RCAF FLIGHT COMMENT

SEPTEMBER • OCTOBER • 1964

FLIGHT COMMENT

Editor—S/L WA Smith

Feature Editor—Miss AV McIntosh

Associate Editor—F/L JT Richards

Artists—JA Dubord
HK Hames

Editorial Assistant—Miss R Mayhew

Flight Comment is produced by the RCAF, Directorate of Flight Safety. The contents do not necessarily reflect RCAF policy and unless otherwise stated should not be construed as regulations, orders or directives.

Contributions, comments and criticisms are welcome; the promotion of flight safety is best served by disseminating on-the-job experience and opinion. Send submissions to: Editor, Flight Comment, AFHQ/DFS, Ottawa 4, Ontario. Annual subscription rate is $2.50 for Canada and USA; other countries $3.50. Subscriptions available at Queen's Printer and Controller of Stationery, Hull, P.Q.

G/C AB SEARLE
DIRECTOR OF FLIGHT SAFETY

W/C D WARREN
ACCIDENT PREVENTION

W/C JT MULLEN
ACCIDENT INVESTIGATION

Articles

Features

ROYAL CANADIAN AIR FORCE
DIRECTORATE OF FLIGHT SAFETY

GROUP CAPTAIN AB SEARLE
DIRECTOR OF FLIGHT SAFETY

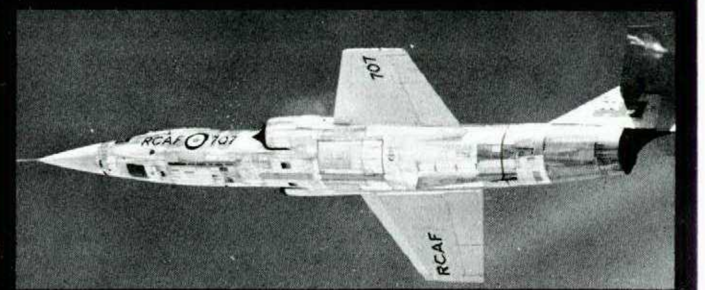
THE article on fatigue in this issue points to a problem inherent in the employment of human beings. Fatigue can be a subtle cause of accidents and may be missed in many cases—after all, others as well as the man who has worked for fourteen consecutive hours may be fatigued. There are few accidents where the cause can be unequivocally labelled fatigue; but the occasional case that does occur should serve to remind us that fatigue may in other cases be hidden, masquerading as say, carelessness. An "O" ring on a CF104 fuel control unit is carelessly positioned and an expensive aircraft is lost. A man leaves a couple of bolts off a propeller assembly after fifteen hours on the job. Another near lethal fatigue-caused error appears as the lead-in story to our fatigue article; it was only superb skill of the aircrew that returned their fully-loaded Hercules safely to base. (An account of the exploit appears as a "Good Show" on page 10 of this issue.)

If a man commits an error due to fatigue who is to blame? The very implication in punishing him for making the mistake is that he is responsible. This reasoning employs a comforting straight-forward logic which unhappily too often befogs the issue. The man's morale is compromised and the real culprit (the organization under which he is working) prevails to wreak havoc another day. The organization, which is primarily the responsibility of the supervisor, embraces work scheduling, of course, but there are other factors, too. Recently, a supervisor confessed "there is a growing tendency on operations . . . to attempt to break existing records and set new ones . . . but as we have learned, it can result in accidents . . . . Our enviable records will go unchallenged for some time and (may well be) unbeatable without some stretching of rules and facilities". Competition, increased output per man, beating existing records, etc, are all in themselves a good thing. But when further improvement requires stretching human endurance, even though the man himself is completely agreeable, there comes a point when something has to give. This, the supervisor must recognize and call a halt before the damage is done.

Each aircraft accident is carefully analyzed as to why it happened and so our statistics are compiled. These statistics give us a breakdown of the various cause factors but we suspect that there is more to accidents due to human error than the statistics show. Perhaps it was Aircrew Error, or Maintenance—but why? Even an apparently "simple" accident can have very complicated undertones. To ferret them out in every case would require a committee of aircrew, engineers, doctors, psychiatrists, psychologists, all endowed with unusual clairvoyance. Instead of labelling an accident simply "Maintenance", such an august committee should be able to transcribe their findings in this way: "Maintenance—Carelessness—Fatigue—Bad Supervision". Thus the supervisor would realize what was wrong with his organization and take corrective action.

Because sleuthing for sub-causes can be extremely time consuming, there are undoubtedly many accidents where fatigue has gone undetected. Also, fatigue can appear under many guises—as, for instance, catering to an understandable enthusiasm for efficiency and unit pride and so beat an existing record. Thus it is the duty of every supervisor to give his organization some close, honest scrutiny. The man himself, of course, has a duty to report when he is in a fatigued condition; but the onus is primarily on the supervisor. Detecting fatigue may itself be fatiguing but men and machines can be saved—the evidence leads us to no other conclusion.

CHECK-OUT IN THE 104



by S/L J REGAN
AFHQ/DFS

"Tycoon Two, cleared for takeoff, check canopy and lanyard."

"Tycoon Two, canopy and lanyard checked."

A burst of power moves the 104 onto the runway. You let it roll a few yards, getting lined up nice and straight. Now, brakes on, check out engine performance. RPM. Exhaust Gas Temperature. Nozzle Position. Fuel Flow. Oil Pressure... Acceleration and idle checks...the engine is good. Go full afterburner - a pause, then, BAM! the afterburner lights. Brakes off at the same time and the 104 jumps forward, and accelerates, accelerates, accelerates, and you feel the seat against your back pushing, pushing, pushing. 100, 110, 120, 130, 140, 150, 160, performance okay, 170, ease the nosewheel off, 180, 190, ease back on the control column and the 104 starts flying...positively airborne, select gear up, keep the nose coming up...gear locked up, 240, 250, keep the nose coming up. The required climb angle seems steep. The 104 is going like a dart. It howls. It moans. It shakes. And here you're firmly strapped to it. Try a grin, just to prove you've enjoying yourself. Okay, never mind, try one later............

And so it goes. Recently, I was lucky enough to get checked out in the 104. If you are looking forward to the same, or if you are slated for the full course at 6 Strike OTU, Cold Lake, or even if you are not expecting either, pull up a flap, and we'll spend a while with the Coldlakians.

On the first working day at the Lake the CO and his chiefs will greet you and brief you. No fuzzy rambling address, but brief and adequate. An outline of the course, the ungarbled word about what to expect, and about what is expected of you. You decide you can hack it, and you will, too.

About three weeks will pass before you fly the 104. Be patient. It is time well spent. You will get first-class instruction on the aircraft's systems, plenty on how to handle it, and an introduction to the navigation techniques involved in the low-level strike role. Coverage is extensive but you can learn quickly at the free and fast pace of these lectures. On top of these it pays off if you get evening gen sessions going in the quarters, especially since a two-hour handling exam lies between you and your 104 check-out.

Number 10 Field Technical Training Unit figures very significantly during this period. It is very well equipped and with the help of the high calibre staff and excellent mock-ups (or is it mocks-up?) you soon get to understand how the 104 lives and breathes.

Also during the first three weeks you should get three trips in the CF104 Operational Flight and Tactics Trainer - you know, the Simulator. Mind you, you might be out of luck the odd time because of simulator unserviceabilities. Maybe it's better now, but they had their troubles when I went through. Behind the scenes it looked like someone tossed a bomb into Franco-American. It's a great machine though and you should try to get all the time you can.

If you are slated for the full course your program will look like this. Academics: 210 hours of formal lectures, plus 140 hours of supervised mission planning. Mission planning will involve many after-duty hours as the course progresses. You'll get map-happy for sure. There will be a wealth of interesting material, including Radar Interpretation, Target Study, Inertial Navigation and Special Weapons.

The Air Training Program covers 12 areas pertaining to the strike/recce role. A total of 100 hours between the dual and the single 104, 34 hours T-Bird, and about 8 hours in the Pinnocchio Dakota equipped with NASARR. For some reason a lot of people think this is Egyptian equipment but actually it is American and NASARR stands for North American Search and Ranging Radar, or so they tell me.

Inside the Dak, you will find radar equipment set up the same as it is in the 104 - it's a flying classroom in fact. Be prepared for some bumpy Dak trips. No reflection on the pilots. The trips are done low-level and some days are very turbulent. You might wonder how useful the Dak is in training connected with the 104. You will find it quite fast enough, especially if the business of radar interpretation is new to you, and you will soon agree that it is a very effective training aid. You learn to recognize features and checkpoints on the radar scope and to develop the skills needed to apply these techniques on the 104 at low level and high speed.

The Supply and Safety Equipment Sections are impressive. Some items will be new to you. The one-piece helmet for example. And spurs. The spurs fit your new style mukluks and they mate up with leg restraint devices on the 104 ejection seat. (How about that new rocket ejection seat - successful escape is now possible at ground level with speed as low as 90 knots). Incidentally, you will enjoy clanking around in the spurs, but until you complete your first solo trip the OTU staff frown upon the affectation of a bowlegged gait calculated to make you look like the leading man in an airborne version of Wagon Train.

Okay, the first three weeks are about up. Stand by for a Unit Check in the T33. This is the usual drill: local procedures. Area Recce. Aeros. Practice Forced-Landings. Let-downs. (Anyone for TACAN?) and GCAs. I got my check with the Chief Ground Instructor strangely enough. A keen type. When he's not at his desk, he's in the air. (Come to think of it, that could read the other way round.)

Now you are ready and eager to have at the 104. It is a wonderful new world of nozzles, afterburner takeoffs, afterburner climbs, Mach 2, supersonic formation, loops starting at 500 knots plus, twig-tickling at low footage and high knotage, weapon delivery, inertial navigation, boundary layer control, stick shakers, stick pushers, drag chutes, automatic pitch control, and many other features that make the 104 a challenging and immensely interesting aircraft.

