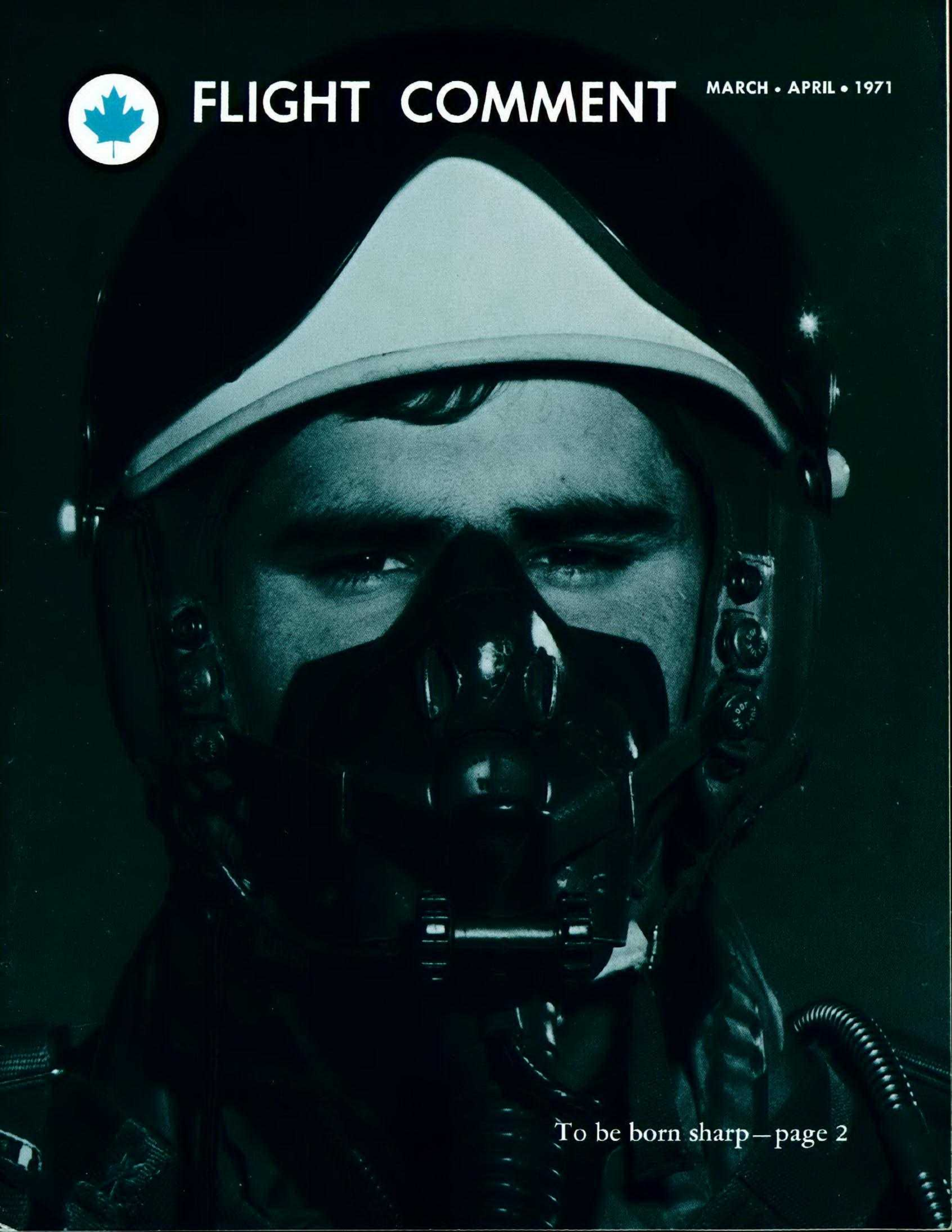
FLIGHT COMMENT

MARCH • APRIL • 1971



To be born sharp—page 2

Comments

During the last two months of 1970 three CF aircraft were refuelled with the wrong type of fuel. In another instance a helicopter pilot discovered that a fuel bowser parked adjacent to a helipad, was filled with MT gas and being used as a mobile fuelling point for military vehicles - this in spite of clearly marked signs stating JP4 and TURBO 2. Obviously this is an area demanding increased education and alertness.

Incidents continue to be reported of jet aircrew missing canopy safety pins. Our information points to two situations as being most likely to set the scene:

- Aircrew from bases where the canopy pins are not installed during turnarounds visiting bases where they are;
- Last minute program changes. If Aircrew are accustomed to the canopy pins being removed by the groundcrew on their own base, chances are they'll miss them if for some reason they're not removed. This might happen when an aircraft not previously on the schedule is suddenly assigned - say for night flying.

