraft.

Non-aircrew Witnesses

Revisit the scene – reinstate in the witness's mind the external features of the mishap, weather, time of day, place (go back to the scene if possible), emotions, relevant thoughts that were experienced at the time of the mishap. For example, a witness saw the aircraft come over the top of that (pointing to a specific building), go behind that tree, and crash into that lake. By putting the witness exactly where they were at the time of the mishap; you can even

continued on page 6

Aircraft Mishap Witness Interviewing *continued from page 5*

calculate the elevation (see TECHNICAL MANUAL SAFETY INVESTIGATION VOLUME II, INVESTIGATIVE TECHNIQUES figures 1-8,1-9, p.1-7), flight path and when or where an ejection (or other significant event) occurred.

Take a scale model of the aircraft involved in the mishap for your witness to work with. A picture is better than only a verbal description, but a non-aviation type witness can grasp what happened better with a scale model. Encourage them to "fly" the model exactly as they remember seeing the mishap aircraft. By having them show you with the model what they saw, you will be able to determine the aircraft attitude and angle of bank and get a better description of what might have fallen from the aircraft, explosions, ejections, fire, etc., prior to ground or water impact.

As stated earlier, use the language of the witness. Remember, you are the expert on your aircraft, it is much easier for you to interpret what they are referring to than to attempt to train them in proper aircraft nomenclature. Again, here is where a scale model of an aircraft is well-worth the money and effort it will take to make one. Additionally, using the language of the witness means speaking at their level, i.e., talk to an engineer at a level commensurate with his professional training, and to a back-woodsman in his vernacular. Be cautious not to talk down, or in a demeaning fashion to the witness. The intent is to communicate with them vice merely transmit and receive words.

Aircraft Mishap Board Interviews

Now that you have gathered all the information individually from your witnesses, using the techniques above, you may still desire to have a group questioning session. The most significant advantage is the synergistic effect of the board members in listening to the witness's narrative account and response to questions, which can lead to a line of thought not previously explored. The major disadvantage is the potential uneasiness of the witness in feeling he is under a punitive board of inquiry, and intentionally (or unintentionally) withholding information. No matter how carefully a board treats the witness, he may start to withdraw or get defensive. It is the Senior member's responsibility to watch for signs of uneasiness and curtail the interview if this occurs. Continuing under these circumstances will prove counter productive. Even if you can elicit a response, its validity should be suspect. Indeed, some boards have chased false leads based on forced witness statements that resulted in wasted effort and did not help solve what caused the mishap.

The Rare Exception

All the above notwithstanding, there are certain, rare instances when intimidation of the witness is desired to bring out the truth. This should be a decision made by the Senior member, and only after trying every other method of recall. If they prove unsuccessful, and it is obvious the witness is lying or intentionally withholding information then use this method. The impact of appearing before a formal beard in dress uniform may be enough to snap a recalcitrant witness back into line. However, even this technique has failed when for any number of reasons, the witness is unwilling to admit the truth, or has so convinced himself of some false set of events that the truth is lost.

There is a lot that we as investigators and potential members of an Aircraft Mishap Board can do to improve our interviewing techniques and thereby increase the amount of correct information gained.

The single-most important item to remember is not to interrupt. Use this article as a reference if you ever need to conduct a mishap or incident interview.

Special recognition is due to Professor Chaytor D. Mason, University of Southern California, upon whose work this article is based.

(1) JOURNAL OF APPLIED PSYCHOLOGY, Oct 1989, V74, #5, 722-727. Field Test of the Cognitive Interview: Enhancing the Recollection of Actual Victims and Witnesses of Crime. Fisher. Gieselman & Amador.

(2) JOURNAL OF APPLIED PSYCHOLOGY, Feb 1985, V70, #2, 401-413. Eyewitness Memory Enhancement in the Police Interview: Cognitive Retrieval Mnemonics Vs Hypnosis. Gieselman, Fisher, Mackinnon & Holland.

LCDR David Thorn teaches Aircraft Mishap Investigation at the Aviation Safety Programs of the Naval Postgraduate School, Monterey California. In July 1990, he became an Aircraft Mishap Investigator at the Naval Safety Center. In addition to being a graduate of the Naval Aviation Safety Officer course, his professional training included: courses from the U. S. Air Force in Aircraft Mishap Investigation and Jet Engine Mishap Investigation; and courses from the Federal Aviation Administration in Rotorcraft Safety and Accident Investigation, and Accident Investigation Recurrent Training. He reported for duty as an instructor at Aviation Safety Programs in September 1991.

Lieutenant Commander Thorn has accumulated over 2000 hours in tactical jet and multi-engine aircraft. He is member MO3359 of the International Society for Air Safety Investigators and has been the investigator in charge of eight mishaps of both fixed and rotary wing aircraft. He has published several mishap investigation articles in APPROACH, ISASI FORUM, and MECH magazines. ◆

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Aviation Safety Programs
Naval Postgraduate School
Monterey. California
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Start the Clock

It was the summer of 96, Chicoutimi had just been flooded 2 days before we arrived with our Griffon that Monday morning. This first day proved to be repetitious with our mission being to evacuate citizens from Grande Baie to Bagotville. These 2 points being only a few miles apart, we only had a few seconds between the pre-take-off check, the level-off check and the pre-landing check to glance at the damage the water had caused.

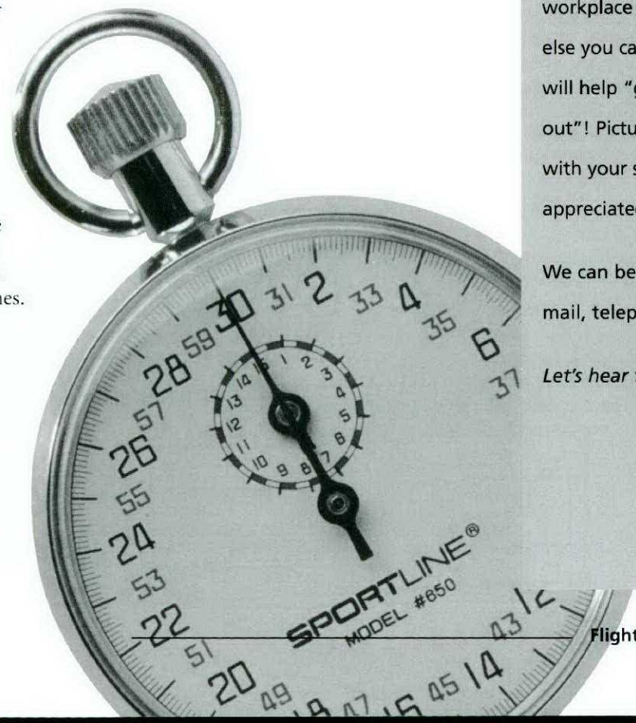
On the second day, our mission had not changed, but something happened and disturbed our routine. On final for Bagotville, with about 10 passengers, the ***Engine Chip*** light came on. Since I was flying, I was looking outside and did not notice the light until the aircraft captain said ***"We have a chip light".*** By the time the flight engineer and I realized what was going on, half the caution panel was lit. The aircraft captain had decided to shut down the engine and secure it.

We landed without any further incident, but it was clear that the flight engineer was furious. No crew cooperation, no request for suggestions, and surely no confirmation of fuel switches. To me, a fresh new pilot with barely 350 hrs on a single pilot helicopter, it was not a big deal, although I thought we could have kept the engine running an extra 2 minutes and landed with both engines.

This incident became a big deal to me only a few months later. I was number 2 in a three ship formation when lead called ***"We are slowing down, we have an engine chip light and we will shut down the engine".*** The next thing I saw, lead was all over my windshield as he turned 90 degrees to the right and he was going down. The aircraft captain, after rolling off the throttle of the affected engine, had shut the fuel valve of the good engine without confirming the switch with his co-pilot or flight engineer. What I saw in my windshield was an autorotating helicopter.

From that day on, the importance of crew cooperation became clearer to me. The crew consists of two qualified pilots and a qualified flight engineer; we should take advantage of those two extra bodies. An old pilot once told me that the first thing to do in an emergency... is to start the clock. ◆

By Captain Delisle



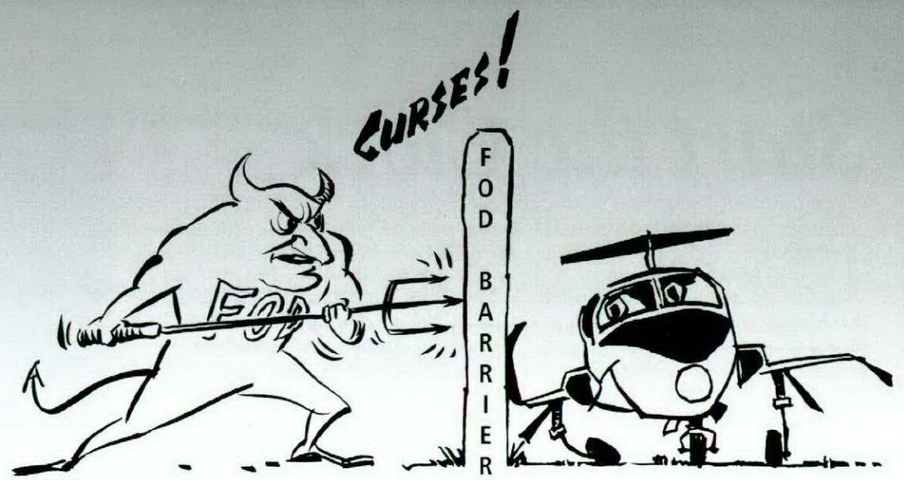
Flight Comment

Flight Comment would like to hear from you !!!

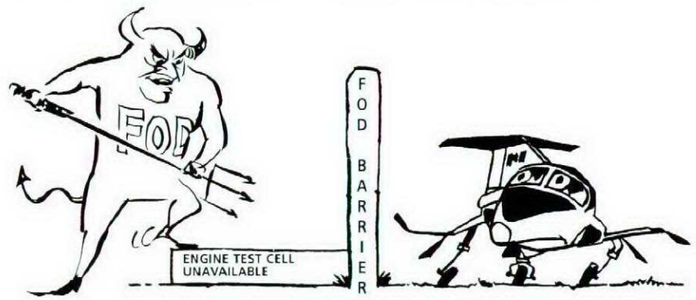
We know there are some great experiences out there waiting to be told, so how about writing them down. How are you accomplishing your job or mission safely? Do you have a "Lessons Learned War Story" that others may benefit from? Any new technological advances or new equipment that makes your job or workplace safer? Anything else you can think of that will help "get the word out"! Pictures and/or slides with your submission are appreciated.

We can be reached by fax, mail, telephone, or E-mail.

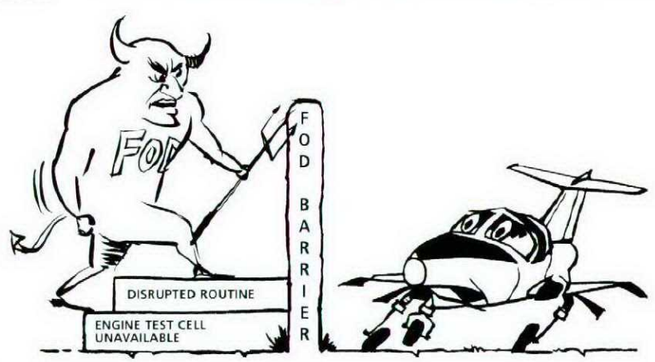
Let's hear from you !!!