Thorough briefings are given before every trip, dual and solo. Questions on emergencies and other vital items will be tossed at you often, so be ready with the right answer. External checks, starting procedures and line procedures are covered first. This must be the easiest aircraft in the world to start. Smooth and positive. It's a good idea to spend time on the line while you're waiting for your turn to check out. Work with the line crew and get to know them. These gentlemen rate with the best in the service. In fact, they reminded me a lot of my old squadron chaps. Starting and line procedures involve a craftily worked out exchange of signals between pilot and ground techs. These help ensure all systems are "go" before leaving the line, so you do your part conscientiously. Comes time for the first trip, dual, and right from the start you know you will like this aircraft. Nice cockpit. Instrument panel a bit crowded maybe but you need info about a lot of items. With all line checks done, you are ready to roll. A brief burst of power moves you out and into a turn to clear the line. Best nosewheel steering you ever tried. Positive control throughout. I've never flown the CF100 but they say the 104 steering is a lot like it. Anyway it is better than the Sabre's. The long pitot boom thrusts out like a lance. And indeed, sitting behind it, you feel like a modern Sir Lancelot. As with the bow-legged gait, however, radio calls like "Taxi clearance for Richard the Lionheart", are firmly discouraged. Pity.

Let's pick it up again where we had you going up like a dart, and then talk about general handling. Which reminds me - once the 104 is airborne, the nosewheel steering button becomes another radio transmit button. More than one first solo brave has left his imprint on the stick and kept this button firmly depressed after takeoff. Some interesting and startling vocabulary has been recorded so take care lest you should contribute some items never learned at your mother's knee.

Controls are light and positive. Powered all through, and the system includes an Automatic Pitch Control incorporating a stick shaker and stick kicker. They really work, too. If you attempt to fly at a critical angle of attack the stick shaker causes the control column to vibrate madly and it won't stop until you ease off the back pressure on the stick. And if you increase back pressure further, that is, if you attempt to increase the angle of attack, the stick kicker takes over and pushes the stick forward. It is a bit weird at first but you soon learn to appreciate the system, though of course you shouldn't experience the kicker except in familiarization and as might be required in an air test. These devices are designed to help keep you out of an intriguing manoeuvre known as pitch-up. Instead of stalling like the aircraft you are used to and either dropping the nose or merely wallowing about, the 104 nose suddenly goes up, and recovery from this fully-stalled condition requires plenty of altitude.

Throughout your 104 flying you will enjoy its extraordinary stability, especially during instrument work and in formation. Regarding formation, one old-timer told me his grannie, even when half full of gin, could formate the 104. Well, being an AFHQ type, and a DFS one at that, I quickly pointed out to him that CFP 100, Art 2.02, does, at least by implication, preclude anybody's grannie, no matter how well qualified, from flying the 104. And, further, that Art 2.25 requires at least eight hours abstinence before flying. These observations must have shaken him a bit because he's avoided me ever since. Anyway, not only does stability help in formation, but so does the quick response to power changes. Throttle opening produces instant acceleration, and a small power reduction results in quick drop-off in speed. You will find many applications for this unusual excellence in airspeed control.

If you are an aerobatic man the 104 is for you. Just thinking about the loop brings me half out of my chair. Drive her along at 10,000 feet, full military power, and 550 knots. Ease on 4 "G" - nice and positive, and up, up, up, she goes in a long streaking arc that carries you well past twenty thousand. The "lance" points the way up past the horizon then traces a path across a long slow expanse of clear blue, until you reach the inverted position.

It's a big, long, loop that gives you plenty of time to enjoy it. You are still upside down and now the lance moves down past the opposite horizon. Down, down, down and then points to the ground directly below. You ease off power as the 104 starts streaking down in the vertical dive. The ground starts to come up fast and you use speed brakes to hold her back. Just about now you figure some unsuspecting Albertan down there is in for a big surprise if you don't start easing this thing out. Again it is a long, smooth manoeuvre as the lance moves over the ground and up once again to the horizon. You check it there then put the spurs to her and let the 104 blaze along in level flight. A check on engine instruments then - BAM - full afterburner, and away you go - for a full afterburner loop. It's gyrendous, just gyrendous. Makes you tired, too.

To allow you to rest up a bit, a stab at Mach 2 is recommended. The 104 achieves this no sweat at all in level flight using full afterburner (A/B). Check your harness is tight. You will see why later. This will be a high altitude run so our speed will be around 660 knots as we go through the sound barrier, that is, as we increase speed past Mach 1, the speed of sound. Some aircraft do strange things when they penetrate the barrier but the 104 slides through as smoothly as a motion calling for an extension of bar hours. No control problems, and only reference to the Machmeter will tell you when you are through. The speed moves up steadily and again you are aware of excellent stability. Try a turn and it feels like the bird is on rails. Now you are up to Mach 2 and you begin to hear a weird howl from the airframe. Something to do with airflow around the engine intakes. 1200 knots, plus. Satisfied? Okay, fuel consumption is very high in afterburner so we won't stay long. Come out of afterburner and 0-00F - you are hard against your harness as the 104 decelerates with a rush. Ease off more power, pop the speed brakes and head for home and for another important phase of the trip - the circuit and landing.

Normal jet circuit procedures are used with the 104. A runup to the pitch at 325 knots, with flaps at takeoff position. You'll be pleased at how quickly you adjust to the higher speeds required in this aircraft. Pitch, and let the 104 coast around to the downwind leg. Wheels down at 260 knots and land-flaps down at 240 knots. The turn on final approach is done at 200 knots, and from there on, with about 87% power on, you begin a precision approach that finds you crossing the runway threshold at about 170 knots. Control is superb and you can place the 104 on the runway with velvet smoothness every time. With nose wheel on and steering engaged, deploy the drag chute. The braking effect will surprise you. No excessive landing run. Release the chute and you're home free. Naturally, you will be feeling pretty pleased with yourself. But don't forget, 104 check-outs are daily routine at Cold Lake, so, as you taxi in to the line, don't expect scenes reminiscent of Lindberg's arrival in Paris. Just park the bird nicely in the space specially tailored for it and shut down. Then go away someplace and think about it all.

Yes, sir, the 104 is a great aeroplane, and I found it inspiring to work with the dedicated people who back it up. My allotted ten-hour familiarization was used up all too soon and, as they say in the travelogues, I reluctantly bid farewell to the open spaces of the Golden West and made my way back to the gloomy catacombs of AFHQ. With just a suggestion of a high speed yaw, and wearing the new thin leading edge look of a man accustomed to travelling at Mach 2, I penetrated the Directorate of Flight Safety. On all sides, little sharp cries of astonishment rang out, tinged with utter disbelief. There had been, apparently, some doubt concerning the possibility of my safe return. The Director, G/C AB Searle (No, it's Arthur Brodie, not After Burner) was engaged in a reheated discussion on statistics - I forget whose. Cooling somewhat, he nevertheless greeted me with exhaustive warmth. "Congratulations Jacques!" (Very democratic, our Groupie - bilingual too). "Your name has been added to a growing and important list." I lowered my eyes, modestly. "In accordance with a recent order affecting those within four years of retirement, you will no longer be allowed proficiency flying."

Oh well, it was great while it lasted, and I can always play with my 104 pin when I feel like handling the bird again - that is if the Coldlakians ever get one for me.

GROUND CHECKED AND FOUND SERVICEABLE

S/L EG SMITH

Any pilot or technician who has been kicking around this old Air Force for any length of time is only too familiar with the term "Ground checked and found serviceable". Does the technician who is prone to use such a term after an unsuccessful attempt at troubleshooting realize that he is in effect, playing a mild form of "Russian roulette" with aircrew's lives at stake? In turn, has this technician failed because his attempts to diagnose a malfunction were made difficult or impossible by a pilot's thoughtlessly obscure L14 entry? Whatever the cause, the familiar term "Ground Checked and Found Serviceable" continues to appear in the L14.

As an example, the hair-greying experience related below occurred as a result of an unprofessional approach to an unreliable aircraft radio that had been Ground Checked and Found Serviceable after three previous flights - each having the same unserviceability reported.

"We were planning a flight in a C45 from Marville, France to Northolt, England. There was some anxiety about the weather, the destination was forecast to be 500 and 1; (ceiling and visibility); Marville was 200 and 1/2. However, after establishing a suitable alternate as part of a very thorough pre-flight preparation, we proceeded to the flight to sign out our aircraft. The L14 disclosed a disturbing situation; on three previous flights the radios had become unserviceable about an hour after takeoff. In each case, the rectification column contained the old familiar "Ground Checked and Found Serviceable".

In each case, the pilots had tolerated this vague phraseology in the L14, and were most aware of the need for reliable radios under the weather conditions common to this region, but with no choice of another aircraft, elected to carry on with the flight as planned. These previous flights turned out to have been "no sweat" affairs in good weather.

"Prior to takeoff everything checked serviceable. As we penetrated cloud after takeoff it became apparent that a return to Marville was out of the question; there was no doubt that the weather observer had been somewhat optimistic in calling the ceiling 200 feet! The flight was normal until we attempted to pass a position report to Brussels ATC when just south of Brussels. Repeated attempts to contact this agency were futile. It was soon obvious that both the receiver and transmitter were unserviceable.

"Here we were, on an IFR flight plan at night above an overcast with the weather at Marville so poor as to preclude our returning. The only alternative was to continue the flight as planned and cleared by ATC. Our real concern, however, was the necessity for an instrument let-down and most probably a GCA at Northolt in a congested area near London airport - but without radios, a GCA was impossible. In spite of our being unable to obtain an accurate altimeter setting, it was decided to carry out a beacon let-down over water using the still-serviceable radio compass - a let-down that would deviate sufficiently from the published pattern to avoid other traffic and ensure cloud-breaking over water to avoid high ground. Our intention was now to land at Manston.

"The let-down was successful as a cloud-breaking procedure; we broke out of cloud about 200 feet above the water. At this altitude, the aircraft was homed to Manston by radio compass and an unannounced landing was carried out successfully.

"It is impossible to convey in words the anxiety that prevailed in the aircraft. Had it not been for the Third Party another DFS statistic listed as "Undetermined" would now be in RCAF files. The crew had no alternative but to follow the procedure they did."

Why were these men placed in such jeopardy?

AIB investigations continue to uncover the too casual an attitude of some maintenance personnel who leave their tell-tale "Ground Checked and Found Serviceable" in the L14. If the pilot who writes a thorough report on a malfunction seeks out the NCO i/c or specialist to brief him on all pertinent symptoms, it will ease the problem of trouble-shooting. If the technician is unsuccessful in pinpointing the cause of the malfunction, he should refer the problem to his supervisor who can decide on the proper course of action - preferably a change of component and a test flight in good weather.