The WO i/c Aircraft Maintenance at CFB Winnipeg is on the scrounge for five permanent magnets to use in constructing the FOD Picker described in our Sep/Oct issue. The magnets can be obtained from unserviceable magnetron tubes (Part No. QK338A, NATO No. 4960-21-818-5726) used in FPS6B radar equipment. Any ADC radar bases which can spare these parts could assist by sending them c/o #16 Hangar.

The sonnet on the back cover was written by Pilot Officer John Gillespie Magee Jr., an American citizen who enlisted in the Royal Canadian Air Force in September 1940. He served overseas with the RCAF on 412 spitfire squadron until he was killed in a mid-air collision on December 11th, 1941. His sonnet was composed in September of that year, as the exultant freedom of soaring 30,000 feet made a word-pattern in his mind. It was scribbled on the back of a letter which he sent to his mother in Washington, shortly after he landed.

CANADIAN FORCES HEADQUARTERS — DIRECTORATE OF FLIGHT SAFETY

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Education and analysis

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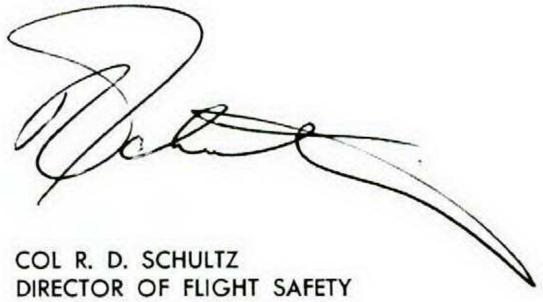
The need To Know!

If you have to ask whether an aircraft occurrence is reportable or not, it is almost certain that the answer is "yes" - report it. In other words, if the event prompted the question then to some degree at least you feel that the information may be of use to someone, somewhere, sometime.

This simple guide may not satisfy everyone, but the appeal to report practically everything and anything is based on the "need to know" to prevent aircraft being damaged or personnel being injured or killed. What may appear to you to be a trivial matter or an isolated instance, could establish a significant trend when correlated with other information at higher headquarters. If your information might lead to saving lives and aircraft resources, then become involved and tell someone.

During each of the last three years approximately 3000 occurrences have been reported, so obviously the word has gotten through. These ranged from the very serious accident, to what an individual thought just might be a hazard to aircraft operations in some way or other. Examination of these reports proved that very few were a waste of effort and most either supported further investigation or resulted in immediate preventative measures. By any yardstick our flight safety reporting system is working well and is producing positive results.

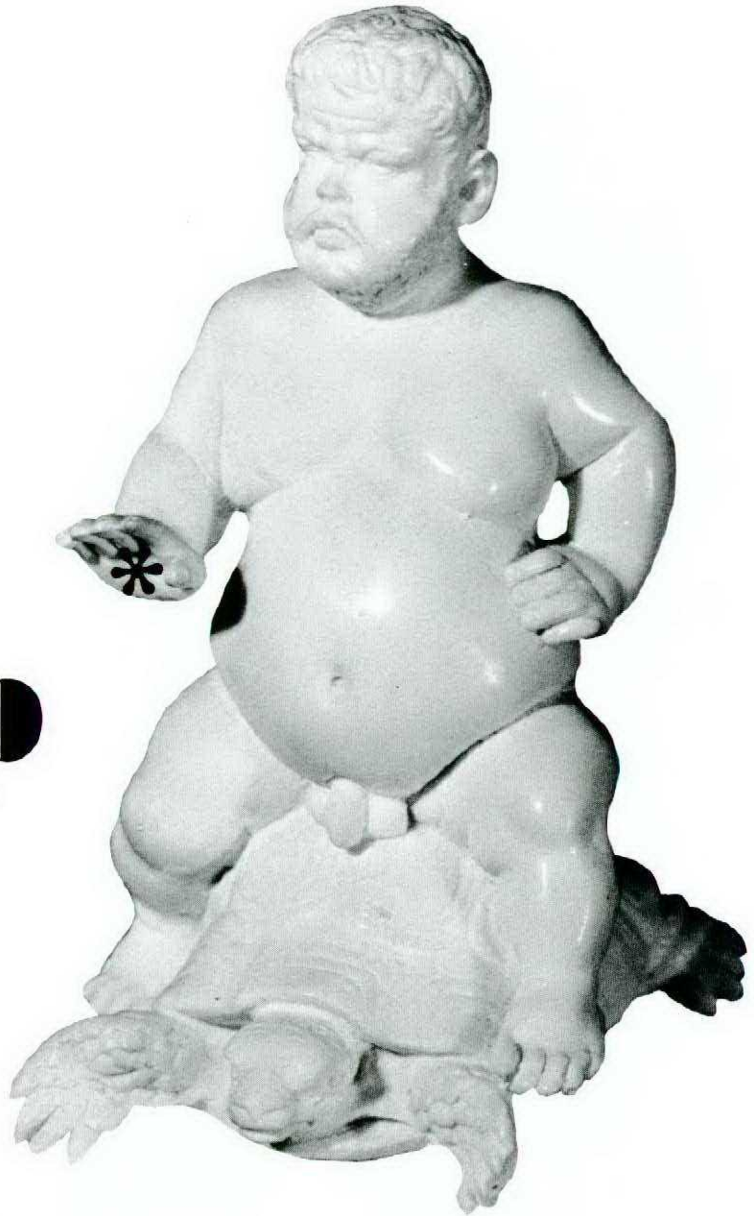
Finally, as the one agency involved in reviewing most of these reports, be assured that DFS does not advocate duplication of effort unless there is a good possibility of something to be gained. We are confident that the present reporting system is achieving the desired result overall, therefore, if you have information that you feel may be of value in identifying a hazard, report it and let us decide what needs to be done.