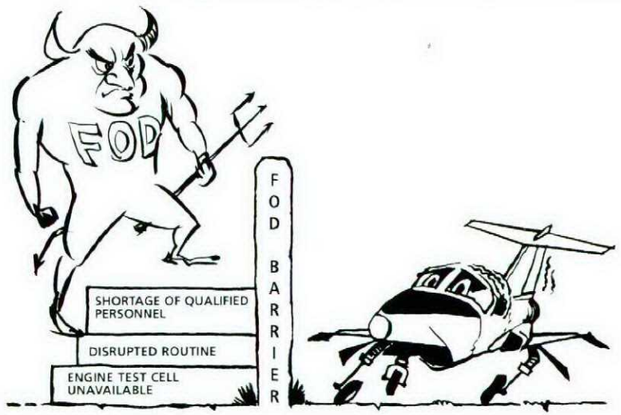
step 1 The engine test cell was temporarily unavailable during renovations, so it was necessary to test-run the engine in an airframe — a stub pipe being used in lieu of the tailpipe and aft section.



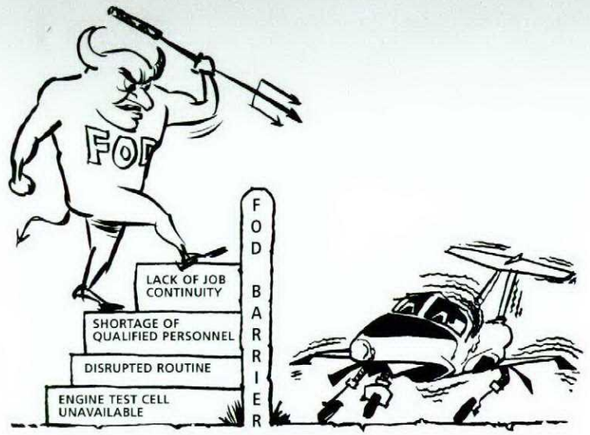
step 2 The hangar floor was being painted, necessitating moving the aircraft, engines, parts and equipment from one side of the hangar to the other — and back again when the floor was finished. Work continued during this shuttling. The engine was installed in an airframe and readied for the run-up.



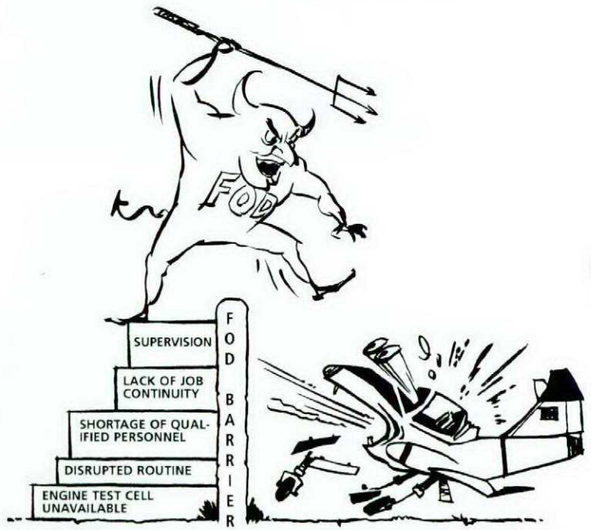
step 3 Sick parade, leave, and a recent rotation of technicians between sections, meant that there were only two technicians on duty qualified to carry out post-inspection engine run-ups.



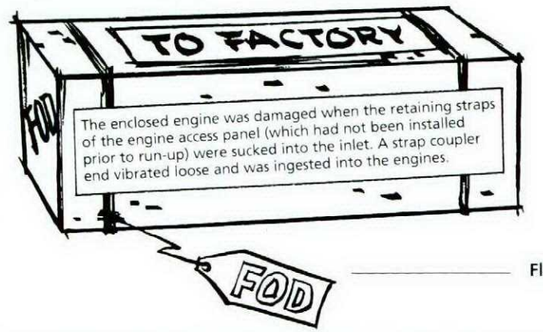
One step, two step...



step 4 These two technicians had to be taken off another job to run up the engine; they were therefore, not previously involved in the inspection of either the engine or the airframe...



step 5 Throughout, supervisors could have exercised increased surveillance of the work considering the potential created by the unusual circumstances.



Aircraft Accident Investigation

Tim Kerss, B747 Classic, British Airways

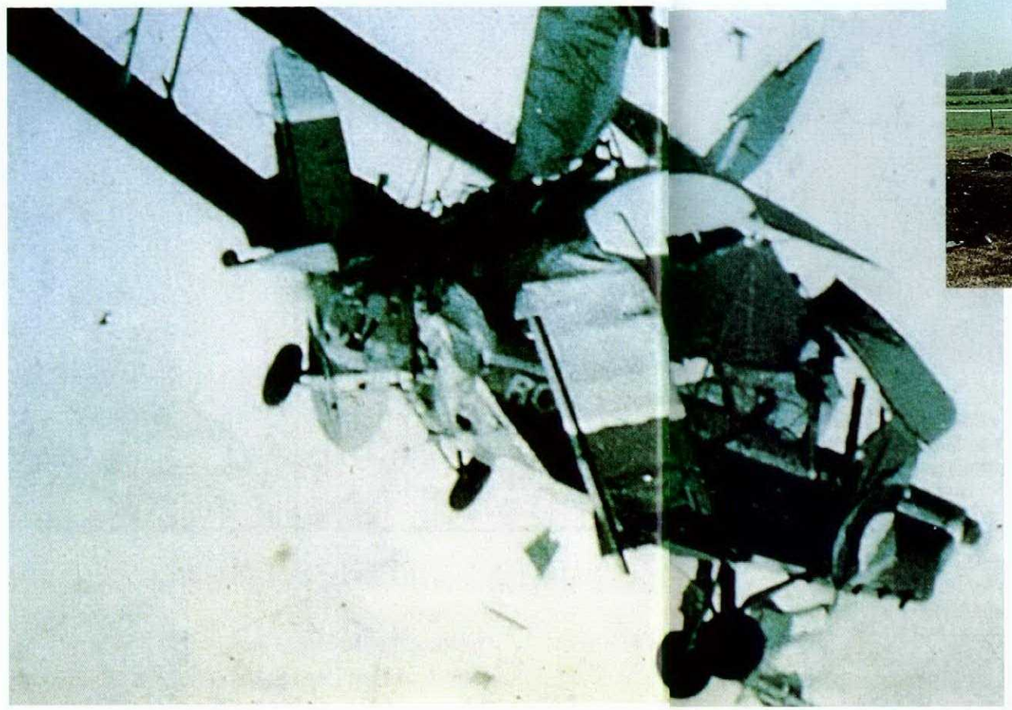
Introduction

Whatever your job in aviation, the greatest nightmare of all comes with the "snap" of the flight safety chain - and an aircraft accident occurs. Usually it is an horrific event that initially attracts a great deal of media coverage. But after many minutes of sensationalism and speculation during the main news cast, a single sentence will invariably state that "an investigation into the cause is underway". Few of us realize the mammoth task that is normally hidden behind those few words, what follows is the painstaking task of piecing together every relevant event that led up to the accident, and it often takes a team of experts many months of deep investigation. Their ultimate aim; to prevent the same event ever happening again.

In 21 years of flying with the RAF I was fortunate enough never to have had an accident, but for a period of two and a half years (between 1988 and 1990) I assisted in the investigation of 25 accidents and serious incidents to military aircraft around the World as the RAF's first Board of Inquiry Adviser. To explain, when the RAF has an accident or serious incident a "Board of Inquiry", alias an investigation team, is convened to determine the cause or causes. The team normally comprises three members; a senior officer (president), a pilot and an engineer all of whom have considerable experience on the type of aircraft involved. Unfortunately being experts in the operation of an aircraft does not make them experts in accident investigation; enter the Board of Inquiry Adviser - ME! My job was to advise the investigation teams on how to proceed and hopefully alleviate the shock of being given a job for which most personnel have no formal training. Prior to taking up my post I did attend a six week course on aircraft accident investigation, and with this behind me, together with ever increasing experience of the procedures involved, I was able to steer the teams along the right procedural tracks. This meant that they used their time efficiently and avoided some of the pitfalls experienced by their predecessors.

During my time in the job I was lucky enough to observe at first-hand members of the Farnborough-based Aircraft Accident Investigations Branch (AAIB) at work and learnt about the procedures involved in bringing clues together to (hopefully) get an accurate picture of what went wrong and why. Whilst the detail of each accident was different, the basic mechanics of the investigation were similar.

The subject of aircraft accident investigation is fascinating, and at the end of my tour I decided to collect my thoughts and experiences on paper, and produced an article entitled "You want me to do what?!" for the RAF "Air Clues" magazine. It was aimed at the poor soul who had just been told



An aircraft accident is a traumatic event. The horror and confusion can prevent clear thinking by those tasked to conduct the investigation.

Eyewitnesses must be interviewed after the event. But who makes the best eyewitness?

Where do you begin???

that **he** had been selected from a cast of thousands to be a member of an accident investigation team. What follows is a slightly revamped version of that article. The vast majority of you will, thankfully, never see or experience an accident at first hand, but I hope that like me you will find it interesting to learn about the procedures involved and of just some of the techniques used by the experts to find the clues within the wreckage.....

.....We all dread it, that call from your boss or the Station Commander - "Do not pass Go, do not collect £200, you, sunshine, are on a Board of Inquiry ..... you convene tomorrow at 8 a.m. on the other side of the country". As if it wasn't bad enough watching next week's fishing holiday disappear down the tubes, not to mention your wedding anniversary, the chances are that you are about to be shown a heap of wreckage surrounded by a lot of panic and confusion - and YOU are supposed to find out what happened and why! Engineers deal with broken aeroplanes, don't they? So why have they given you one that has been spectacularly reduced to kit form?? Where do you begin??? How on earth are you going to find the solution from a mass of twisted metal, especially if the air crew aren't around to tell their story?

Initial Actions

An aircraft accident is a rare but extremely traumatic event, and it's effects can be far-reaching. People who are thrust in charge at the scene are unsure of what decisions are right at the time; reference to books and manuals may be totally impractical in the prevailing circumstances. However, they must be informed that the first priority at the scene of the aircraft accident (after rescue, of course) is to preserve the clues that will fade with time. The crash site must be cordoned-off, and guarded; it is quite amazing what items will be taken away by over-zealous "souvenir hunters". Photographs must be taken from every angle and of as much detail as possible, and eye witnesses traced. Requests put out on local radio and in the press for witnesses to come forward can produce wonders.

Having decided upon a suitable geographical location from which to base the investigation (often initially in the vicinity of the accident site), the team should set up in a quiet room in which they can collate their evidence, conduct interviews and brainstorm! I found that the most valuable piece of equipment at the early stage was a simple magi-board, or blackboard. On it one can PLAN a course of action. I usually divided the board into four sections - a plan/diary of action, a list of witnesses to be seen, a list of specialists to be consulted and finally an area for notes. The beauty of this simple system is that at a glance each member of the team knows what is planned, and when it is scheduled to take place. Also, any changes in the plan can be highlighted in different colours.

So, with the immediate plan of action in mind you can start collecting the evidence that passing time will erode quickest; allocate times to interview key witnesses and visit the site of the accident. In the early stages of an investigation interviews will probably be informal as you try to "soak up" as much information as possible. It is imperative at this stage that you TAKE NOTES. You will be amazed how people's memories can fade over the first few days; when you eventually come to take formal evidence these notes will act as useful memory joggers. Take statements from eye witnesses who saw the aircraft from different angles.
In this way you will get a 3D picture of its final flight path. When spoilt for choice, take formal evidence from about ten eye witnesses. Incidentally, formal interviews always take twice as long as you might imagine, so allow at least an hour for even the simplest interview.

One of your first priorities will be to visit the crash site, for this you should allow at least half a day. On site, take time to absorb the lay-out of the wreckage. It might seem like mayhem at first, but given time you will get a feel for where different parts of the aircraft have come to rest: clusters of instruments, for example, will normally be found within quite a small area. In the initial stages the golden rule is DON'T TOUCH ANYTHING!!! Keep your hands welded in your pockets otherwise they WILL find their way to switches, instruments, sub-scale setting knobs etc., etc ..... and in one fell swoop vital evidence may be destroyed.