Remember that a component may function normally on the ground but not in the air - let's once and for all ban the term "Ground Checked and Found Serviceable".

"On the glide path, 130 your heading...2 miles, excellent rate of descent, 130 your heading...1-3/4 miles from touchdown, 130 your heading, 130 - GCA just lost you on precision - lost you - carry out missed approach - GCA standing by."

"Tower, GCA, I just lost radar contact at, ah, 2-1/2 miles."

"Are you still talking to him?"

"9697, GCA, do you read?"

"See anything at all on radar, GCA?"

"Haven't got a thing Tower."

"9697, Tower, do you read?"

"Have you got him, Tower?"

"Negative."

"Looks bad!"

"I'm treating this as an off-station crash at 2-1/2 miles."

"Roger."

FINAL TALK-DOWN TO BRISTOL 9697

This was the final talkdown to Bristol 9697. The aircraft crashed into dense woods 1-1/2 miles from touchdown. It was dark and the GCA operator erroneously reported that he had lost contact at 2-1/2 miles. As the crash actually occurred at 1-1/2 miles, 2-1/2 hours elapsed before the site was located. Fortunately there was no major fire but of the eleven on board, only three survived.

Of the thousands and thousands of approaches completed since the RCAF adopted GCA as an approach aid, this is the first accident for which GCA was to blame. Obviously this is an isolated case which should not destroy our faith in GCA. But a close analysis of this accident suggests some areas where we can "double check", just to be sure.

The investigation indicated that the GCA operator was telling the pilot that he was "on the glide path" when in fact he was about 200 ft low. The weather at the start of the approach was 200 ft and 4 miles; during the approach a special observation was taken and relayed to the pilot as 150 ft overcast and three miles visibility. This was below limits but the pilot elected to continue the approach, requesting Met to select the best alternate in the area in case a diversion should be necessary.

The approach was apparently going normally when without warning the aircraft crashed into a tree. The tree that was first struck was 140 ft above the aerodrome elevation. Had the aircraft been on the proper glide path it would have been 373 ft above the aerodrome elevation. Thus the aircraft was 233 ft too low and in fact 60 ft below the minimum altitude which is permissible without visual contact with the runway. It is not likely that a pilot would deliberately descend below minimum altitude at a mile and a half from touchdown even when GCA was calling him "on the glide path". One explanation is that the altimeter setting passed to the pilot was 30.32, but the correct altimeter setting taken immediately after the crash was 30.30. This difference could account for a loss of 20 ft and since the maximum allowable error for a serviceable altimeter is 50 ft, these could combine to account for the 60 ft below minimum. Thus it might have been that the pilot was just levelling off at what he thought was the correct minimum when the crash occurred. In fact, one of the survivors is under the impression that power was being applied just as the aircraft struck something. On the other hand, many pilots when doing a precision GCA are not in the habit of closely monitoring the altimeter until less than one mile from touchdown because, with 2-1/2 degree glide slope, minimum altitude should not be reached until three quarters of a mile. The pilots of Bristol 9697 simply may not have noticed that they were passing through minimum altitude.

A check of the GCA unit showed that the radar gave an unusually large return. Although one might normally think a large return a good thing, with GCA it can reduce accuracy. On this particular equipment the large return combined with the operator using excessive gain caused a side lobe effect so that it was possible to track the wrong lobe. Thus when the operator thought he had the aircraft on the glide path, it was in fact about 200 ft low.

On the cross-sectional diagram (Fig 1) the maximum permissible obstruction heights are shown. The tree which 9697 hit is shown a little less than 1-1/2 miles and as can be seen it is just under the maximum height permissible. The top of the tree is 233 ft below the glide path.

The diagram also shows that it is dangerous to let down to GCA minimum altitude (200 ft above airfield elevation) at distances in excess of one mile. From 1-3/4 to 4-1/4 miles GCA minimum can be right at ground level and beyond that distance it can be below ground level. A pilot should become suspicious if GCA is calling him on the glide path and minimum altitude is getting close at anything more than one mile from touchdown. Note, though, that at one mile the glide path for a 2-1/2 degree slope is only 66 ft above the minimum. In aircraft having two pilots it should be SOP for the pilot not flying, to cross check the altimeter for proper reading every time GCA gives a distance. Of course this will require GCA to call the distances very accurately and the pilot to carry a chart so that he can calculate the indicated altitude that corresponds to the distance from touchdown. Fig 2 gives the altitudes above the aerodrome that correspond to the various distances for 2-1/2 and 3 degree glide angles.

In a single-seat aircraft it may be too much to expect the pilot to perform all the required calculations and fly the aircraft at the same time. However, it would be a good idea to memorize a few check points - for example 800 ft above runway elevation at 3 NM (for a 2-1/2 degree glide path) should be easy to remember. Also at particular airfields the indicated altitude and distance may occur in round numbers that can easily be remembered. For example, at 2 miles from touchdown at Ottawa, the indicated altitude should be 900 ft. (906 ft to be exact). Another good check point is the distance at which the glide path is initially intercepted. Bristol 9697, for example, intercepted the glide path at 6-3/4 miles. At an altitude of 2500 ft indicated, the glide path should be intercepted at 6 miles. Therefore at 6-3/4 miles, if the altimeter is reading 2500 ft, the pilot can conclude that either his altimeter is reading 200 ft low or the GCA glide path is in error. He knows the amount of discrepancy (200 ft) because every three quarters of a mile represents 200 ft of altitude. The difference between GCA and the altimeter can then be resolved at 6 miles before a dangerous situation develops.

As previously mentioned, this is the first accident in the RCAF caused by GCA and consequently we should not suddenly decide it can no longer be trusted. The thousands and thousands of successful runs have proven its dependability. In fact, it was probably that complete trust in GCA that led to the one crash we have had. But we must always remember, humans, or equipment made by humans, are never infallible. A pilot does an external check of this aircraft before flight not because he expects to find something wrong or because he doesn't trust the airmen who did the BFI - it's just a double check. If a double check is possible, then certainly it is worth the effort especially when your life and the lives of others may be at stake.

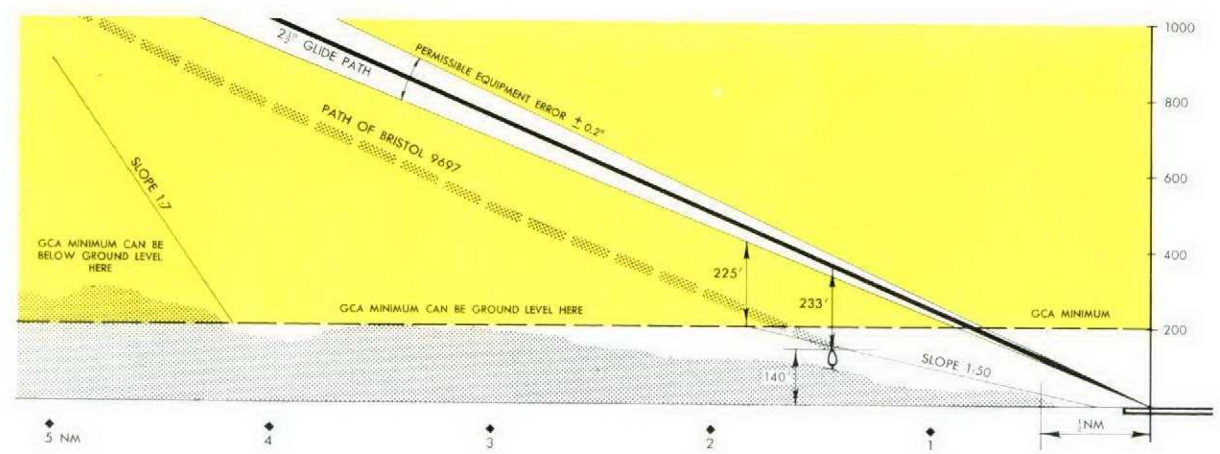


FIG 1

FIG 2 ALTITUDE ABOVE AERODROME IN FEET

GLIDE ANGLE	¼NM	½NM	¾NM	1MN	2NM	3NM	4NM	5NM	6NM	7NM	8NM	9NM	10NM	11NM	12NM	13NM	14NM	15NM
2° 30′	67	133	200	266	532	800	1065	1330	1600	1860	2130	2400	2660	2920	3190	3460	3720	4000
3°	80	159	238	318	635	955	1270	1590	1910	2220	2540	2860	3180	3500	3820	4130	4450	4770

GOOD SHOW

O/C RG BOEMARK-NOEL

During a night exercise of circuits and landings at Stn Moose Jaw, O/C RG Boemark-Noel levelled his aircraft at a thousand feet. The student pilot relates "I heard a loud bang and felt something strike the right side of my face forcefully, temporarily blinding me". A bird had struck the windscreen damaging the front and side panels. O/C Boemark-Noel was temporarily blinded due to small fragments of the windscreen striking him in the face. Despite his affected vision this cadet successfully landed the aircraft and was then taken to the hospital for treatment.

Considering this student's level of experience the emergency was handled in a most commendable manner. We are pleased to include him in our "Good Show" column.

LAC GF CUMMINGS

LAC GF Cummings, of 409 AW(F) Sqn, Comox, was replacing a CF101 static ground wire, when he noticed that the wheel assembly of the left nosewheel appeared to be damaged. Checking further on his own initiative he discovered that the inner bearings had disintegrated.

LAC Cummings, by his alertness discovered a failure that would have caused serious damage to the aircraft on the next flight had it remained undetected. This is a good example of accident prevention, and Flight Comment is pleased to include this airman in the list of "Good Shows".

A/SUB-LT RW LUXON

A/Sub-Lt RW Luxon of Centralia was flying the last leg of a Chipmunk solo navigation trip. Approaching the check point near Kitchener, Ont, his engine began rough running with severe airframe vibration. Prescribed emergency checks failed to remedy the situation; the engine could maintain only 1500-1600 rpm. When the throttle was opened for more power the engine cut.