COL R. D. SCHULTZ
DIRECTOR OF FLIGHT SAFETY

P.S. The revised "Flight Safety For The Canadian Forces" (CFP 135B) contains the details.

To be born sharp

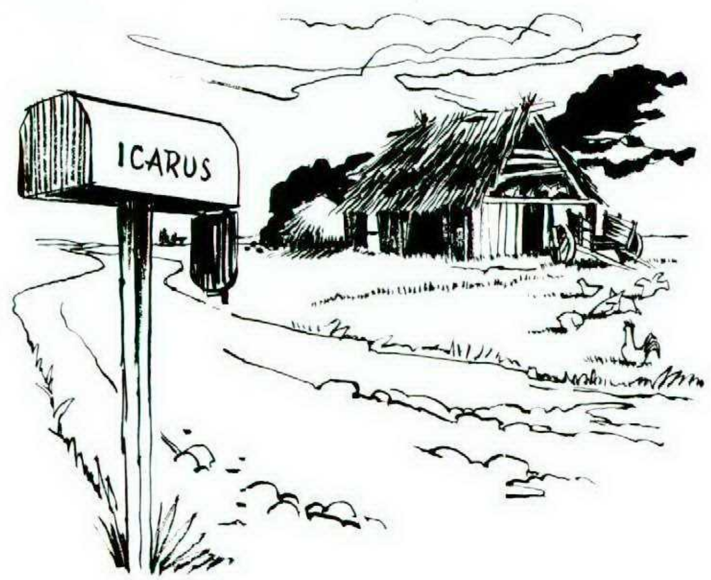


Maj L. N. Howlett CFIEM

Maj J. Soutendam CFIEM

The authors wish to acknowledge the invaluable assistance of those Aircrew and Flight Surgeons who have made the effort to report Special Occurrences and thank them for their patience and understanding insofar as feedback may have been intolerably slow. The authors also wish to express their gratitude to non-military pilots and all other individuals who have gone out of their way to assist in this investigation in the interest of Flight Safety and Aviation Medicine.

It all started as far back as Man's first flight, when Icarus and his father attempted to escape from Crete by donning a set of locally manufactured wings. During the pre-flight briefing Daedalus cautioned his son against high altitude flight without an on-board oxygen* system, but Icarus, who wanted to get airborne so badly he could taste it, was either not listening or didn't give a tinker's damn. The outcome of the flight, of course, is well known - Icarus "bought the farm".



* **Oxygen is from the Greek OXYS meaning "sharp" "acid" plus the root of GIGNESTHAI, "to be born".**

The Board of Inquiry suggested that the major cause of this accident was "increased atmospheric temperature at high altitude which led to structural failure of the wings and the resultant brick-like descent with fatal consequences for Icarus". The Board finding is questionable and of course you know better - or do you? A more accurate diagnosis might have attributed the cause to hypoxia, fatigue or disorientation, with all considerations favouring hypoxia.

What is most disturbing about all this is that since Icarus we have gone through two world wars and many smaller ones with their associated balloon and aircraft flights and we are still making the same mistakes. In spite of many known hypoxia fatalities, we still haven't learned very much, or, let's rephrase that, we *Still aren't listening too well.* Since WW II, there has been incredibly rapid progress in aviation and aerospace technology, but we are still having far too many hypoxia incidents and accidents. Why? Is it lack of knowledge and understanding or is it that we are too complacent about aviation physiology and oxygen requirements.