Wreckage Investigation

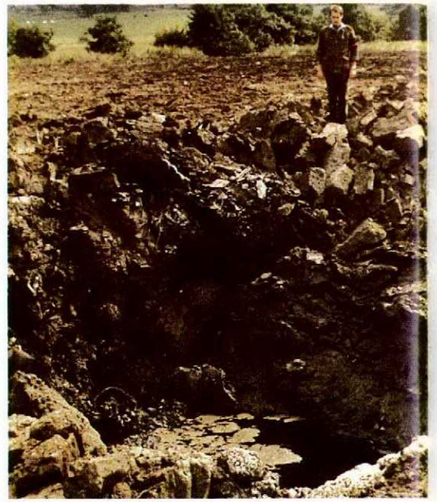
The subject of wreckage investigation is massive, and I don't claim to be an expert - that comes after about ten years of practice! However what follows are a few pointers that I have seen used in the field and may prove useful on your initial walkround.

- As you walk the site you will begin to get a feel for the aircraft's final flight path - the following features may seem obvious but they need to be stated. Firstly, the crater should indicate whether the aircraft was travelling quickly or slowly? The degree of wreckage destruction and forward throw should give a few hints. Whilst an aircraft that has hit the ground at high speed will leave a ragged impact mark with wreckage thrown forward, an aircraft that has stalled, spun, or pancaked into the ground may leave a clearly defined aircraft shaped impact mark with very little forward throw of wreckage.

- Looking round the extremities of the site may be profitable in determining the final flight path. Obviously the direction of the wreckage trail will give impact direction, but what about dive angle and aircraft attitude? A swathe cut in trees can be a gift, not only can this give flight path angle, but also roll angle and, if paint scrapes are present on the trees, it may also be possible to determine which way up the aircraft was as well. However, we are not always so lucky. A line drawn between an impact mark on a nearby structure and the initial crater may provide a solution. Alternatively, measurement of the impact angle may be possible in the earth of the crater itself, although to provide a valid result these measurements must be taken as close as possible to the first point of impact as this is where the aircraft still had most of its momentum: it had not yet decelerated, or been deflected by the ground. Obviously for accuracy, one must take into account the local slope of the ground at the crater and the relative angle to flight path of the piece of aircraft structure that made the mark.

- Impact marks can give important clues and must be well guarded and assessed whilst still fresh. They may reveal few pointers superficially but can contain pieces of wreckage and/or paint flakes. More-over, by mapping them out on a scale diagram, and then matching a model of the same scale, it is often possible to work out the impact attitude and aircraft's subsequent motion over or along the ground. Note that such clues can be lost forever if the crash site is not sealed off properly. Tyre tracks and footprints are some of the accident investigator's worst enemies.

- In trying to determine which way up the aircraft was at impact it is sometimes all to easy to ignore the obvious. Regardless of the confusing ground impact marks, if pieces of wreckage known to have come from the right hand side of the aircraft are strewn to the right of the wreckage trail, then it would be fair to assume that the aircraft was upright. If, however, the degree of destruction is so great that even this is not possible, fragments of nav light glass may dive the same away.



The crater should indicate whether the aircraft was travelling quickly or slowly.

- If airborne break-up is suspected it is important to find the detached piece or pieces: this may involve a painstaking search under the final flightpath. However, if the wreckage is very fragmented the task of reconstruction may be totally impossible and in the absence of other information one may be forced to seek out just the aircraft extremities and thus conclude that the aircraft was whole at the time of impact.

- How much fuel was the aircraft carrying? Most accidents result in a fire; however, when this is not the case and the aircraft structure has been disrupted, fuel will be spilt on the surrounding land, killing grass and plants. The spread of "grass browning" give a direct indication of how much fuel was being carried and may enable you to discount straightforward running out of fuel as a cause.

Fire

Fire is an almost invariable bed fellow of an aircraft accident, and some knowledge of the subject may help you towards your conclusions.

- When the wreckage has burnt the question will be asked, "Did the fire start before or after the aircraft hit the ground?" Here is your chance to put on the detective's deer-stalker. Ground fires tend to be sooty, leaving a blackened structure. The presence of wind blast in the airborne case results in a hotter fire than on the ground and so airborne fires tend to be cleaner and lead to more deformation of the aircraft structure. The greater heat can cause aluminum alloy structures to delaminate and adopt a wire-brush like appearance. Moreover, where molten metal has been exposed to airflow, "streaming" across the aircraft structure may be observed. Another method for determining whether the fire occurred before or after the aircraft crashed is to look at creases that have been formed in the skin. If sooting or discolouration is constant across a crease one can assume that the heating occurred before the crease was made: that is, before the aircraft crashed. Had the fire occurred afterwards one would expect to see variation across the fold due to local shielding effects.

- When metal experiences high temperatures it may discolour or deform structurally. One way to discover what temperature a component has experienced is to take a sample of the structure and heat it in a laboratory to specific known temperatures. When it shows the same degree of discolouration and/or structural deformation the appropriate temperature has been reached.

- As a last thought in this section, never ignore the obvious. The aircraft structure may be burnt to a cinder, but what about the grass surrounding it?

Flying Controls

As an ab-initio investigator, deep investigation of control systems and engines will be out of your hands, however there are a few clues to look for on site.

- What position were the flying controls in when the aircraft hit the ground? With powered flying controls (PFCUs) you may be lucky. The PFCU may freeze on impact or its "ram" may be bent, or at least scored by the PFCU body. Examination of the control surface itself may reveal some answers. If the aircraft is relatively intact, the controls may have jarred forward and contacted the surrounding wing or fin structure. Matching witness marks thus created with the aircraft structure can give an indication of the control's position at impact. In a similar vein, continuity of scratch marks across the control surface and onto its supporting structure can provide us with clues. Moreover, if the control surface impinges on to the fuselage or another surface whose position is known, such as ailerons on to flaps, the two can be married up and the moving control's position determined.

Engines

- Turning to engines, a quick look at the compressor blades of a jet engine may provide a few useful clues. Severely distorted or sheared-off blades indicate that the engine was rotating at high rpm, whilst little deformation will occur to a windmilling or seized engine. Deposits of metal on, or severe damage to, turbine blades may indicate an engine surge. However, do not take everything at face value: an engine under power that has progressively broken up from the front during the impact sequence may also exhibit similar signs to an engine surge. Always seek expert assessment.

Impact marks on the ground can yield not only the aircraft's angle and speed but even the control surface deflection.

- Examine propellers for witness marks to indicate rotation. A propeller that was developing power at impact will probably be severely distorted or even bend forward. A wealth of information may be held in propeller slash marks which, like impact marks, must be protected, photographed and examined at an early stage. The distance between slash marks can reveal:

- If the engine was developing power
- Propeller blade angle
- Engine rpm and power
- Rate and angle of descent
- Ground speed

These facts are derived either by use of mathematical formulae or graphs.

Miscellaneous Information

- Note the position of the Central Warning Panel in the wreckage, it may hold vital evidence. After a hard impact, the filament of a lit bulb can stretch considerably. Analysis of the CWP bulbs can therefore reveal not only what systems had failed at impact, but also, by implication, that the associated electrical bus bars were energised.

- Maps and crew documents should be recovered as soon as possible after the accident before the weather takes its toll. These can quite often reveal information which can never be discovered from other sources.

- Was ejection attempted? Examination of the underside of the canopy may reveal tell-tale plunger marks which indicate that the ejection sequence was initiated, and detailed investigation of the seat by the manufacturers and/or RAF specialists can determine how well it functioned under the circumstances.

- In the case of a midair collision, it may be possible to marry portions of wreckage together on site to find out what hit what. However this should only be attempted once a comprehensive wreckage plot has been made. Witness marks may hold further clues including indications of relative velocity, bank angles and what hit what; the use of models to reconstruct the collision is essential.

- Ask the appropriate ATC centre to scan recordings from different radar heads and contact AWACS Ops to find out if they were monitoring the area at the time of the accident. Radar can give track, height and speed: it may help answer many points about the final flight path.

Wreckage strewn over a long trail indicates an impact at high speed.

Subsequent Investigation

In my time as Board of Inquiry Adviser I have seen all the above techniques employed on accident inquiries. They are just some of many used by the experts, normally to substantiate the facts found in subsequent more detailed investigation.

Once you have looked around the site which is the subject of your investigation you will need to formulate a further plan of action based upon your conclusions. Unless the solution is anything but obvious you should have called in AAIB to assist with detailed wreckage analysis. Manufacturers also give excellent service and most companies have a team specially trained in post-accident investigation. Always bear in mind that these agencies like to get on the scene as soon as possible after the accident, so don't delay your request for them to attend. Other facilities available include the RAF School of Aviation Medicine for medical and behavioural analysis, and the Institute of Pathology and Tropical Medicine for pathological analysis. The RAF intelligence services are even able to provide performance data from amateur video of the aircraft. The subject of accident data recorders is a topic unto itself, and the AAIB and RAF have units dedicated to the extrapolation of information from them. All I would advise is not to brief people at the accident site to look out for "the black box", because they'll never find it! The box in question is usually bright dayglo, and a diagram or picture at the site works wonders. I have been amazed not only at the survivability of "the black box", but at the information it can provide. In these days of computer technology a full three dimensional image of the accident, complete with soundtrack, can be replayed before your very eyes!

When you have obtained as much information as possible through these channels you will be in a position to interview witnesses, experts and other people who were associated with the events that led up to the accident. The procedures for doing so are laid down formally, and legal advice will be given if necessary. However, a few hints and tips at this stage:

a. Surprisingly, the best eye witnesses are people who know nothing about aviation or flying! They will tell you what they saw; aviators, on the other hand, tend to fill the gaps or invent explanations for what they didn't understand, and thus recount what they think they saw. The best eye witnesses tend to be teenagers. the boys will tell you the make, model, squadron or airline and history of the aircraft; but the girls will tell you the colour of the pilot's eyes - or the colour of the flame that was coming from the aircraft's tail! A model, and even a journey to the point which eye witnesses saw the accident will often pay dividends. Do listen to what you are told, and don't lead people on – if they say the aircraft was falling like a leaf; maybe it was in a spin!

b. Allow plenty of time for each interview; if you try to rush you may fluster the witness into saying something they didn't mean.

c. In matters of aircraft handling always seek the advice of an expert such as the manufacturer or an experienced pilot.

d. Photographs are a gift as they convey a plethora of information.

Of course it is important to identify whether the accident under investigation has highlighted a risk to other aircraft and whether immediate steps need to be taken (such as grounding) pending the results of a full investigation. However, once "the heat is off" start to work sensible hours. Accident investigation is physically demanding and tiring

A photo can be worth a thousand words.

work. If you keep burning the midnight oil for too long your team will be incapable of clear and rational thought by the end of the first week! I would recommend that everyone takes a break over the second weekend following the accident.

As you approach the end of your investigation ask someone outside the team to vet your final report. When you've been working on an accident for the best part of a month it can be easy to "miss the wood for the trees" and/or not include facts that may seem obvious to you, but whose omission renders the report illogical.

Experience Shared

There is no doubt that having spent two and a half years looking into events that occurred when the flight safety chain broke I felt a far wiser man. But was there a common thread that could be used to make the chain stronger? Alas, short of not flying at all, I fear not - most aircraft accidents lie within the "noise" of statistics. Of course the accidents that I assisted on were all to military aircraft and, as I am finding out having joined British Airways, there are many differences between the modus operandi of the military and civil worlds. However, there were five lessons which emerged for me as sound advice, and which could be applied across the board. They may appear to be "old-hat", but as the person who, at the time, had seen the aftermath of more accidents than any other airman in the RAF during that two year period, I felt well qualified to make them:

1. The simple repetitive trips where everything is going just fine are the ones to watch. Arousal levels become too low, and it's all too easy to forget that you're in an aircraft hurtling through space at about 800 feet per second.