At an altitude of 2500 ft, A/Sub-Lt Luxon elected to force-land while there was still some engine power. Landing at Kitchener was ruled out to avoid the hazards of overflying a populated area in case of complete power failure. A successful forced landing was made in a rolling field with only slight wing tip damage caused by striking a sharp knoll.

A/Sub-Lt Luxon is to be commended for his capable and professional handling of this emergency and Flight Comment is pleased to include him in the list of "Good Shows".

F/L RD NURSE F/L WJ HUTCHINSON

F/L RD NURSE

F/L WJ HUTCHINSON

F/L RD Nurse, aircraft captain, and F/L WJ Hutchinson, first officer, were flying a Hercules from Thule in Greenland to Alert, NWT as part of Operation "Boxtop".

The aircraft had just taken off from Thule at 135,000 lbs all-up weight with 35,000 lbs of diesel fuel in bulk fuel bags in the cargo compartment. Shortly after initiating the climb, number four propeller low oil light illuminated. Number four was feathered. As the crew started a turn back to Thule, number three propeller low oil light came on. Number three was also feathered. With both engines out on the starboard side the situation was indeed tense. Obviously they were losing oil and there was the worry that possibly the same thing would happen to the two remaining engines. However, with superb airmanship and cool judgement the aircraft was safely landed at Thule. This was the first time an RCAF C130 has been landed at maximum all-up weight with two engines out.

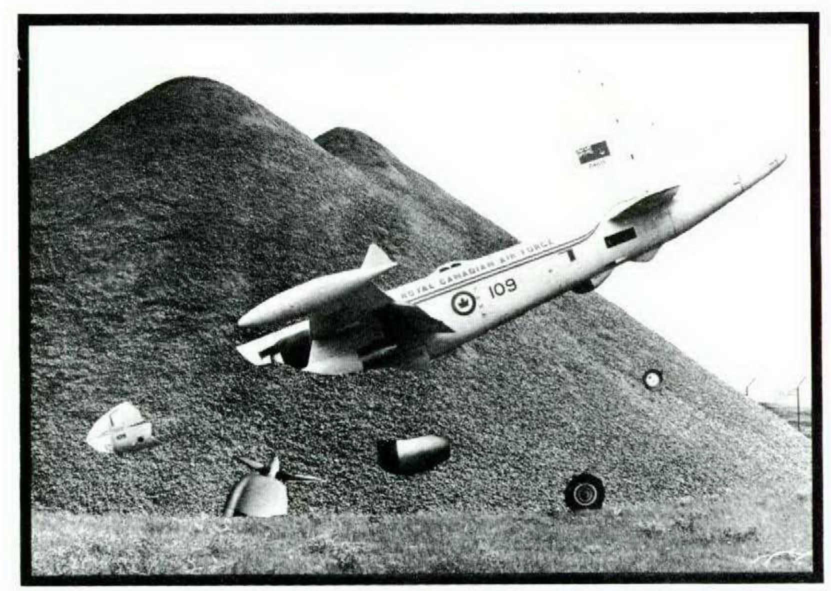
The loss of oil was due to the oil caps not being installed properly after an inspection. Both F/L Nurse and F/L Hutchinson are commended for their professional assessment and reaction to this emergency. The captain was sitting in the right hand seat during the emergency and there was no time to change seats with his first officer who performed the landing. His comment afterwards was, "In a situation like this, it is always handy to have a chap sitting beside you with 10,000 flying hours" (which F/L Nurse has).

"Good Show" to both F/L Nurse and F/L Hutchinson.

WARNING CONSTRUCTION IN PROGRESS

As anyone who has been to RCAF Stn Summerside lately will know, there is a lot of construction going on. To warn pilots of the danger, F/L Bud Lloyd, then Station Flight Safety Officer, displayed this rather interesting poster.

WARNING



CONSTRUCTION

IN PROGRESS AT THIS AERODROME

NATO RUNWAY MARKINGS

It's embarrassing enough to drop beyond your axles in mud on a back-road some dark night but when the same kind of thing happens to your aircraft in broad daylight in the runway overrun at a busy airport, not even a visor can hide the crimson glow! In this case (see photo) the pilot simply mistook, what looked to him like a black-top runway extension and made an honest error. The large YELLOW CHEVRONS covering this area conveyed nothing to him. These chevrons should have told him to STAY OFF.

It was Pilot Error - but an error quite a few of us could commit. What would those markings have told you?

Although not all runways have NATO standard markings, the RCAF has adopted the system and all aircrew should become familiar with it. The important feature of this system is the method of marking DECEPTIVE PAVING, ie, paving which is merely a veneer of asphalt extending from the edges of taxiways and along the sides and in overruns of runways. These areas are thinly paved (to solve problems of FOD, drainage, weeds, etc) and will not support a load. They are all marked by YELLOW bands three feet wide. From the edge of taxistrips these bands extend at right angles whereas in areas of deceptive paving in overruns and adjacent to runways, these bands are at 45 degrees.

Deceptive paving markings are not mandatory. It is possible therefore to have such areas NOT marked in this manner.

Mandatory are:

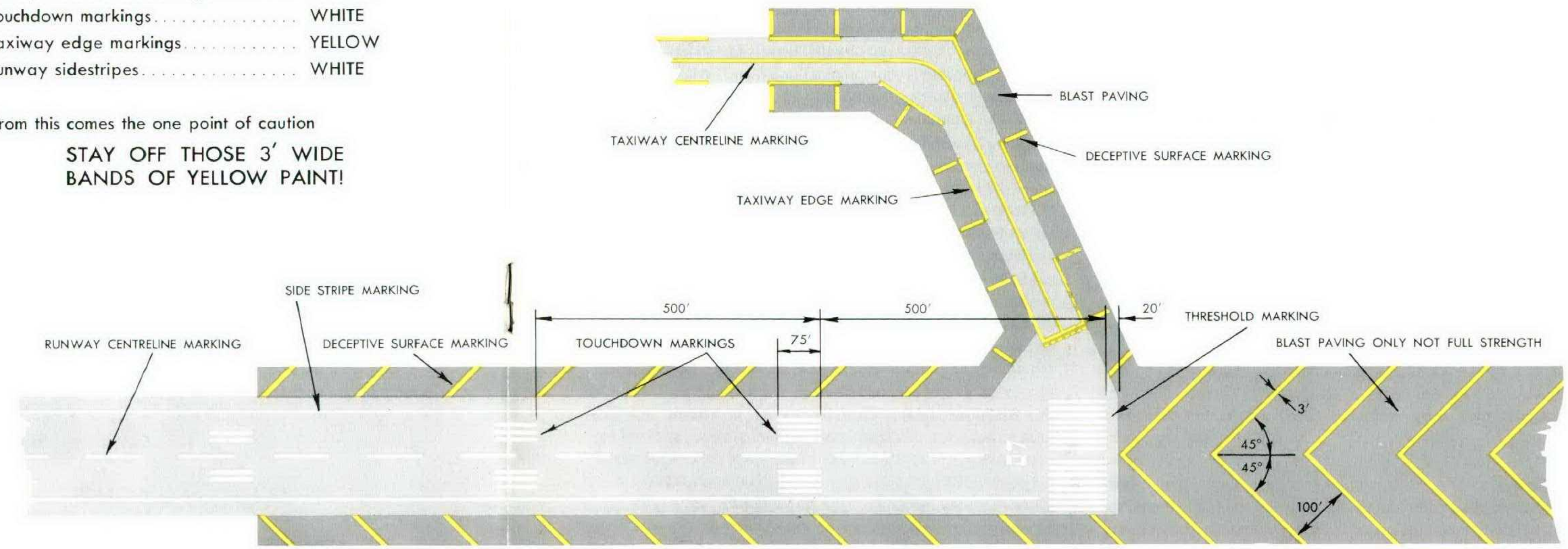
runway centre-line marking	WHITE
taxiway centre-line marking	YELLOW
runway threshold marking	WHITE
holding position marking	WHITE
runway numbering	WHITE

Those which are not mandatory are:

deceptive surface markings	YELLOW
touchdown markings	WHITE
taxiway edge markings	YELLOW
runway sidestripes	WHITE

From this comes the one point of caution

STAY OFF THOSE 3′ WIDE BANDS OF YELLOW PAINT!



THE MIGRATORY BIRD PROBLEM

For several weeks out of each year the RCAF must share the airspace over Canada with millions of bird-brained aviators who, without a flight plan and in a NORDO (no radios) flight condition, fly their own centuries-old airways. The sheer size and weight of some of these migrants (up to 30 lbs) is enough to make anyone realize that bird strikes at present aircraft cruising speeds render all our aircraft most vulnerable, particularly in the cockpit window regions. By good fortune - and at the present state of our knowledge and technology, it is this alone - the RCAF has not sustained loss of life by bird strikes, although there's been some dicey close calls.

The in-flight bird strike hazard is most acute during the Fall migrations from September to November, when enormous numbers of birds take to the sky. Large waves or formations of birds are liable to be in almost every region in Canada where military aircraft are flying. Most Canadian birds migrate south of the border to their winter homes but the most hazardous are the large species such as geese, swans, ducks and cranes. The greatest hazard potential lies in their habit of migrating in huge flocks in concentrated areas. In some places as many as 500,000 birds may take off in short intervals creating an almost solid path across the sky flying up to altitudes between 5000 and 10,000 feet.

The accompanying map produced by Dr FG Cooch of the Wild Life Service of Canada shows the migratory routes of the larger birds, ducks, geese, cranes and swans.

The largest concentration in point of time is usually between September 25 and October 20. Migrators usually start leaving their homes in the northern regions of Canada around the beginning of September and stop at "staging" areas such as Hudson Bay, James Bay, Cap Tourmente, PQ, Kingsville, Ont, and Big Grass Marsh, Man. They feed and rest until weather conditions favourable to migration, eg, a tail wind, signal their departure. Geese, for example usually take off in large groups from dusk to midnight. Although the right conditions start the birds on their journey they will not stop for weather once they are on their way. They do however, have traditional stopover areas enroute to feed and rest. The Blue Goose may fly non-stop from James Bay to Louisiana, a distance of 1700 miles.