Let's see if we can place things in their proper perspective. To you the pilot it could mean the difference, between getting back safely and not getting back at all.

The fact is, that although present day aircraft and weapons systems represent the latest advances in design and performance, man has simply not kept pace; he hasn't changed at all in the last couple of hundred years. He remains very much a ground-borne type requiring a physical environment which must be maintained in a very narrow, critical envelope. Attempting to operate outside the environment without proper equipment and techniques spells almost certain disaster.

What then is HYPOXIA all about? Simply defined, it is a state of oxygen insufficiency. For you this could mean the decrease of the critical oxygen pressure in the lungs, the blood or the various other tissues and organs, with an inevitable impairment in performance, even to the point of failure. The basic problem is that you have no oxygen reserve. If you don't get it from an external source such as the atmosphere or an O_2 system, you will not survive. Although hypoxia is caused by both altitude exposure and clinical diseases, we will assume you are healthy and discuss the altitude and self-induced hypoxia problems only. By convention, we accept four basic hypoxia classifications:

HYPOXIC HYPOXIA

This is often called altitude hypoxia and is perhaps the most common type in the case of aircrew. Here we have a low oxygen pressure in the lungs, with a resulting low pressure in the arterial blood which means you no longer have adequate oxygen for combustion. You will experience something similar to complete engine failure - and for you it will be akin to engine failure in a CF104, T33 or Tutor, since you are all single-engine jobs!

The cause is either flight above 10,000 feet MSL without an oxygen system on board, or oxygen equipment failure (including poorly fitting masks).

HYPEMIC HYPOXIA (ANEMIC HYPOXIA)

Here the O_2 pressure in the lungs is adequate, but once inside the blood, the O_2 transportation system breaks down. Oxygen is primarily transported in a chemical bonding with an active oxygen carrier called haemoglobin (Hgb). In this case, haemoglobin, a protein and iron complex, is no longer available for O_2 transport. It is fairly well known that haemoglobin has a greater affinity for carbon monoxide (CO) than O_2. It is CO poisoning which reduces the amount of available Hgb transport for our friend O_2 - hence, insufficient O_2 supply by the blood.

The cause could be in-flight fires or smoking. Certain drugs will also bind Hgb, making less available for O_2 carrying.

STAGNANT HYPOXIA

This type is often called circulatory hypoxia. Although the arterial blood has a normal amount of oxygen under normal pressure, low blood circulation results in insufficient delivery of O_2 to the tissues.

It could be caused by injury during flight, with or without actual blood loss, but among aircrew it is more commonly a reduced flow of blood caused by pulling "G".

HISTO TOXIC HYPOXIA

This is a matter of "histo" or tissue poisoning. Lung and arterial blood oxygen pressure and saturation are adequate, but the tissue cells will no longer absorb the available O_2 because of significantly reduced tissue metabolism. The tissues are less active and produce less energy, consequently your muscular and mental performance is seriously impaired.

The primary cause here is alcohol consumption and drug use and abuse. Alcohol, like the smoking problem is a self-induced stress; drugs become a problem when they are self prescribed - DRUGS SHOULD BE TAKEN ONLY WHEN ADVISED AND PRESCRIBED BY YOUR FLIGHT SURGEON.

Flying is terribly unforgiving of errors through ignorance or complacency. There is likely no activity that requires a higher degree of sustained professionalism (a much abused word) than flying. If you make only limited attempts to thoroughly understand your aircraft and rely instead upon the manufacturers and technical services to keep you safely airborne, would you consider yourself to be a professional pilot? - a mediocre pilot would be more accurate.

Should you fail to understand and appreciate the integral requirements of the man/machine/environment complex, you have no business getting airborne. The days when pilots could be satisfied with knowing and understanding only a little about their aircraft and virtually nothing about themselves, have long since gone. Some apparently don't believe this, but, as the adage says, 'there are no old bold pilots'. Aircrew who are uninformed about the limitations of their own "bodyframe", like the DODO bird, will soon be extinct.

SYMPTOMS FAMILIARITY YOUR RESPONSIBILITY

We may be open to criticism by some of our contemporaries for trying to oversimplify the causes and problems of hypoxia. Granted, we have excluded much of the academics of respiration under normal and abnormal environmental conditions, and we have not attempted to deal with oxygen systems, the atmosphere or other aspects. We feel that more detailed information on these subjects can be obtained through the Flight Surgeon and from the Biosciences Officers, conducting "HAI" courses.

We have purposely not given you a list of the signs and symptoms of hypoxia because you will remember from your "HAI" that everyone has his own peculiar symptoms. If you are fuzzy on yours and what to do about them, it's time you refreshed your memory.