2. If it doesn't feel right, don't do it. If you're getting that uneasy feeling, level off (or climb) and collect your thoughts, make the situation more manageable and discuss your thoughts with those around you. After all, just as the balance of world power won't be changed by the military pilot who presses on into murky weather at low level an everyday training mission, so nobody will thank you for pressing on with an extremely rushed approach that goes horribly wrong.

3. Fly within the rules. Yes, we've all heard that one before, but during my time as the Board of Inquiry Adviser at least two pilots lost their lives because they didn't.

4. If it's unbriefed or out of the ordinary - stop and think! History has shown that in general aviation many accidents and incidents have occurred during impulsive low passes and "beat-ups" that weren't thought through. But in a similar vein, what about that runway switch that you've just agreed to on short finals - have you thought that one through; just what did it say on the AIS?

5. Learn from previous accidents and incidents; we all know what has happened on our fleet since we joined it, but what about those events ten, or even (in the case of the 747 Classic) 25 years ago? In many cases the crews have moved on, and yet the operation and systems of the aircraft are much the same. A little time spent researching the past, or a visit to Safety Services, may prove invaluable in learning something about the foibles of your type of aircraft.

Photographs are a gift as they convey a plethora of information.

In Conclusion.....

The paragraphs above might qualify for an award in the "stating the obvious" category, but the principles are sound and if you stick to them you may never have to meet an aircraft accident investigator, other than socially; I know that they would be the first to admit that that is how they would prefer to keep it! It is natural to shut our minds to that which is abhorrent, and aircraft accidents certainly fall into that category. My tour forced me to see the consequences first hand and compelled me to think long and hard about their causes. Let me leave you with one final thought; the difference between an accident and a close shave is often minute. That extra degree of care, of planning, of forethought on your part might make all the difference! ◆

About the Author

I joined the RAF from University in 1978. After training on the Jet Provost and Hawk I ended up posted to the Jaguar, which I then flew for most of my RAF career. Four operational tours; one in Germany, two in Norfolk, and one as a flying instructor in Scotland culminating as the Commanding Officer of No. 54(F) Squadron at Coltishall from 1993 - 1995 with the rank of Wing Commander. I flew nearly 3000 hours in the Jaguar (peanuts for a Jumbo pilot, but quite a lot in the Jag!). 1988 -1990 RAF's first Board of Inquiry Adviser, as described in this article. I joined British Airways last year as a F/O on the 747 Classic and thoroughly enjoy it!

Reprinted coutesy of British Airways Flight Deck

Epilogue

Aircraft Accident Summary
TYPE: CF188713
LOCATION: Klamath Falls, Oregon
DATE: 15 June 1995

CF188713 departed Klamath Falls, Oregon, on 15 Jun 95 as the number two aircraft in a two plane CF18 formation. Just prior to entering cloud the aircraft lost AC power. After a short delay, the two aircraft commenced a straight-in formation approach to the departure airfield. Approximately seven minutes after take-off, and before the aircraft was configured to land, the mishap aircraft lost essential DC power and the aircraft flight controls reverted to mechanical mode with ailerons and rudders inoperative (MECH-OFF-OFF). The pilot successfully lowered the landing gear using the emergency method but was unable to lower the flaps. The aircraft flew in MECH-OFF-OFF mode for approximately two minutes. As the approach speed decayed below 200 KCAS, the mishap aircraft became increasingly difficult to control. At one and a half miles on final, the mishap aircraft began an uncommanded roll to the right and the pilot ejected. The aircraft sustained "A" category damage and the pilot received minor injuries during the parachute landing.

The investigation concluded that at least one generator was serviceable at the time of impact and that a persistent electrical fault had caused both aircraft generators to drop off-line. The GEN TIE modification, C-12-188-000/CD-030, which is designed to mitigate the probability of double generator failure by providing automatic AC bus isolation, was not implemented on the mishap aircraft. The nature of the electrical fault which caused the AC power system to fail could not be determined and the relevance of the GEN TIE modification to this accident could therefore not be assessed

Following AC power failure, DC power was provided by the utility and/or emergency batteries for approximately 7 minutes, which is well short of the 20 minute figure given in the aircraft operating instructions (AOIs). The mishap aircraft's utility battery was recovered from the wreckage and found to be operating at less than 75 percent of its rated capacity. The investigation could not determine if premature failure of the DC power system was solely attributable to reduced battery capacity. It became apparent, however, that a comprehensive review of in-service CF 18 battery maintenance practises was necessary to confirm the validity of flight line checks and to identify improved procedures for the procurement and storage of CF18 batteries.

MECH-OFF-OFF mode provides aircrew with an opportunity to reposition a disabled aircraft prior to ejection. MECH-OFF-OFF mode offers minimal lateral authority at greater than 10 degrees angle of attack (AOA) and, although not expressly prohibited, landing in MECH-OFF-OFF mode is not recommended. The investigation concluded that the final approach speed of the mishap aircraft was at least 65 kts too slow for the aircraft configuration. While it is possible that an aerodynamic stall caused the aircraft to depart controlled flight, it is equally possible that insufficient differential stabilizer authority was available to counteract a right rolling moment, possibly induced by aileron trim. It is evident, however, that the approach profile flown by the mishap pilot was unlikely to result in a successful landing. The investigation concluded that existing CF18 publications did not contain adequate information about flapless approach speeds.

Stitching on the rear upper cross strap of the mishap pilot's simplified combined harness (SCH) was severely torn during the ejection sequence. Had the upper cross strap torn completely free, the pilot may have fallen from his parachute harness. Similar damage to the SCH has been noted in previous and subsequent CF18 accidents.

Following the accident, the decision was taken to accelerate fleet-wide implementation of the CF18 GEN TIE modification. A thorough review of in-service battery maintenance procedures was initiated to ensure that, in the event of primary power failure, battery power is available for at least the period of time specified in the CF18 AOI. Interim changes to the AOI and checklist procedure for U/E battery checks have also been implemented. Recommended speeds for a flapless (zero degree LEF/TEF) were included in the CF 18 AOI. The Checklist procedure for double GCU failure was also amended to include the conditional selection of half flap, recommended minimum manoeuvring speeds, and a warning of the imminent potential for an FCS reversion to MECH-OFF-OFF. Finally, two prototype modifications to the CF18 parachute harness were developed and are currently being evaluated. ◆

Aircraft Accident Summary
TYPE: CP140 AURORA 140104
LOCATION: Comox, BC
DATE: 28 May 1996

The crew was conducting a pilot proficiency flight and during a left-seat short field landing sequence, the aircraft departed the runway. It came to rest about 400 feet to the left and 3200 feet from the threshold. Skid marks and residual rubber fragments on the runway showed that after touchdown excessive left brake was applied and both tires on the left main landing gear failed. There was additional minor damage to the left main gear assembly, doors and nose wheel tires. Damage was assessed as D category and there were no injuries.

This incident exposed the lack of formalised training and AOI documentation with respect to foot positioning and inadvertent brake application with rudder input on the Aurora. Short field landing techniques are now taught on the Aurora MOAT and rules have been applied to limit conditions under which they are practised.

The analysis of the Flight Data Recorder (FDR) was vital in understanding the sequence of events with respect to the flight control inputs. This data showed that all four power levers were advanced out of the "beta" range after the aircraft swerved toward the infield and the throttles stayed at about 500 to 1000 positive horsepower until reverse power was again applied 15 to 17 seconds later.

Why the pilot thought the power levers were in an asymmetric position to recover from the swerve while all four were really between 500 and 1000 positive horsepower may not be well understood unless human factors are considered. Studies have shown that human performance in high stress situations is directly affected by the setting of "triggers". The best example of such behaviour is "if this engine quits after the end of the runway disappears, I'll eject". The pilot has set his "trigger" and in the event can react in time to save himself. It is incumbent on aircrew of all aircraft operations to set such "triggers" in place so that reaction in stressful situations is swift and correct. Certainly crew discussions and the resulting setting of "triggers" to react to run-off incidents should greatly reduce the possibility of another aircraft departing the runway under these circumstances.

It is notable that an Aurora "How to Fly" book has not been developed after flying this aircraft for nearly seventeen years. The need for this type of publication, particularly as our experience levels at the unit drop, is imperative if we are to pass on experience to neophyte personnel without having them make the same mistakes as their forerunners. ◆

Epilogue

Aircraft Accident Summary
TYPE: CC144604
DATE: 23 Jun 96
LOCATION: 12 Wing, Shearwater

Challenger aircraft CC144604 was tasked on a mission to transport media personnel in support of Exercise MARCOT 1996. The aircraft landed at 12 Wing Shearwater on completion of the mission and was returning to the ramp to disembark the passengers. While taxiing and carrying out the generator shutdown sequence of the post-landing check, a momentary power interruption occurred, the nose landing gear collapsed and the aircraft came to a sliding stop. The pilots carried out an emergency shutdown while the AESOP initiated an emergency overwing evacuation of the six passengers. All nine personnel on board safely escaped the aircraft with no injuries. The aircraft sustained "C" category damage.

The subsequent investigation confirmed that there had been an internal failure of the Nose Landing Gear Selector Valve. The momentary power interruption was due to an improper transition of the generators during the post-landing check by the co-pilot. This valve failure, combined with the power interruption, resulted in a bypass condition to the retraction side of the valve. Subsequently, the nose landing gear retracted without gear handle selection. This valve has been replaced throughout the fleet with a newly designed valve, which should prevent a recurrence of the failure. Although not a direct cause to the nose landing gear collapse, the improper generator transition re-emphasises the importance of thoroughly following published checklist actions.

Investigation of this accident also revealed that the stacking of two life rafts in front of the emergency exit hampered the emergency egress from the aircraft. This local procedure has been addressed and all personnel are reminded to be vigilant when conducting aircraft configuration changes which involve the rearrangement of emergency equipment.

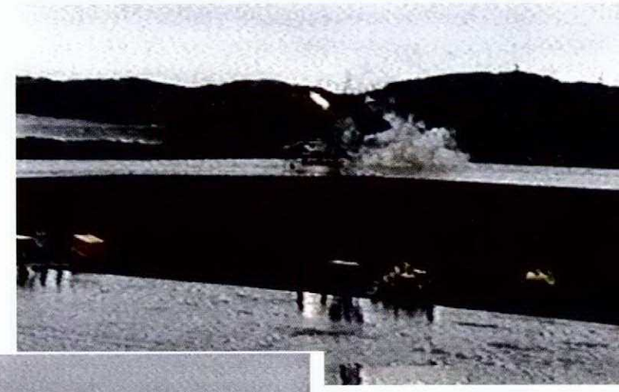
The documentation for this mission did not allow for the identification of the passengers on board the aircraft. This deficiency has been rectified and we should always be aware of potential changes to manifests and documentation when our mission is out of the ordinary.

As a result of initial findings of this investigation, changes were made to the post-landing check of one unit operating the Challenger. Similar changes were not made to the other unit. This discrepancy is being addressed, however, all units operating same-type aircraft should be co-ordinating with respect to AOI's, checklists and standards as a matter of commonality.