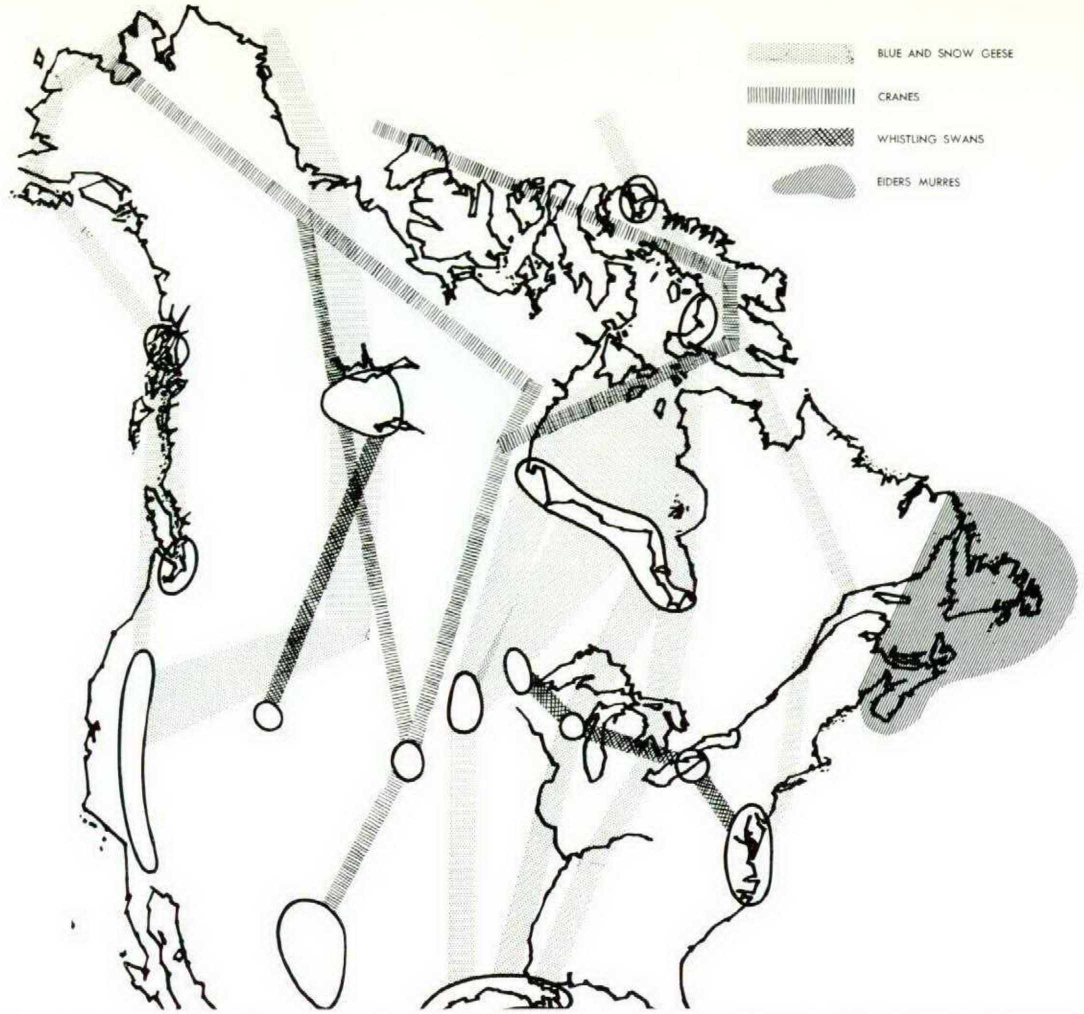
Bird watching and banding plus many experiments have revealed many of the secrets of migration. Moon watching with small telescopes and now the radar screen have exposed more facts about night movements. But ornithologists are still searching for some definite answers to questions. Why do birds leave their breeding areas in the north, travel long distances to winter homes and return the following year to the same breeding scene on a remarkable time schedule? How do some shore birds quite successfully fly from the ends of the earth twice each year such as the Arctic Tern which nests from the Gulf of the St Lawrence to the Polar region and winters as far south as Antarctica? How do birds maintain direction or find their way at night? Many theories have been advanced and studies made to prove them.

AID FOR AIRCREW

The risk and cost involved in bird strikes have sparked an intense interest in bird habits and in the application of knowledge already acquired. Much has been done to overcome bird strike hazards at airports but until lately little has been accomplished to alleviate the in-flight problem. An effective bird reporting system in the migration period, that is, facilities to warn aircrew of the presence of large bird flocks in the flight path region seems to be the best answer to the problem and is now in the development stage by the National Research Council Associate Committee on Bird Hazards to Aircraft.

The use of radar to track bird movements and the relationship between migration and weather conditions are two quite recent discoveries which the committee are making use of to work out their bird warning program. Radar has proved to be an effective instrument for providing information on the direction and density of bird flights. On a radar screen many echoes dismissed previously as "noise" or "angels" are in fact echoes from birds in flight. This was confirmed dramatically by time-lapse motion photography utilizing one frame for each sweep of the radar screen.

For fifteen years ornithologists have been



working on a theory that weather patterns influence bird migrations, reaching maximum density under certain favourable and therefore predictable weather conditions. In the Fall, birds fly southward down the east side of a high pressure area which has a southward flow of air. In the spring they fly northward up the west side of a high pressure area with its northward flow of air or in the warm sector of a low pressure system.

Last autumn an experiment at Toronto Airport evaluated the feasibility of correlating weather maps and radar to predict bird movements. A motion picture camera was installed on a monitor radar screen using info from the local Area Traffic Control radar unit. Two heavy flights were recorded, one of small birds on Oct 8 and 9 and one of larger birds in flocks, probably waterfowl on Oct 29. Results of the experiment have shown there is a good possibility that weather forecasts can be utilized in predicting mass movements of some birds. Further study of this bird detection and warning program will be made again this Fall. A vital part of this program is the information that aircrew can provide by conscientiously reporting all in-flight bird observations on form AFHQ 1143 recently released in the RCAF. (See your FSO). Accurate information on the altitudes at which birds fly is especially needed.

The frightening possibilities of a severe bird strike should spur aircrew to take into account some ways to combat the hazard:

- if possible, avoid low altitude flights in migration "airways" - add a few thousand at this time of year;
- watch the weather map for the wind favouring migration; and
- give all possible help to the development program now underway by reporting your observations on the RCAF BIRD REPORT form AFHQ 1143.

References: Canadian Wild Life Service—
(Dr FG Cooch and Dr VEF Solman)

The Migration of Birds—Jean Dorst
(of National Museum of Natural History, Paris 1956, translation 1962)

Associate Committee on Bird Hazards to Aircraft
(S/L GW Ovans)

DANTE'S INFERNO

by COLONEL WR TURNER, MD

At the risk of being killjoys, may we point out one more problem for the pilot to mull over? The problem simply stated, is this: cockpit heating and ventilation malfunctions, with failure on the hot side, can be disastrous. The following case history, occurring in another command, shows what can happen:

"During an extended overwater flight, the cockpit air temperature of an F100 aircraft failed to the full hot position. Attempts to correct the condition were to no avail and the pilot elected to continue on to destination rather than land at an alternate airfield enroute. Air refueling had been accomplished and sufficient fuel was available to reach the destination if the malfunctioning aircraft remained at altitude with other aircraft in the flight.

"A short time after overflying the alternate airfield, the pilot decided that the cockpit temperature was too hot to continue on to the destination with the rest of the flight. He was joined by a wingman and both aircraft turned back toward the alternate airfield. While enroute to the alternate, the wingman noted very erratic flight techniques being used by the pilot of the malfunctioning F100. Finally, it became necessary for the wing aircraft to take the lead position and continually give verbal instructions to the pilot in distress. Both aircraft were descended to a lower altitude where the canopy of the distressed aircraft was jettisoned. Apparently, the pilot's exposure to the extreme cockpit heating had overtaxed his physical tolerances because erratic flight techniques continued even after canopy jettison. In fact the distressed pilot extended and retracted speed brakes and landing gear spasmodically - contrary to the escort pilot's instructions. Eventually the pilot lost all ability to control his aircraft and crashed into the ground just 10 miles short of the alternate airfield.

"Had the pilot of this aircraft made the decision to land at the alternate airfield when the malfunction first occurred, or at least jettisoned the canopy at the first symptoms of erratic flight, there is little doubt that he would have landed safely at the alternate field."

What happened? It's fairly simple: hot air may have been injected into the cockpit in this case at temperatures as high as 250°F. This might be a welcome thing in a 2-storey farm house at Flin Flon in January, but in an aircraft cockpit, it proves to be too much. In spite of radiation to the outside of the aircraft, temperatures built up rapidly. The result? A heat load which the human body, as remarkable and as adaptable as it might be, cannot tolerate. Man's first response to overheating is by vaso-motor regulation. In case you don't know, this gem-type phrase simply means that the blood flow at the surface areas of the body, to dissipate heat, is increased several times. If this doesn't serve to keep body temperature within normal limits we start to sweat and lose heat more effectively by evaporative cooling from the skin surface. But when sweating ceases to be adequate, we have reached the end of the line, and the body temperature inevitably rises. This is when we get into trouble. If the deep body temperature rises more than 4°F, cooling mechanisms cease to be efficient, and we get deeper and deeper into trouble. Just think about it: if you had a fever of 103°F, would you consider yourself qualified to fly? But we go farther than this. When our body temperature reaches this level, heat exhaustion ensues. Fatigue, headache, dizziness, nausea, shortness of breath, apathy, poor judgement, irritability, and finally fainting follow. These symptoms hardly describe a pilot capable of continuing safe and effective flight. Beyond this point, although the pilot may be incapacitated enough that he will never reach a further point, heat stroke occurs, and body temperature climbs rapidly to temperatures of 105°F or above. At these levels, convulsions and coma occur rapidly and death may be imminent. With the cockpit temperatures that we are dealing with in a full heat-on failure, all body functions could become completely disorganized within one-half hour. There is always a great variation in susceptibility from individual to individual, but inevitably, with full-on heat failure in present day fighter aircraft, you're bound to be in big trouble quicker than you can say JOE BTFSPLK.

Sounds a little like hypoxia, doesn't it? The way extremes of heat make a pilot utterly incapable of accomplishing his job with such rapidity, and without his even realizing what is happening?