This accident once again enforces the concept that crews must be trained to effectively deal with unexpected emergencies. ◆

Aircraft Accident Summary
TYPE: CF188768
LOCATION: Iqaluit, Northwest Territories
DATE: 14 August 1996

CF188768 was deployed to the Iqaluit Forward Operating Location (FOL) to participate in a NORAD exercise. During take off on 14 Aug 96, the pilot of the mishap aircraft commanded full aft stick at rotation speed, the aircraft did not respond and the pilot elected to abort. The departure end cable was not up and the runway distance remaining was not sufficient to stop the aircraft using maximum braking. The pilot ejected 200 feet from the end of the runway at a speed of approximately 70 knots. The ejection was successful; the aircraft rolled off the departure end of the runway and sustained "A" category damage in the post-crash fire.



The investigation concluded that the aircraft was properly configured for take-off and that the abort was initiated within 10 knots of the correctly calculated nose-wheel lift-off (NWL) speed. The mishap pilot had correctly calculated the abort speed and had exceeded this speed by approximately 50 knots when the decision was taken to abort. The mishap pilot was similarly aware that the departure end cable was not up. The investigation concluded that the pilot exercised poor judgement in attempting to abort the take-off, with no reasonable expectation of succeeding, and that his decision to abort caused the loss of the aircraft.

The investigation also identified several pre-flight events that contributed to this accident. In particular, the lead pilot read back the IFR clearance incorrectly and identified runway 18 vice runway 36 as the departure runway. The accident aircraft experienced an unusual flight control anomaly just prior to line up. Although the anomaly was resolved, it served to undermine the pilot's confidence in his aircraft. The mishap pilot was also unfamiliar with the Iqaluit airfield environment and had limited experience with heavy weight, forward centre of gravity (C of G) aircraft configurations.

The investigation concluded that existing methods for calculating CF18 NWL and T/O speeds do not account for many of the factors which are known to influence these values. This limitation is tacitly acknowledged in the CF18 AOI, which warns that NWL speeds may be delayed by up to 25 knots; a figure which adequately accounts for the cumulative uncertainty associated with all relevant factors. It is nevertheless likely that the absence of a practicable method for calculating accurate NWL and T/O speeds has contributed to the widespread perception that the takeoff characteristics of the CF18 are somehow unusual or unpredictable.

Following this accident, a modification to the CF18 Data Management System (DMS) was initiated to automate the process of calculating CF18 NWL and T/O speeds. The uncertainty associated with DMS derived speeds will be significantly less than Å25 knots because aircraft C of G will have been precisely calculated for each aircraft. However, even DMS derived speeds will be subject to some uncertainty, such as that associated with nose-wheel oleo extension.

A clear abort policy for the CF18 will soon be promulgated by 1 CAD and will provide guidance concerning when a high-speed abort should be considered. Additional guidelines will also be promulgated to govern the use of departure-end arrestor cables. ◆

Epilogue

TYPE: Tutor CT114080
DATE: 7 Oct 96
LOCATION: Little Rock Air Force Base, Arkansas, USA

The mishap aircraft was #2 of a formation of four Tutors arriving at Little Rock AFB for a fuel stop. The formation split up into a section of three aircraft ("vic") and a single ship (#4) for landing. On landing the mishap aircraft's right landing gear struck sandbags securing a temporary lighting fixture designating a displaced threshold. The impact damaged the landing gear actuator rod and the shock strut as well as the attachment point on the wing spar causing the right gear to collapse. The right external tank and wing tip were scraped as the speed decreased and the aircraft settled. After coming to a stop the crew egressed uneventfully. The damage was originally assessed as "D" category but was subsequently upgraded to "B" category as the damage to the right wing structure required its replacement.Investigation revealed that all crews were aware of a NOTAM advising that the first 6200 feet of the 12,000 ft runway was closed. While in the pitch Tower advised lead that the displaced threshold was *"just beyond the midfield taxiway where all the C130s are sittin."* This statement was both ambiguous and imprecise, as it did not specify the exact location of the displaced threshold that was in fact 925 feet beyond the taxiway. In the landing flare lead and #3 noticed obstacles ahead and pulled up slightly to extend. At this point #2 had glanced ahead to check for drift. When he looked back he noted that lead had pulled up unexpectedly. He then touched down. One to two seconds later he was surprised by a large bang and jolt to the aircraft. From across the formation #3 advised him that his gear was collapsing.

Lead interpreted the information that Tower had given him to mean that the displaced threshold was at the intersection and so he planned a touchdown just past it. The lights marking the actual threshold were not easily discernible and the runway markings were not in accordance with USAF guidelines for temporary thresholds. The USAF corrected the problem immediately afterward. Standards and guidelines for marking temporary displaced thresholds do not exist for CF aerodromes. They will be developed as a result of this accident. ◆

Aircraft Accident Summary
TYPE: CF188764
DATE: 19 Oct 96
LOCATION: Andrews AFB, Maryland, USA

CF188764 was participating in a DACT mission at Andrews AFB, Maryland. Just after touchdown the left wing rose and the aircraft tracked to the right of the centre line. The left wing and nose rose to the point that the pilot lost sight of the runway ahead. He attempted to correct using nose wheel steering and only used left aileron input when he felt that runway departure was inevitable. The aircraft departed the right side of the runway with increasing left crab. After crossing a taxiway, the aircraft spun to the right when the right wing dug in and broke off at the hinge. The left main landing gear collapsed as the aircraft came to a stop at the right edge of the runway. After two unsuccessful attempts to jettison the canopy, the pilot raised it electrically and egressed. He suffered minor injuries and the aircraft sustained B category damage.

The weather at the time of the accident was VFR with moderate winds (90° left at 13 knots). The aircraft was serviceable prior to landing. The investigation focused on the pilot's actions during the crosswind landing and his handling of the departure from the runway centre line.

The canopy jettison system was examined to determine why it did not function. The propagation of the charge stopped at the Flexible Confined Detonation Cord (FCDC) which transfers the charge from the canopy rail to the canopy. Non-destructive testing of the FCDC determined that it was cracked. An SI to inspect the fleet for this problem was performed and 16 CF-18s were found to have a cracked FCDC. A programme to retrofit all CF-18 aircraft with a more robust Thin Layer Explosive Line (TLX) will be completed by January 1998.

The pilot decided not to eject due to his assessment that conditions on the infield were ideal. As the aircraft ploughed across the ground it developed left crab of up to 40 degrees. The ground conditions of the infield were considerably wet and this caused the right wing to dig in. The aircraft almost flipped as it spun to the right. The pilot's decision not to eject was contrary to the boldface emergency procedure when the aircraft was about to leave the runway in an uncontrolled condition.

The pilot in this accident had limited training on the OTU and conflicting information on how to properly carry out a crosswind landing in the CF-18. Normally, nose wheel steering (NWS) would maintain directional control but in this scenario the rising left wing prevented the weight on wheels switches from closing and activating the NWS . The pilot delayed the use of aileron to correct this high wing situation beyond the point of recovery.

Following the accident, the CF-18 How To Fly manual was revised making it consistent with the AOI's. Fighter Lead-in Training (FLIT) ground school and clearhood phase briefs now emphasize the AOI crosswind landing technique.

The optimum crosswind landing technique in the CF-18 is as follows:

- Fly a crabbed approach, taking out half the crab just before touchdown;
- Pilot control inputs are not required to counter small directional oscillations that may occur at and immediately following touchdown. Minimize stick and rudder pedal inputs until nose movement is stable. If oscillations continue, **execute a go-around;**
- Lateral stick is not normally required during the landing roll, however, judicious inputs may be required to counter the upwind wing's lifting;
- If the aircraft is about to leave the runway in an uncontrolled condition **EJECT.**

Once again the importance of a timely overshoot decision, as opposed to attempting to salvage a poor approach or landing, must be re-emphasised. ◆

From the Investigator

TYPE: CT114 TUTOR 114048
LOCATION: Assiniboia, Sask
DATE: 25 September 1997

The aircraft was on an instructional mission to introduce low level navigation to the student. Shortly after commencing the second leg of the route at about 500 feet above ground (AGL) a bird was ingested through the engine. The flying instructor traded airspeed for altitude and conducted relight procedures. When the throttle was advanced there was no discernible thrust. After a quick "mayday" call the crew ejected. The aircraft parameters at the time of the ejection were approximately 130 knots, 800 feet per minute descent rate and about 850 feet above ground. The aircraft continued for about 1000 meters, crashed into a ploughed field and caught fire. The pilots were quickly located, loaded into an ambulance and enroute to hospital within 55 minutes of ejecting.

Both crew tumbled during the ejection sequence, although in opposite direction, and both had seat/man interference problems. In the student pilots case these problems were most severe as the seat was completely entwined in the parachute shroud lines, which caused a very high descent rate and major injury. The other pilot suffered only minor injury although his ejection seat struck the back of his helmet.

This accident was relatively straightforward in terms of the cause for the engine failure and therefore most efforts have been expended on the ejection sequence and the seat/man interference problems that were evident. The seat/man separation problem of the ROCAT ejection system in the CT114 and CT133 fleets is a known problem with limited solutions. It will take a protracted time to address this issue; in the meantime, all affected aircrew must continue to set their personal ejection parameters before flight so that no time is lost to indecision should ejection be the only viable alternative.

In addition, during the investigation of a "slow burning" ballistic initiator it was discovered that some of the time expiry dates on the initiators were in error. This lead to a Special Inspection on the CT114 fleet and other actions on the CT133 fleet, which uses a similar ejection system.

Finally, a reminder that Aircrew Life Support Equipment (ALSE) must be worn properly during flying duties. CF flying clothing offers protection from fire through the dual layer principle, without it aircrew are essentially without fire protection. Also, while it may appear that there is not much open water on the prairies, had the student pilot landed in water with the injuries sustained and no Life Preserver Survival Vest (LPSV), his survival would have been in question. Give yourself a chance, wear your ALSE! ◆

TYPE: Air Cadet Glider C-GCLW
LOCATION: Moose Jaw, Saskatchewan
DATE: 14 Sept 97

Circumstances

The accident occurred during the Winch Launch Conversion Course that was being run to train recently licenced Air Cadet glider pilots on the winch tow method of launching the glider. The flight proceeded normally until just after the "All out" call ordering the application of winch power for take-off. Shortly afterwards, the winch instructor, who was monitoring the actions of a winch operator, heard a garbled transmission on the SP10 FM radio which he understood to include the word "Stop". Interpreting this to be a transmission from the LCO to discontinue the launch, the winch instructor directed the immediate reduction of power on the winch engine.

At this point the glider had reached an altitude of approximately 50 feet. The instructor pilot noted the loss of thrust, took control of the glider, lowered the nose and attempted to land straight ahead. The glider impacted the ground in a nose down attitude tearing off the skid plate, then pivoted rearward striking and breaking the tail wheel spring just aft of its point of attachment. The glider came to rest 25 meters from the initial impact point. Both crewmembers egressed unassisted but suffered minor injuries in the hard landing. The glider received "C" category damage.

Investigation

The investigation revealed that the glider and winch were serviceable and the crews possessed the qualifications, currency and experience required to carry out their respective duties. The instructor in the rear seat of the glider, however, did not fully appreciate the importance of the warning in the CFP 242 (Air Cadet Gliding Program Manual) to have sufficient airspeed before raising the nose for the initial climb. As a result of its lower speed the glider quickly decelerated and stalled when the winch power was reduced.

The source of the transmission containing the perceived Stop command could not be located. The LCO, who was monitoring the same frequency, did not hear this transmission. 15 Wing Telecom technicians confirmed the correct functioning of the FM radios in use at the gliding site and were unable to generate cross channel interference or splashover from any of the frequencies in use at Moose Jaw. This FM radio operates on a Public band, the use of which is not controlled. Another owner of the same set could be using the frequency and not be aware of the use of the frequency by the Air Cadet Gliding Program in Moose Jaw.

DFS Comments

Using the winch tow method of launching gliders is inexpensive, efficient and allows the Air Cadet Gliding Programme to maximize the number of Cadets that get this vital motivational flight. If it is to be carried out safely however, the take-off procedures and associated hazards must be completely understood. The guidelines and cautions contained in the CFP 242 were developed based upon years of experience and careful analysis of previous occurrences. They must be rigidly followed if we are to prevent accidents such as this from re-occurring. ◆

Disorientation

TO MOST PILOTS THE TERM 'SPATIAL DISORIENTATION' CONJURES UP A PICTURE OF AN INEXPERIENCED FLYER, CAUGHT OUT IN BAD WEATHER AND FORCED TO FLY INTO CLOUD. VERY SOON THE UNFAMILIAR AND CONFLICTING SENSATIONS FROM THE BODY'S 'POSITION SENSE' ORGANS CONFLICT WITH THE PILOT'S INTERPRETATION OF THE AIRCRAFT'S INSTRUMENTS. PANIC SETS IN AND CONTROL IS LOST.

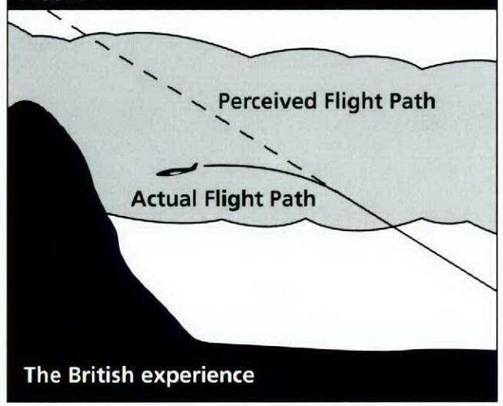
This scenario is common enough as a cause of fatal accidents but there is also a very subtle and dangerous form of disorientation to which even experienced pilots can fall victim. The wings may be level and the course steady, with the pilot completely unaware that it is occurring. This is the 'false climb' or somatogravic illusion.

Many accidents are reported in which an aircraft flown by an instrument-rated pilot strikes a hilltop in cloud or poor visibility or crashes into the ground after takeoff on a dark night. The actual cause of these accidents is difficult to establish as they are usually fatal, with the aircraft extensively damaged. An inordinate number of such accidents occur within a few feet of safety and it seems reasonable to presume that many pilots in similar circumstances escape the same fate by a small margin and fly on unaware of their proximity to a disaster.

In Britain during World War II, an investigation was carried out into a series of accidents which had occurred at flying training units in which aircraft taking off on dark nights crashed into the ground shortly after leaving the runway. No obvious cause of these accidents was found, but eventually investigators concluded that the pilots were deluded into thinking that their aircraft was climbing or at least in level flight, when in fact the aircraft was descending (fig.1). The report called this phenomenon the 'false climb' illusion.

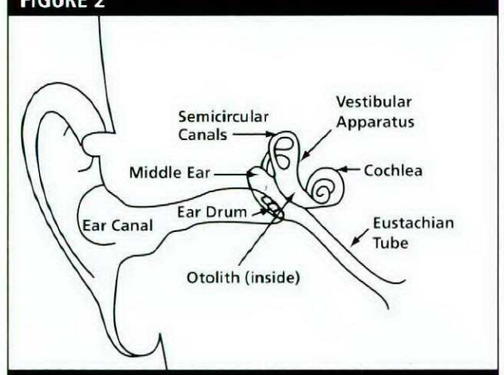
The main culprit in this illusion was found to be the otolith, an organ which forms part of the inner ear and vestibular apparatus, as illustrated in (fig. 2). The otolith has its own special function—to sense and signal to the other organs the position of the head relative to the vertical. In the absence of visual cues, this signal becomes a powerful influence on the balance and orientation of the body. Without the otolith, it would be impossible to maintain one's balance with eyes closed.

FIGURE 1



The British experience

FIGURE 2



Inner-ear

A detailed description of the structure and function of the otolith is outside the scope of this article but in relation to the 'false climb' illusion, it can be described as a hair which stands vertically with a small stone at its tip (see fig. 3). The base of the hair is inserted into a sensory cell which covers information about the angle of the hair to the brain.

When the head is tilted backwards,as in (fig. 4), the weight of the stone bends the hair, and this message is relayed by the sensory cells to the brain, where it is interpreted as a backward tilt. If the head is held vertically and accelerated forwards, the hair will bend in a similar fashion owing to the inertia of the stone. Thus both tilt and acceleration produce the same response by the otolith. However, the brain is unable to differentiate between these responses: 'acceleration' is read as 'tilt'.

If tilt and acceleration are experienced simultaneously and in the same direction, the interpretation is that of a much steeper tilt. This is the explanation of the 'false climb' illusion. When a pilot is subjected to climb and forward acceleration at the same time and deprived of external visual cues, he experiences a strong sensation of a steeper than actual climb. It is this illusion which tempts the pilot to lower the nose of the aircraft. This increases the forward acceleration component and increases the illusion of climbing steeply. Owing to lag in the altimeter and vertical speed indicator, the loss of height may go unnoticed until it's too late to avoid ground contact.

It has been shown that a relatively low linear acceleration of 0.2g, if sustained for several minutes, is sufficient to produce this illusion. After a brief acceleration, such as a catapult launching (5g for 2-3 seconds), the apparent nose-up illusion takes a minute or so to die away. Opposite sensations are produced by tilting the head forward or by decelerating the subject.

There are three common situations in which the 'false climb' illusion can occur. In these cases, it is assumed that visibility outside the cockpit is absent or at least inadequate for visual flight.

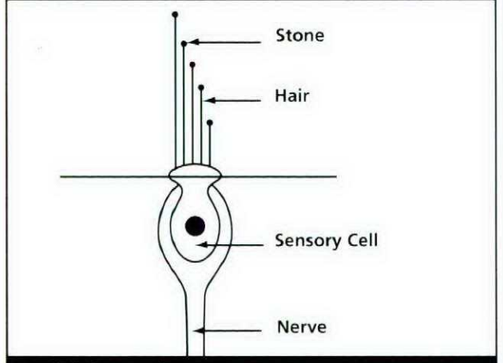
These situations are:

- takeoff—night or instrument flight rules;
- overshoot (missed approach); and
- climb from visual flight rules into instrument flight rules conditions.

The takeoff and overshoot, on dark nights or in instrument flight rules conditions, are clear-cut situations where the pilot is set up for the illusion. During a climb from visual flight rules into instrument flight rules conditions, the illusion can be compounded by turbulence or by referring to an artificial horizon that isn't quite erect. This situation may well have been responsible for many hillside crashes. Usually the decision to climb has been dictated by deteriorating weather conditions and is unplanned, which is enough to cause some anxiety and to interfere with correct decision-making. As the aircraft is already flying at a reduced power and airspeed, the full-throttle climb will produce the illusion. ◆

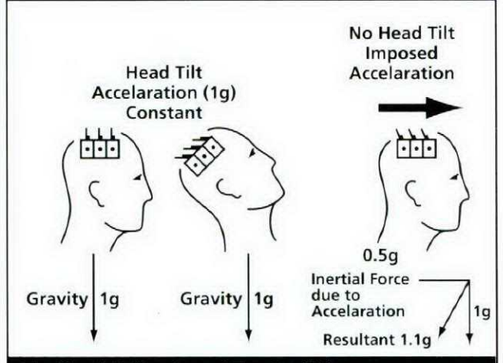
Reprinted courtesy of Asia-Pacific Air Safety November 1997 issue 16

FIGURE 3



Otolith hair and stone

FIGURE 4

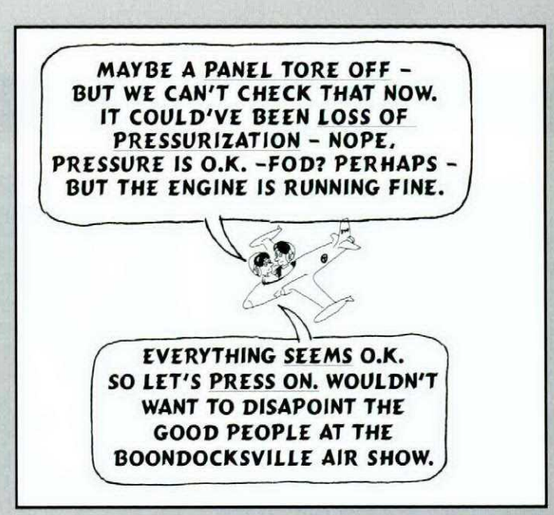


Idealised deflection of the Otolith organ

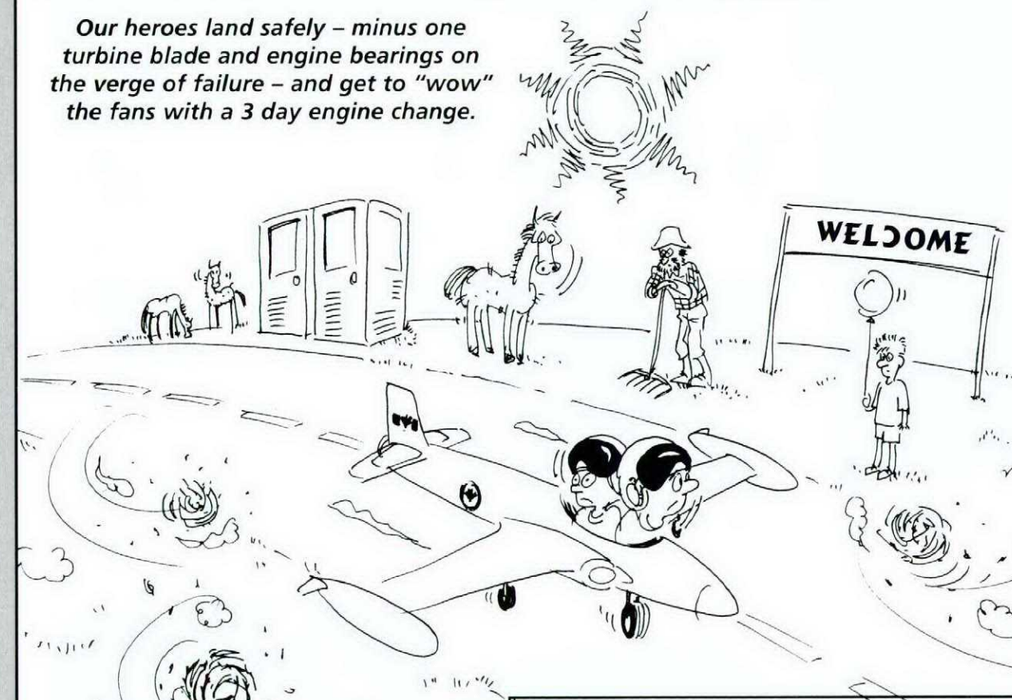
AIRSOP'S FABLE

Everything you wanted to know about bangs *but were never taught

Bang!
Bang!
Bang!
Bang!
GOTCHA!
or Pressonitis



Our heroes land safely – minus one turbine blade and engine bearings on the verge of failure – and get to "wow" the fans with a 3 day engine change.



Moral:

IF YOU **HEAR** AN AIRFRAME BANG – LAND!

IF YOU **HEAR** AN ENGINE BANG – LAND!

IF YOU **HEAR** ANY BANG – *LAND* AS SOON AS PRACTICAL!

DON'T PRESS ON!

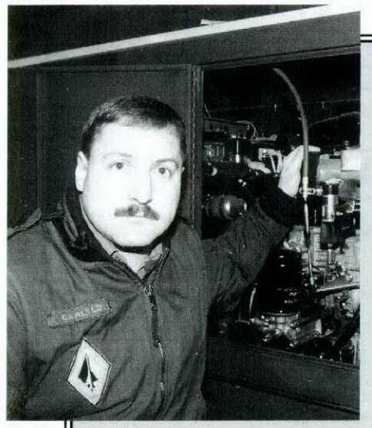
For Professionalism

Captain James Atwood

Captain Atwood, a 3 CFFTS instructor pilot, was conducting a student training mission in a Jet Ranger helicopter. At five hundred feet above ground level Captain Atwood initiated a simulated engine failure for the student pilot. Shortly after rolling the throttle to idle, for the simulation, the engine out tone and light were noticed. Secondary indications confirmed that the engine had failed.