Another example:

"A pilot of a T33 landed at a transient base and reported that the cockpit temperature control had failed to the full hot position just prior to landing. Transient maintenance personnel made 'adjustments' on the cooling system but reported to the pilot that certain replacement parts were not available to insure positive repair. In his anxiety to continue with the cross-country mission, the pilot elected to fly the aircraft to a distant base rather than remain on the ground awaiting replacement parts.

"A normal takeoff was made and the cockpit temperature again failed to the full hot position during the turn out of traffic. The pilot decided to continue on course to the distant base using ram air to cool the cockpit. He stated that he closed all vents in an attempt to stop the hot air flow into the cockpit.

"After 15-20 minutes of flight the temperature in the cockpit was so hot he was no longer able to handle the throttle with his bare hands (he finally had to borrow a pair of gloves from the enlisted man who was a passenger in the rear cockpit). The cockpit heat became so unbearable that he decided to return to the base of takeoff.

"Three erratic landing approaches were made at the field. Ground observers stated that each successive approach looked worse - some observers believed that the pilot was experiencing control difficulties. On the third approach, a very unprofessional landing was accomplished and a full stop was made at the end of the runway. No attempt was made to taxi off onto a taxiway.

"The pilot raised the canopy and got out of the cockpit. He was standing on the wing helping his passenger out when he collapsed. Both occupants of the aircraft were then taken to the base hospital in an ambulance. Examination revealed large areas of their bodies were reddened - as if scalded by boiling water.

"Interrogation revealed that the pilot was not aware of the ventilation standpipe to the right rear of the ejection seat. It had been open during the entire flight. When asked why he did not jettison the canopy when temperatures became extreme, his reply was, 'I've got too much pride to jettison a canopy for such a minor problem.'

"He had been airborne for approximately forty-five minutes. His false pride nearly caused the destruction of an aircraft and possible death to himself and his passenger."

The same sort of case, and in a T-bird yet! Somebody "lucked out" in this case, especially when he did not realize that he was in the condition that he was. Imagine, assisting his passenger from the aircraft, then collapsing. Again, loss of body heat balance is a sneaky thing, and drags you down before you know what's happening.

We continue to experience heat-vent failures. For the most part these occur in situations where rapid landing can be accomplished. But, the same events can and do occur under circumstances where instant terra firma is not available, and prolonged flight might be required. When rapid landing cannot be accomplished, some means of turning off the pressure cooker is imperative. Even though this may mean jettisoning a canopy, which might mean buying the boys a beer at the club, it seems preferable to having the boys buying flowers for your funeral. Think about it. Remember that a heat-on failure can "cook your goose" in a remarkably short time, and that as you are cooking, you lose your senses as insidiously as you do from lack of oxygen. Think about this problem, and keep it in mind. It might prevent you from having a bad day.

PACAF FLYER

Two vital oil caps were improperly installed recently resulting in a close-call for the crew of a four-engined aircraft. The man who made the mistake had performed this routine job many times before and yet a near-disastrous error was made. Why?

The error had been committed by a well-motivated man but under fatigue-inducing circumstances—away from base—very adverse weather—on a special max-effort type exercise.

FATIGUE

by COLONEL WR TURNER, MD

Fishin' and sittin' are, at times, enough to fatigue a body. On the other hand aircrew must continue to operate efficiently under a multitude of continued stresses. The author discusses these pressures, and proposes one way to overcome their effect.

Lately, much has been said and written about fatigue, this as a result of our increased alert posture.

Time was, when aircrew would complain of being overworked when they put in a 40-hour week, and we have seen those same aircrew when world conditions change and defense must adapt, sit in the hangar - in the alert shack - by the phones - or wherever they are needed - for 120 hours a week.

It seems there is always a shortage of personnel, yet still we must accomplish the same vital mission with what we have. So we must be on the lookout for the symptoms and results of fatigue and attempt to eliminate accidents or hazards thus caused.

Many aircraft accidents are attributed to materiel failure due to structural fatigue, as a result of twisting, torsion, tension, stress, vibration, etc. Engineers do their best to design aircraft and components that resist fatigue failure. But what of our aircrews – crews that must adapt to the same stresses and strains, plus many more?

Last year an aircraft on disaster relief landed with the gear indicating unsafe. A major accident resulted - a reduction in mission capability. It was pilot error, but what had happened? The crew were fatigued. They had flown for about ten hours, landed at a staging base, loaded their own bird and took off for a strange field in a strange country. The co-pilot remembers seeing the unsafe indication; the pilot heard the horn, yet the aircraft was bellied in.

WHAT IS FATIGUE?

What is fatigue - this fatigue that affects us so radically? How do we look for evidences of fatigue following a mishap? What are the results of fatigue?

Aviation Medicine studies have proven that advanced chronic fatigue can cause circulatory instability, loss of weight, hypoglycemia, and disturbances of co-ordination. These are only the overt symptoms. Actually, "fatigue" has no specific scientific meaning, nor can it be measured or defined. When we are fatigued we have feelings of tiredness, lassitude, sleepiness, and so on, but these are incidental. A man must realize that fatigue results in loss of efficiency and skill. Since we cannot measure fatigue we have difficulty in controlling it but we can study the factors that produce fatigue and the relationship that these factors have to each other.

FATIGUE CAUSES

So we get down to what causes fatigue. First of all, the causes must be placed in two categories - environmental or external causes, and internal causes. Here's a few of the environmental factors that cause fatigue:

- prolonged flight
- poor visibility
- turbulence
- climatic changes
- number of landings
- route flown
- density of traffic

Then, add to the above conditions:

- cramped positions
- restricted movement
- temperature extremes
- noise
- vibration
- acceleration (g forces)
- decreased barometric pressure
- various degrees of hypoxia

You will notice that several of these items, or rather most of them, are parallel to the factors inducing structural failure in metals. These fatigue-inducing circumstances are external factors only, but humans are not metal and are subject to internal stress as well. Let's look at some of these internal factors:

boredom	panic
responsibility	frustration
attention	concentration
uncertainty	apprehension
anxiety	fear

If the experts in aerodynamics subjected their prototype aircraft to half these stresses we'd be pretty far back in the field of flying! But we're not through yet. Let's add more factors to the list we stuff into the cockpit with our crews:

- pain
- hunger
- thirst
- lack of experience
- concern over status (don't laugh)
- family illness
- financial problems
- hangovers (admittedly self-induced)
- personal inadequacies
- inadequacies in teamwork

The old cliche about the weight of the paperwork equalling the weight of the aircraft? Peanuts. Now that we've loaded this crew down like a pack mule, what is the result? A relatively simple and routine task is forgotten. Is there any wonder then, why fatigue is so insidious and deadly?

THE PROOF

In the Cambridge Cockpit Studies on fatigue conducted in England with a Spitfire simulator, these four conclusions were drawn:

- the timing of motor responses suffers as fatigue develops.
- fatigue produces a willingness to accept lower standards of accuracy and performance.
- fatigue tends to induce a shifting from pure instrument flying to seat-of-the-pants flying.
- fatigue induces a failure to check all instruments and control switches as specified.

THE DANGERS

You will agree that stress is uncomfortable, and so we are tempted to escape from it as soon as possible. Thus, accident reports indicate short-cuts, reductions in standards and all too often, get-home-itis. In addition, end deterioration sets in when crews become aware that the end of a mission is in sight and we note a sudden increase in error as a result of this relaxation. Could this be a reason for the percentage of our accidents that occur in the landing phase of a mission? Probably.

Missions causing anxiety produce far more fatigue than do longer routine missions. Anxiety causes tiredness. This aspect of fatigue could be the topic of a separate article; we mention it only in passing.

But what are some of the other more obvious results or reactions of this thing called fatigue?

- drowsiness
- lack of stability
- day-dreaming
- failure to remain alert
- carelessness
- loss of self-control
- becoming aware of an error, but being apathetic about making a correction
- irritability
- irrationality

By irrationality, I refer to irrational acts which invite or cause accidents, but often can neither be remembered nor explained by the person.

COPING WITH FATIGUE

Having delved briefly into the causes and effects of fatigue, I'd like to recommend a method for reducing fatigue, and it involves only one word: Training. For example, training, or overlearning of emergency procedures enables aircrew to cope rapidly and almost automatically with a situation. This reduces the amount of stress involved in flying as competence builds confidence.

Learning the facts of fatigue will make us more alert to its symptoms and therefore aid in keeping us from committing errors resulting from fatigue. Training, with experience enables a man to concentrate on only the more important details of a job. No effort or stress is wasted on trivia, unnecessary activities, or the portions of a job which can be performed with little effort.

A good instrument cross-check for example evolves from continual instrument training. We know that fatigue will degrade the best cross-check, sometimes to the extent of fixation on only one instrument. Training enables aircrew to make the proper decision, sometimes in a split second, even though decision-making is readily degraded by fatigue.

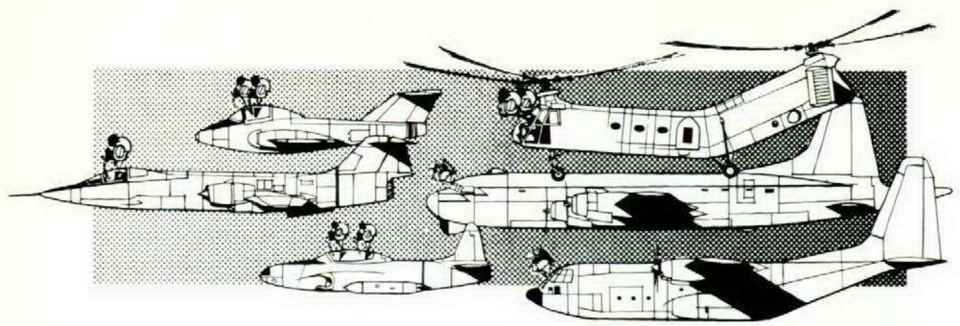
The supervisor must be alert to the results of fatigue, as well as its symptoms, not only in himself but in those he supervises. The individual, in turn, should be able to recognize the onset of fatigue and its potential for causing disaster. Schedules must not be enforced without consideration of fatigue. Every level of command has its responsibility in eliminating the fatigue factor. When long hours cannot be avoided, fatigue must be recognized as a potential hazard as it invariably leads to apathy or at the other extreme continued stress and anxiety.