Captain Atwood immediately took control and carried out a flawless autorotation to a nearby field. No injuries or aircraft damage were sustained. Subsequent investigation revealed that the throttle linkage had failed.

Captain Atwood's outstanding aircraft handling skills and timely reaction to the emergency prevented the loss of both the crew and the aircraft. ◆



Master Corporal Doug Carlyle

During the acceptance checks of new ground power units Master Corporal Carlyle noticed a potentially hazardous situation. The fuel lines from the fuel tank to the engine of the ground power unit were poorly routed and could rub on the engine and generator wiring harness. Master Corporal Carlyle devised an alternate means of routing the fuel lines to avoid chaffing.

Master Corporal Carlyle's solution was quickly adopted throughout the Canadian Forces. Inspections during the modification process revealed numerous ground power units with damaged fuel lines.

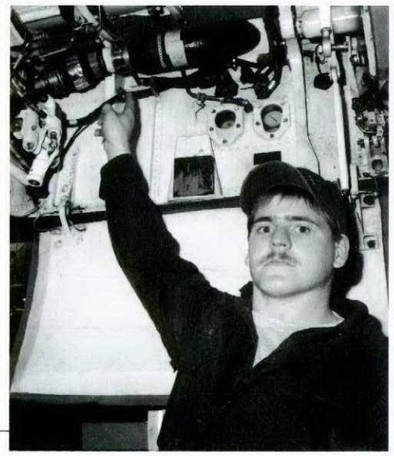
Master Corporal Carlyle's strict attention to detail and professionalism allowed him to find a first rate solution to an unfamiliar problem. The repairs were made with a minimum of equipment downtime and removed the risk of a disastrous fuel leak and fire. Well done! ◆

Corporal Leon Hynes

Cpl Hynes, an Airframe Technician with 441 Tactical Fighter Squadron, was carrying out a routine survey of the right hand main landing gear wheel well of a CF188 Hornet during a Periodic Inspection.

During the check he noticed that an Environmental Control System (ECS) style aluminum clamp with steel bands was installed on a main fuel line instead of a steel clamp. Although the clamps have the same overall dimensions, the proper clamp is made entirely of steel and made to be stress corrosion resistant. Had there been a fire in the wheel well the aluminum clamp would most likely have melted thereby causing a large fuel leak and spreading the fire. Further investigation revealed that 5 out of 18 of the squadron aircraft had improper clamps installed. All squadron aircraft were repaired and a fleet wide Special Inspection (SI) was implemented.

Cpl Hyne's professionalism, dedication and utmost concern for safety prevented a potentially serious flight safety occurrence. ◆



Corporal Ken Jackson

During a routine B check on 16 April 1997, Corporal Jackson noticed an unusual dark streak on aircraft 133656. Corporal Jackson notified his supervisor, and the aircraft was declared unserviceable. An inspection was carried out with no fault found. The aircraft was declared serviceable and was returned to the flight line.

On 1 May 1997, Corporal Jackson again noticed the formation of a dark streak in the same location. He immediately notified his supervisor and the aircraft was again declared unserviceable. This time the decision was made to remove the engine for a closer inspection. During the inspection it became apparent that an interconnect between combustion chambers was not secured. This condition was allowing flames to intrude into the compressor, the cooling air turbine, and over the bearing line. An eventual engine fire was a near certainty.

Corporal Jackson's dedication and perseverance prevented a possible disaster. Well done! ◆

Second Lieutenant Frank Gallos & Second Lieutenant Scott Anningson

Second Lieutenant Gallos and Second Lieutenant Anningson, both student pilots, were conducting a student mutual flight during the multi-engine flying training course. During an unsafe landing gear emergency they noticed that the rudder trim was responding opposite to what it should have. They used reverse inputs as required and reported the fault promptly upon landing.

Subsequent investigation revealed that the rudder trim had been inadvertently rigged incorrectly. During engine out scenarios the rudder trim plays a critical role in the safe handling of the aircraft. Should an engine failure have occurred, and the trim problem gone undetected, a tragedy could have resulted.

Second Lieutenant Gallos and Second Lieutenant Anningson are to be commended for their professionalism in recognizing that a potentially serious rigging problem existed with a flight control surface. Well done! ◆

Sergeant Reg Lapierre

Sergeant Lapierre, a flight engineer with 438 Tactical Helicopter Squadron, was conducting a pre-flight inspection of a Griffon helicopter when he noticed a black powdery residue on the horn assembly bolt of one of the main rotor blades. Sergeant Lapierre decided to conduct a more thorough inspection of the horn assembly. The subsequent inspection revealed an abnormal amount of play between the bolt and the pitch horn bushings. The aircraft was declared unserviceable and a repair crew determined that the bolt had been subjected to abnormal and extensive wear due to corrosion.

The only visual indication of the fault was the black powdery residue on the bolt. The nut and pin were properly in place and intact. The torque of the bolt was correct. A routine inspection had been completed shortly before the incident and nothing unusual was observed.

Sergeant Lapierre's superior professionalism and conscientiousness allowed him to identify a potentially disastrous unserviceabilty. Well done. ◆

For Professionalism

Master Corporal Jim Lindsay

While rigging an Aurora engine during periodic maintenance Master Corporal Lindsay discovered that despite carefully following technical orders he could not achieve optimum alignment of the engine power control rod. Although able to make adjustments that marginally met the published specifications Master Corporal Lindsay was dissatisfied with the results and decided to investigate further. His investigation led to the discovery that the engine control rods and the emergency control rods had been interchanged.

The faulty installation was not readily detectable. The two rods were identical to the eye – except for a one-quarter difference in barrel length. Other engines were inspected and were also found to have rods interchanged. Subsequently a fleet wide special inspection was issued.

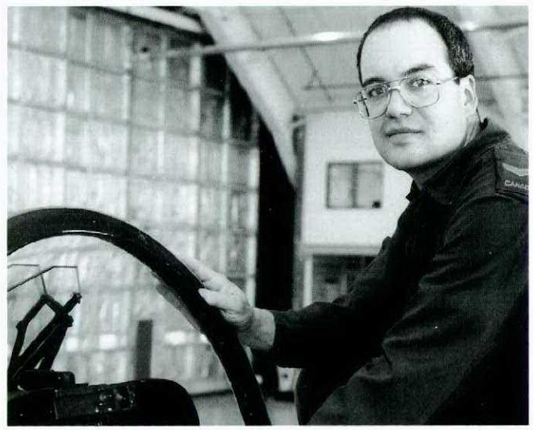
Master Corporal Lindsay's professionalism and refusal to settle for marginally acceptable results revealed a serious deficiency in a critical flight system. Well done! ◆

Corporal Robert A. Petsche

During a routine AVS survey of a CF-188 cockpit during a periodic inspection, Corporal Petsche decided to further investigate a re-occurring overheating problem with the R/H DDI. Although not part of the normal routine AVS inspection, Corporal Petsche removed the R/H DDI and inspected the cooling air duct. The air duct was almost completely clogged with FOD.

A further investigation revealed that 80 percent of squadron aircraft had FOD in the R/H DDI cooling air duct. A Special Inspection was immediately released by DAEPM. Corporal Petsche's follow-up investigation into what caused the FOD led to his submission of a UCR and a recommended solution to the problem.

Corporal Petsche's excellent initiative and high motivation have helped prevent future flight safety incidents involving overheating and dust contamination. Well done. ◆



Corporal Robert G. Bauer

Corporal Bauer, an AVS technician undergoing training on the Griffon helicopter, was assisting with an acceptance check on a new aircraft. During the inspection of the avionics compartment Corporal Bauer noticed an unusual item underneath the ARC-210 receiver. The object was identified as a pair of side cutters that had been left in the aircraft during manufacture.

The tool had gone unnoticed throughout extensive ground and flight quality assurance checks. Had the tool continued to have gone undetected the potential existed for an in-flight incident or damage to aircraft components.

The gray colour of the side cutters made them very difficult to distinguish among the surrounding avionics trays. Corporal Bauer demonstrated superior attention to detail when working in an unfamiliar area. Well done! ◆

Tower Control Team

Captains Hagen, White and Merkel were the tower controllers and chief controller respectively, working an afternoon shift during Maple Flag XXX. The recovery of the 88 fighter aircraft that were airborne had only recently commenced when a USAF F-16 checked in with Capt White reporting engine problems. Based on wind information the pilot requested direct overhead the airfield to a high key position for landing on runway 04. Given the aerodrome configuration at 4 Wing Cold Lake, this would entail landing across the active parallel runways.

As Captains White and Hagen continued to work the recovery, Captain Merkel scanned for the emergency aircraft. Once visually acquired, the aircraft was switched over to Captain Hagen controlling the inner runway while Captain White continued to deconflict the increasing air traffic from the recovery coordinator position. To avoid the approach end cable, the F-16 landed long and the pilot used maximum aerodynamic braking. However, it was readily apparent that the aircraft was too hot and that a departure end engagement would occur. Captain Merkel was watching through his binoculars and detected that the aircraft's arrestor hook had not yet been lowered. Captain Hagen, although now focussed on controlling his own circuit traffic, alertly took notice and immediately informed the F-16 pilot that his hook was up. With approximately 100 feet of runway remaining to the arrestor cable, the hook was lowered and a successful engagement occurred. In a later discussion with the pilot, he stated that it was "to say the least a very timely call!"

There is little doubt that the actions of Captains Hagen, White and Merkel prevented a serious accident. Well done! ◆

Master Corporal Terry Doody

Master Corporal Doody, an ACS technician, reported to aircraft 130316 at the request of Corporal Rancourt for a damage evaluation on the left hand FS 946 upper frame attachment fitting where a two inch crack had been found. Master Corporal Doody quickly determined that the damage was on the aircraft's primary structure. Suspecting that there might be further damage in the surrounding area, Master Corporal Doody suggested that he and Corporal Rancourt inspect the interior fuselage frames moving aft from FS 946. During their inspection they found further cracking at FS 946 and additional cracking at FS 1012. All cracked fittings were subsequently replaced.

Master Corporal Doody's technical expertise and professionalism in initiating further in-depth inspection of the aircraft prevented further crack progression. If these faults had gone undetected the structural integrity of the aircraft could have been affected. Well done! ◆

Corporal Michel J. Lavoie

Upon receipt of a shipment of CF-188 tires from a new supplier, Corporal Lavoie noticed that the new tires appeared to be of a larger diameter than the previous tires. On his own initiative, Corporal Lavoie took measurements of both the old and new tires. He discovered that the new tires were indeed significantly larger than those of the old supplier were.

Corporal Lavoie then arranged for 441 Squadron to carry out a main landing gear retraction test using one of the new tires. The retraction tests verified that there was insufficient clearance within the wheel-well. Subsequent investigation by representatives from the tire company confirmed that the tires were not suitable for use on the Hornet aircraft.

Had the new type of tires been installed, aircraft damage or a serious accident may well have resulted. Corporal Lavoie`s dedication and keenness in pursuing an investigation into a seemingly minor difference in the appearance of CF-188 tires was directly responsible for preventing their installation on aircraft. ◆

Corporal Serge Rancourt

During a "B" check on CC130316, Corporal Rancourt noted an insulation blanket partially undone in the rear of the cargo area. Prior to installing the blanket, Corporal Rancourt inspected the area underneath and discovered a two inch crack on the upper frame structural attachment fitting. Corporal rancourt immediately asked an ACS technician to carry out a damage assessment. After determining that the damage was indeed structural they proceeded to inspect further frames aft FS 946 and located further structural damage. Corporal Rancourt informed his supervisors and the damage was repaired.

Over the next several months Corporal Rancourt inspected the CC130 fleet for cracking in the aft fuselage frames. In the course of these inspections damage was also found in the structural "T" fitting on the aircraft 130313. Had these faults gone undetected, further crack progression could have affected the structural integrity of the aircraft.

Corporal Rancourt' initiative, dedication, and professionalism elimininated the potential for a costly repair by outside resources on 130316 and provided valuable information on defects that could have had serious airworthiness implications on the CC130 fleet. ◆

Bombardier Sylvain Bourgeois

Bombardier Bourgeois, an artilleryman serving in Haiti, was on guard duty manning an observation post near runway 27 at Port-au-Prince International Airport. While watching a Griffon helicopter departing on a night goggle training mission, Bombardier Bourgeois noticed that the aircraft's baggage compartment door was open. Unable to attract the crew's attention with hand signals, he immediately reported the situation to his command post.

In less than two minutes the Griffon crew was notified that their baggage compartment door was open. After completing a precautionary landing the flight engineer stepped out to investigate. Fortunately there was no damage to the aircraft and nothing had fallen out.

Had it not been for Bombardier Bourgeois' alertness, keen sense of observation, and timely reaction valuable aircraft equipment could have fallen out possibly striking the tail rotor. ◆

We Learn FROM Others

During a recent tow job of a Labrador helicopter I heard a clunking noise from the nose wheel area. The day before a technician had received a GOOD SHOW award for a similar type of find. The award had been presented in front of the entire section.

Simply another person receiving an award? Well at the time that's what I thought too, until my experience with the clunking sound. The usual "are you looking for an award as well?" could be heard from a few other members of the tow crew. But, for myself the noise was real and required the necessary reporting. The anomaly was reported to the towing supervisor, who in turn contacted an airframe technician. Further investigation revealed that the nose gear bushing was worn and unserviceable. I credit part, if not all of this finding, to the fact that another technician was recognized publicly for his excellent work. This knowledge allowed me to become aware of a problem that had happened before, but that I had not heard of through normal channels.

This is one example of why we have **GOOD SHOW *and* FOR PROFESSIONALISM** awards in the Air Force. This time I benefited from another's award. The next time it could be you. ◆

Corporal Brad Stewart

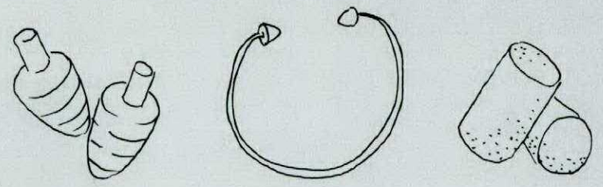
If it's ISSUED, is it SAFE?

In today's military cutting back overhead and saving money is very important. Local purchase of items is not uncommon. However; by purchasing hearing protection off-the-shelf, well meaning individuals may inadvertently be causing you hearing damage.

In the past three years I have had the chance to travel to almost every Canadian Forces Base teaching Aeromedical Training to Aircrew, Ground Crew and Support Personnel. While talking to these groups I discovered that some military personnel are using unapproved earplugs. These earplugs have not been tested by CF Agencies and their use may cause hearing problems.

It became apparent that some of these earplugs were being issued through local supply systems while others were individual purchases. The unapproved earplugs are the EAR Ultrafit and CABOFLEX Semi-Aural Hearing Protector. The Noise Reduction Rating (NRR) as specified by the Environmental Protection Agency is 21 decibels (dB) for the Ultrafit and 20 dB for the CABOFLEX. If you are in an environment of 95dB wearing earplugs with a NRR of 20 dB; assuming a proper fit, you will be exposed to 75 dB. These NRR values are much lower than the NRR for the CF issue EAR Classic Foam earplugs which is 29 dB. You may not think that 9 dB is a big difference, but as decibel levels increase linearly, the actual sound pressure increases logarithmically (6db-twice, 12db=4 times and 18db=8 times).

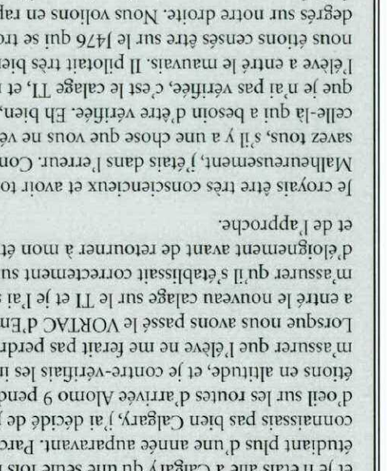
The next time you are on the flight line and you see aircrew or ground crew wearing a non-issue type of earplugs you should inform them of the potential hazards associated with their use. ◆



EAR Classic CABOFLEX Ultrafit

Master Corporal R.C. Kelly

Accomplissements



Capitaine Duane D. Lecaine

Le capitaine Lecaine, pilote du 410e Escadron d'entraînement opérationnel à l'appui tactique, revenait d'une mission d'entraînement et se préparait à atterrir.

Ayant vérifié et confirmé qu'il avait «trois verts» en approche, il a été surpris lorsque l'avion s'est mis à tirer de côté après avoir atterri. Il a alors un coup d'œil sur les voyants du train d'atterrissage et a constaté qu'il y avait affaire à une défaillance de la barre de redressement droite. Se rendant compte qu'il ne pouvait abaisser la crosse d'arrêt à temps pour accrocher le câble à l'entrée de piste, il a remis les gaz et repris de l'altitude tout juste avant que la post-combustion ne s'allume. Laissant le train d'atterrissage abaissé et après avoir informé la tour de contrôle des ennuis qu'il avait, le capt Lecaine a effectué un atterrissage parfait avec accrochage du câble d'arrêt. Une inspection après vol a révélé que la roue droite était pincée d'environ vingt degrés.

Grâce à son professionnalisme et parce qu'il su agir sans hésiter et su quoi faire face à la défaillance d'une barre de redressement, le capt Lecaine a évité un accident qui aurait pu entraîner la perte de son avion si celui-ci avait quitté la piste d'atterrissage.

Bravo capt Lecaine! ◆

La mission

J'étais à mes premières armes comme instructeur, ne comptant que 58 heures d'expérience à ce titre. Les conditions météorologiques étaient bonnes et en route à environ vingt-cinq mille pieds, nous volions en VMC et l'élève était aux commandes.

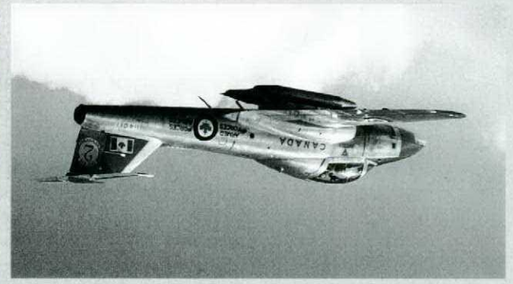
C'était le premier voyage de l'élève hors de la Saskatchewan et je n'étais allé à Calgary qu'une seule fois lorsque j'étais étudiant plus d'une année auparavant. Parce que je ne connaissais pas bien Calgary, j'ai décidé de jeter un coup d'oeil sur les routes d'arrivée Alomo 9 pendant que nous étions en altitude, et je contre-vérifiais les instruments pour m'assurer que l'élève ne me ferait pas perdre mon certificat. Lorsque nous avons passé le VORTAC d'Empress, l'élève a entré le nouveau calage sur le TI et j'ai surveillé pour m'assurer qu'il s'établissait correctement sur le radial d'éloignement avant de retourner à mon étude de l'arrivée et de l'approche.

Je croyais être très consciencieux et avoir tout vérifié. Malheureusement, j'étais dans l'erreur. Comme vous le savez tous, s'il y a une chose que vous ne vérifiez pas, c'est celle-là qui a besoin d'être vérifiée. Eh bien, la seule chose que je n'ai pas vérifiée, c'est le calage TI, et naturellement, l'élève a entré le mauvais. Il pilotait très bien le J504 mais nous étions censés être sur le J476 qui se trouvait à 15 degrés sur notre droite. Nous volions en rapprochement de Calgary sur une route réservée aux départs de Calgary.

La première indication que j'ai eue que les choses n'allaient pas comme prévu est lorsque l'ATC à 16 NM à l'ouest d'Empress nous a appelés. Après nous être rendus compte de ce qui était arrivé, nous devions intercepter un vecteur de 30 degrés sur la droite, et voilà tout! Qu'est-ce qui serait arrivé si nous avions été en IMC et avions perdu la communication, ce qui arrive souvent dans le Tutor dans cette partie du pays avec les seules radios UHF de 1960. J'aurais fini par me rendre compte que nous étions sur la mauvaise voie, mais la communication étant interrompue, comment l'ATC aurait-il pu prévoir ce que j'allais faire si déjà je ne me conformais pas à mon plan de vol.

Cela m'a appris à tout vérifier. Lorsque vous volez en tant que membre d'équipage, que vous ne pilotez pas, vous devriez vérifier la moindre petite chose comme si vous pilotiez. C'est ce que je fais maintenant, tout le temps, quelle que soit la personne avec qui je vole. ◆

Captain A.P. Young



Good Show

Captain Duane D. Lecaine

Captain Lecaine, a pilot with 410 Tactical Fighter (Operation Training) Squadron, was returning from a routine training mission and preparing to land.

After having checked and confirmed that he had "three green" on approach, it was highly unexpected when the aircraft immediately started to pull towards the side of the runway upon landing. A glance at the landing gear indicators showed that a right planing link failure had occurred. Realizing he could not deploy the hook in time to catch the approach end cable, Captain Lecaine quickly initiated an overshoot getting airborne almost before the afterburners came in. Leaving the landing gear down and informing the tower of his problem, Captain Lecaine proceeded to carry out a flawless approach end cable engagement. Post flight inspection revealed that the right wheel was toed in approximately twenty degrees.

Captain Lecaine's professionalism, quick thinking and skilful handling of a planing link failure averted a serious flight safety occurrence which could have resulted in the loss of an aircraft had it departed the runway. Well done Captain Lecaine! ◆

The Mission

The mission was an IF 25 – 26 out and back to Calgary. I was a pipeline instructor with 58 hours instructional. The weather was good and enroute in the mid twenties, we were VMC so the student had the bag on.

This was the first trip for the student out of Saskatchewan and I had been to Calgary only once when I was a student more than a year before. Because I was not that familiar with Calgary I decided to take a look at the Alomo 9 arrival while we were at altitude and I was cross checking the instruments to make sure the student would not blow my ticket. As we crossed the Empress VORTAC the student dialed in the new setting on the TI and I watched to make sure he got on the outbound radial properly before returning to my study of the arrival and approach.

I thought I was being very conscientious and checking everything. Unfortunately I was wrong. As you all know, if there is one thing that you do not check, that is the one thing that needs to be checked. Well the only thing I did not check was the TI setting, and of course the student put the wrong one in. He was doing a great job flying the J504 but we were suppose to be on the J476 which was 15 degrees to our right. We were flying inbound to Calgary on a route designed for departures out of Calgary.

The first indication that I had that things were not going as planned was when we were called by ATC 16 NM west of Empress. After realizing what happened, we got a vector 30 degrees right to reintercept and that was the end of it. What if we were IMC and lost comms, which often happens in the Tutor in that part of the country with 1960s UHF only radios. I would have eventually realized we were on the wrong track but with a comm fail, how would I be predictable for ATC if I was already not complying with my flight plan.

That taught me to check everything. While flying as a crewmember, if you are not flying at the time you should check every single thing as if you were flying. I do this now, all the time, no matter who I am flying with. ◆

Captain A.P. Young