FATIGUE—A KILLER?

In the early days of aviation, carbon monoxide was suspected to be an insidious killer; later, as we went higher into the atmosphere, hypoxia joined the list. To this list add fatigue. And how many accidents attributed to carbon monoxide and hypoxia were actually compounded by fatigue? Preventing future fatigue-caused accidents will depend on our understanding the phenomenon - and all of us doing something about it.

INTERCEPTOR

HEADS-UP



F/L GC BOYER

During a training mission, the student pilots were carrying out a manual gear raising and lowering practice. During the raising of the nosewheel, abnormal jerking and vibration was felt; a visual inspection confirmed that a cam follower in the nosewheel mechanism was badly damaged. The nose gear was lowered and raised another time, but jammed down in an unsafe condition. The two engineers working in unison bent the damaged cam mechanism out of the way after a ten-minute struggle. The pin was then inserted. The captain landed the aircraft without incident, but with considerable caution since hidden damage to the nosewheel may have occurred resulting in possible loss of nosewheel steering. Metal fatigue was to blame.

Flight Comment is pleased to recognize F/L Boyer's able handling of this emergency by awarding him a "Heads-Up".

F/L HE TREWIN

F/L HE Trewin, captain of a passenger Dakota, sensed an unusual tendency to swing to the left just as he reached takeoff speed. The swing was corrected with right rudder and as the aircraft became airborne, a definite vibration was noticed. When the brakes were applied the vibration stopped. F/L Trewin concluded from these symptoms that probably the port tire had blown, However, there was always the chance that something more serious was wrong with the undercarriage and it would be prudent to take all possible precautions.

During the flight, F/L Trewin personally briefed each passenger that he might have to use harsh braking on landing. He ensured that everyone had his seat belt done up tightly and that all loose articles and cargo were securely tied down with extra lashings. Emergency exits were again pointed out and the crewman, Cpl F Pattison, was stationed in the cabin for landing.

An emergency was declared and the fire trucks and ambulances alerted. The runway in use had a 15 kt crosswind from the left. As the indications were that the difficulty was most likely with the port undercarriage, F/L Trewin requested and received permission to land on the opposite end of the runway so that he would have a starboard crosswind on landing.

On touchdown, F/L Trewin held the port wheel off as long as possible and finally when it settled, kept the aircraft straight by using port engine and hard right brake. The aircraft was brought smoothly to a stop not more than 30 feet off the centre line. Inspection of the wheel confirmed that the tire had blown and in addition the wheel rim itself had failed.

For the very thorough preparation and professional manner in which F/L Trewin executed the landing, Flight Comment is pleased to cite his performance as an example of "Heads-Up" flying.

F/L DJ McKAY

F/L DJ McKay was flying a CF104 on a night mission. Just as he was coming off target, the platform toppled, the OFF flag appeared, the Inertial Navigator fault light came on, and the autopilot disengaged. F/L McKay turned to a westerly heading and climbed to just below an overcast at 10,000 feet from which rain was falling. Three air alignments were attempted without success. On the third alignment the PHI and main attitude indicator froze on a heading of 280°. A check of the C2G compass indicated it had frozen on a heading of 150°. TACAN was selected but no station could be picked up. The aircraft was without compass or navigational equipment.

Radio contact on normal channels could not be made. Guard frequency was then selected and although many calls were received it was difficult to make much sense out of them. Finally, fairly good radio contact was established with 4 Wing RATCON.

RATCON was on the ball and guided the aircraft to an uneventful landing using no-compass techniques. As F/L McKay said in his statement, "they have my heartfelt thanks".

Heads-Up to both F/L McKay and 4 Wing RATCON for their competent and professional handling of this emergency.

F/L MS VACIRCA and F/O AE SANDSTROM

F/L MS Vacirca was captain and F/O AE Sandstrom was first pilot in a C119 on a flight from Inuvik to Namao. On takeoff using normal power settings, the port engine failed just before reaching liftoff. The aircrew took immediate action to abort the takeoff and by use of brakes and reverse on the starboard engine, brought the aircraft to a safe stop on a compacted snow-covered runway. After stopping, the port engine warning light came on and again the crew took proper emergency action. The fire was quickly extinguished.

The professional manner in which the crew recognized the emergency situation and completed the successful abort was a display of good judgement and airmanship. Had the crew delayed only a few seconds, they would have been committed to get the aircraft airborne and then attempt an emergency landing, with the risk of a serious accident.

"Heads-Up" all the way for this crew of the C119.

"Profit by the mistakes of others—
there is no need to make them yourself."

ARRIVALS and DEPARTURES

HARVARD—GROUNDLOOPS
After touching down, the Harvard skipped and swung left. The student overcorrected and caused a swing to the right. Full power was applied but the aircraft continued off the right-hand side of the runway for about 30 ft, lurched into the air in a very nose high attitude and finally stalled, dropped its left wing and ended up in a heap almost completely demolished. Luckily, the student was able to crawl out uninjured except for a few scratches.

And at the other Harvard FTS 13 days later, a student on his first solo had a similar experience although fortunately the damage was considerably less. Again the Harvard started a left swing after touchdown and the student overcorrected to the right and added power. The aircraft lifted into the air but the right wing hit the ground. It then slid off the runway and came to rest on the grass with the right undercarriage broken off.

The student pilot stated: "I attempted to correct the swing with rudder, and after failing, added power". The key words seem to be "after failing, added power". It is generally agreed that adding power in a fully-developed groundloop only adds to the damage. On the other hand, how many swings have been corrected by the use of power so that there was no groundloop and hence no damage to report. The subject certainly seems controversial. The following are extracts from the D14.

The Unit Commander: "In my lengthy experience with the Harvard I have witnessed numerous groundloops but I am still unhappily unable to suggest a cure. I am, however, absolutely convinced that the use of power to recover from a groundloop or a swing which is not controllable by rudder and brake, is most foolhardy."

He went on to analyze the unit's last 20 landing accidents, 16 of which were groundloops. Power was not used in eight of these, and in that eight, five of the aircraft slightly damaged one wing tip, two slightly damaged both wing tips and one ended up on its nose because it ran into deep snow. Of the other eight where power was used, three came spectacularly to rest inverted, two suffered extensive damage to the wings and undercarriage, and two got airborne, stalled and crashed.

The Commanding Officer: "It seems to me we stand to gain much if it can be established clearly and taught firmly that the use of power, ie, opening the throttle, is not to be used in an attempt to correct a groundloop. We should go one step further—recognize that the groundloop is an uncontrollable swing or turn and that the best thing to do is to keep the control column back, the rudder centred and the brakes on.

The point I think should be made and which may have got lost—an uncorrected swing may develop into a groundloop, thus to avoid a groundloop it is essential to correct the swing, as described by F/L JB Peart in "Flight Comment", May-Jun 64, page 24. It will be observed that F/L Peart offers the steps to take to prevent and correct a swing, not a groundloop. Obviously if you correct a swing you prevent a groundloop."

The Air Officer Commanding: "Except for the statement which can be seriously misconstrued, that 'the best thing to do is to keep the control column back, the rudder centred and the brakes on', it is agreed that the above observations merit consideration. It is axiomatic that to prevent a groundloop the initial swing must be corrected; and that misuse of power will extend the damage to a groundlooping aircraft. Conversely, it has been established that judicious use of power is an excellent corrective measure. The basic training problem is one of technique of instruction. The successful instructor has the ability to instil in a student the confidence and knowledge whereby an incipient swing can be recognized and corrected before it reaches serious proportions. No amount of explanatory detail in training publications can replace this vital step."

F86 — WHEEL DISINTEGRATION
As the pilot turned off the runway after a normal landing in a Sabre, he heard a loud cracking noise. The aircraft was stopped and shut down. Investigation revealed that the starboard main wheel had exploded. The wheel casting fractured, probably due to metal fatigue, on the lock-ring side so that the lock-ring was released causing the tire to blow. A hole was punctured in the starboard drop tank by a flying piece of metal. Taxi speed had been very slow and pilot technique was normal in all respects.

In addition to the obvious difficulty of controlling an aircraft should the wheel disintegrate at high speed, an exploding wheel can be very dangerous—even fatal, should it happen when the aircraft is, for example, taxiing into the line where personnel are likely to be nearby. In recognition of this and since many Sabre wheels are getting rather old now, a special inspection was issued 31 Jan 63 whereby all wheels were to be given a dye penetrant check each time the tire was changed. Although the station received the special inspection order it was unfortunately not issued to the tire bay.

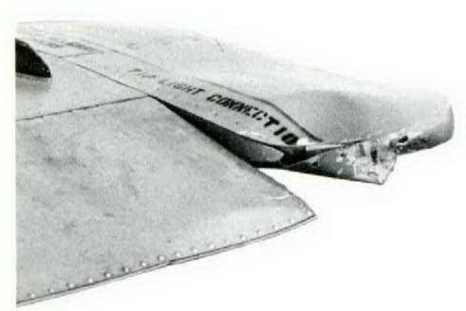
Luckily the wheel exploded when nobody was near. It is not known whether or not a dye penetrant check would have discovered the fatigue fracture in time but in any case, the station is now carefully carrying out the inspection, as ordered.

T33 — HYPERVENTILATION A student pilot noted after takeoff that the starboard main wing tank was venting fuel. This was no problem for the local flight intended, and the mission was continued. On reaching 35,000 ft, he noticed for the first time that he had virtually no cabin pressurization; the cabin altimeter read 34,000 ft. He notified the tower, checked the oxygen system (it checked serviceable) and began a maximum rate descent. He then began feeling dizzy and very light-headed. Suspecting hypoxia he activated the emergency system but this did not help; in fact, he must have lapsed into a state of semi-consciousness because later, he could remember little of the descent. He levelled the aircraft at 8000 ft and although still feeling slightly dizzy and light-headed, landed the aircraft without further incident.

A check of the oxygen system indicated that the only unserviceability was that pressure breathing would occur about 2000 ft sooner than designed. The only conclusion: hyperventilation, undoubtedly induced by anxiety of the inexperienced student concerning the venting fuel, lost pressurization and pressure breathing. Any one of these occurrences by itself is normally of minor concern; together they very nearly cost us a pilot and aircraft.

The venting fuel was caused by the refuelling crew carelessly trapping the bonding wire between the tank and the cap. Even more disturbing was the fact the cabin pressurization was lost because two holes in the pressure bulkhead were blanked with nothing more than sealing compound. The holes had been left vacant by the change of position of the brake fluid reservoir when TACAN was installed. It was obviously only a matter of time until the pressure blew out the sealing compound. An inspection of the other TACAN-modified T33s uncovered another one with the holes blanked in the same way.

This incident has a message for both groundcrew and aircrew. Groundcrew: a very minor malfunction can snowball into something disastrous. Aircrew: although hyperventilation may not have received the same emphasis as hypoxia, don't forget that it too is a potential killer.



T33 — TIP-TANK JETTISON Soon after takeoff it became apparent that the port tip-tank had failed to feed. It was later found to have been caused by the cap retaining chain preventing the proper seating of the cap. During the ensuing period as the pilot attempted to start the tank feeding, the differential in fuel became such that full right trim was needed to hold the aircraft level. A dummy run across the aerodrome was made at 260 knots but even at this speed, it required full trim and some aileron to hold the wings level. The pilot jettisoned the tips and completed a normal landing. The aircraft sustained damage to the starboard wing tip as shown in the photograph.

The pilot permitted the tip tank differential to exceed the maximum permissible for landing; he should have landed before this condition made jettisoning the tip tanks necessary. A pilot should not take off in a T33 with more than 100 gallons in each tip without first ensuring that both are feeding. However, if he does (such as a formation takeoff) then it should be possible to land the aircraft before 100 gallons differential occurs. Landing in an overweight condition is tacitly agreed to in EOs where it states "When landing with more than 12,000 lbs all-up weight, attempt to touch down with a minimum rate of sink".

An insufficient clearance between the tip tank and wing tip fairings caused the wing tip damage. This maintenance error coupled with careless fitting of the tip tank fuel cap resulted in unnecessary damage to an aircraft and the loss of two tip tanks.

CF104—STARTER EXPLODED On start-up, the RPM rose to only 6% with JPT continuing to rise through 750 degrees. The engine was shut down and an external inspection of the aircraft revealed metal particles in the tail cone. The starter had disintegrated as a result of ingesting a small metal locking pin from the air delivery hose coupling.

Thirty-three days before, a special inspection had been ordered to be carried out "immediately"; had this been done as required the expensive damage to this aircraft would not have occurred.

One of the unique features of the word "immediately" is its unmistakable clarity.

CF104—BAIL OUT "I'll read the bail-out procedure if you wish now."

"Go ahead."

"Roger, lower your visor."

"Check."

"Sit back in the seat, put your arms in, bring your feet in, put your head back against the head rest."

"Roger."

"You can send the chopper after me. I'm down to 14,000 ft. I'm going to unhook my oxygen and bail out at this time."

"Has he bailed out?"

"Roger, he has bailed out."

On a routine training mission, the pilot realized that the afterburner nozzle had malfunctioned, remaining in an open position. After attempting an emergency closing (ENCS) which failed, the pilot set up a course for return to base above a low undercast. Following the ENCS attempt, the nozzle went to full wide open and the oil low level light flashed on. A burner climb to 32,000 feet was followed by a glide toward base. During a second burner climb the pilot had an extended conversation with two other pilots and several persons on the ground. Conflicting advice and some vague instructions were given. The pilot's problem was whether to descend through the undercast and attempt a failed nozzle landing in weather of 2500 and $2\frac{1}{2}$ with the possibility of oil starvation and engine seizure. The pilot elected not to attempt a landing.

The ejection at 12,000 feet was successful. The exact cause of the nozzle failure is obscure. The performance of this aircraft in an open nozzle condition is being further explored so that aircrew can become better informed.

The experience gained from this accident indicates that all units would be well advised to review their crash procedures and particularly their facilities for assisting aircrew.

LETTERS TO THE EDITOR

Dear Sir:

I have just read the letter to the Editor by F/L JB Peart in which he expounds at great length on the Harvard groundloop.

I too am an ex-Harvard instructor who (at this point I will cross my fingers and touch wood) has never had a groundloop. I feel that I might even look back on this feat with more pride when it is pointed out that a good portion of the 2,000 hours on type was spent in the Texan with a free-castoring tailwheel. However, it is not with pride that I write this letter, it is merely to point out that never in all the time I was on the Yellow Peril would I have had the guts to make the statements that Peart made. Quote "If they had been sufficiently on the ball it would never have happened" unquote. At this point Mr Editor I have a question. Would he make this statement if he was still instructing on this aircraft?

Constructive criticism and experienced counselling are the chief components in a progressive flight safety program but this letter smacks more of an out-and-out "Holier than Thou" attitude than either of the above. It is too easy to be an expert when you no longer have to do the job yourself.

F/L GW Moore
Stn Chatham

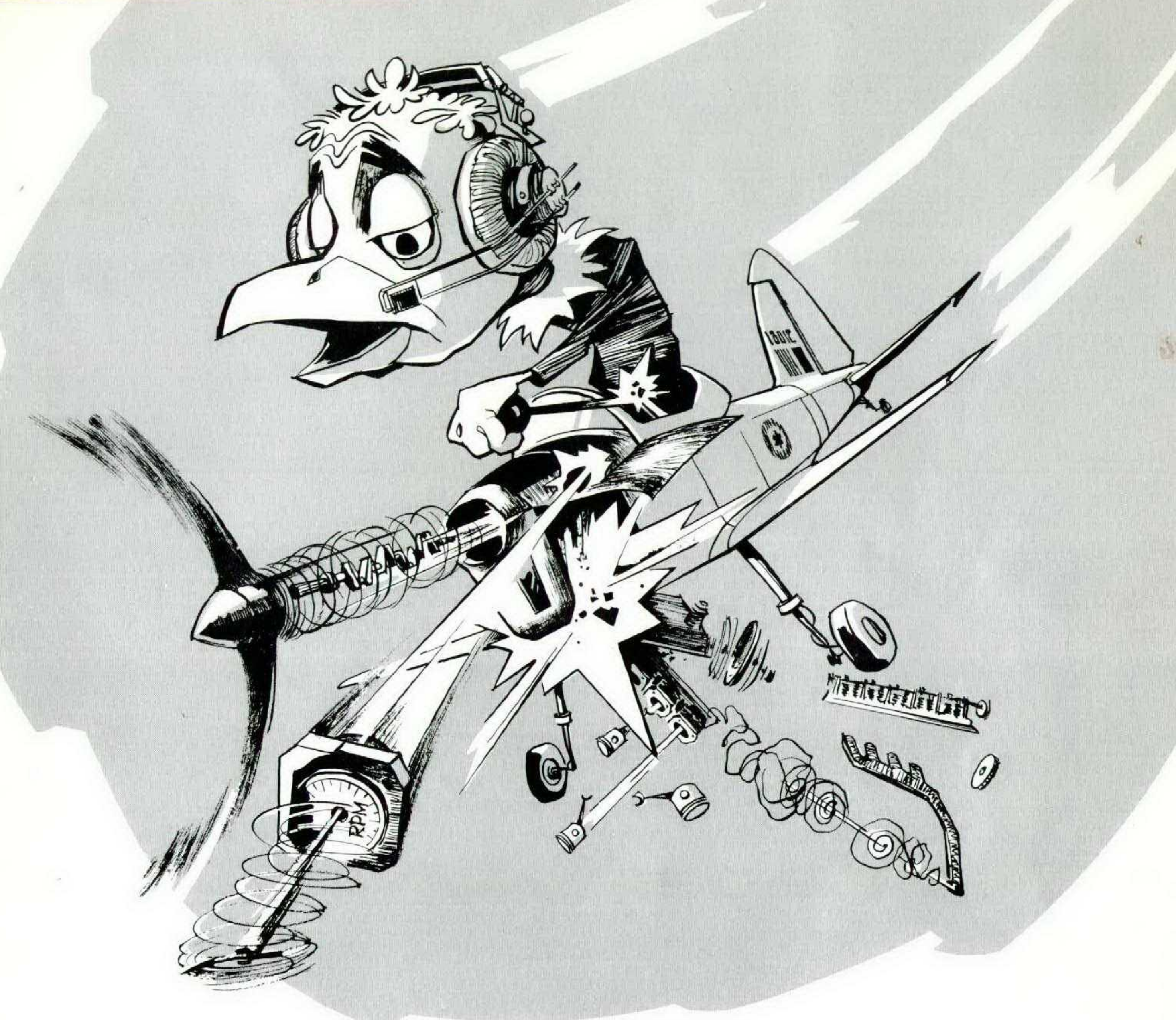
Dear Sir:

In your May-Jun issue, S/L Sutherland stated that the Mar-Apr issue was incorrect in crediting AMC with the engineering of the a/m modification.

To set the record straight, this modification was developed and prototyped at 6RD under project WF4R and passed to CEPE for evaluation. The resulting 6V modification is substantially that submitted by the Engineering Section of 6 Repair Depot.

F/O G FANCY
6RD Trenton

BIRD WATCHERS' CORNER



"THE BLUNDERING BUSTING BUSTARD"

This Bustard (species Fracturus Aerodynum) hails to the name of "Crazy" which by comic coincidence alludes to his true nature—an exuberant disdain for engine and propeller limits. Favourite habitat is the trainer cockpit where fledgling birds of all species try out their feathers. Bustards prefer to fly alone to ensure blundering goes unnoticed—disproving the time-honoured notion that birds of a feather flock together. Bustards, in their cockpit solitude pulverize power plants and punish propellers as if the engine dials had been installed only to plug some ugly holes in the instrument panel. Attempts to exterminate the Blunder Wonder have failed—bird records reveal that Fracturus Aerodynum regrettably, is not always the sole victim of his own damage dementia.

CALL: AOIs, AOIs—THATSTUFF'SFORTHEOTHERGUYS

POOR SUPERVISION

BAD SCHEDULING

TOO LONG HOURS

FATIGUE

MISTAKE

ACCIDENT