There is one possible danger in being aware of your symptoms; this comes from viewing them dogmatically without considering the possibility of variations in your susceptibility to lack of oxygen. After all, you guys are dynamic types who live and work in a dynamic environment - we have been pointedly reminded of this fact on a number of occasions. During your flights this environment is constantly changing and these changes greatly affect your symptoms to the changing conditions. Some of the variables are altitude, rate of ascent and descent, time at altitude, ambient temperature and physical activity. You, on the other hand, will show variations in your built-in tolerance, physical fitness, acclimatization, and emotional state - these are constantly changing even when you are in top physical shape and in the peak of health.

Closely related to the matter of symptoms and signs of hypoxia is the fact that they become increasingly pronounced as the partial pressure of oxygen decreases at low barometric pressures.

The final item which we feel is essential to know is *Useful Consciousness Time,* that is, the time available to you or the other members of your flight crew to recognize the problem, re-establish an O_2 supply and initiate emergency procedures.

It is most important for crews of pressurized aircraft to understand that the time available to them in the event of a sudden decompression can be very brief indeed - *18 seconds* of useful consciousness for a pilot who is performing moderate physical activity at an altitude of *40,000 feet.*

STAGES OF HYPOXIA

STAGE	ALTITUDE IN FEET		ARTERIAL O_2
	Breathing Air	Breathing 100% O_2	Saturation
Indifferent	0 to 10,000	34,000 to 39,000	95 to 90
Compensatory	10,000 to 15,000	39,000 to 42,500	90 to 80
Disturbance	15,000 to 20,000	42,500 to 44,800	80 to 70
Critical	20,000 to 23,000	44,800 to 45,500	70 to 60

(Flight Surgeon's Guide AFP 161-18 Dec 68)

TIMES OF USEFUL CONSCIOUSNESS

ALTITUDE (FEET)	MODERATE PHYSICAL ACTIVITY	SITTING QUIETLY
22,000	5 min.	10 min.
25,000	2 min.	3 min.
28,000	60 sec.	90 sec.
30,000	45 sec.	75 sec.
35,000	30 sec.	45 sec.
40,000	18 sec.	30 sec.

(USAF Flight Surgeon's Manual)

A sudden complete decompression is a relatively rare event but cases do occur in the Canadian Forces. The consequences of hypoxia at high altitude in these circumstances could be catastrophic and must be viewed as such despite the fact that we have no *proven* fatalities from this cause alone - the reason; causes sometimes die with the crew.

DO WE HAVE A PROBLEM WITH OUR OXYGEN EQUIPMENT?

During the latter half of 1970, this question, like many others related to the interdependence of the pilot and his life support systems, reappeared. Although the time-frame covers a period of six months, this represents only that time when the incidence of "oxygen-like" problems seem to be highest; such problems are always occurring. Similarly, the fact that the CF5 and CF104 were singled out during this high incidence period does not exclude the occurrences involving the CF101, Tutor or T33. The following cases involving the CF5 are a representative sampling of the situation.

Possibly the case which focused most attention upon the apparent rash of O_2 problems was a fatal CF5 accident in June 70. The cause of the accident is unknown, but for the purpose of this discussion, it can be stated that hypoxia may have been a contributing factor although it certainly could not be identified as the cause per se.

The next reported Special Occurrence was June 70 and also involved a CF5. Examining the regulator, the unit found that it delivered pressure breathing at 15000 feet cabin altitude; CFIEM subsequently found a continuous flow fault. The regulator was returned to the contractor for repair where the findings were verified. The regulator had been in use for only 74 hours. At present, the incidence of MD2 failures seems to be progressively decreasing as a direct result of the constant effort being made to improve their serviceability and hence their reliability. Are you being as critical with regard to your serviceability and reliability? In this case, a physiologic incident report does not appear to have been raised. Hopefully we are not missing the boat in only linking the cause of these to regulator malfunctions!

One week later in Jul 70, a pilot reported an incident while flying a CF5 on a test flight profile similar to that which had been flown by the one involved in the fatal accident in June. Detailed comments relating to this incident are indeed interesting from the standpoint of human factor considerations in flight, and although the reason for the incident is undetermined, hypoxic hypoxia must be considered in relation to the mask suspension configuration utilized by the pilot. A further comment which must not be omitted in the review of these CF5 cases is the current practice of some pilots to fly without a G-suit. Wearing such a supportive garment is most important when varying G-stresses play a significant role in flights - not necessarily just in terms of increased "g" forces so much as increased frequency, duration and degree anticipatory reaction.

Two incidents occurred soon after. One was an example of a pilot's exposure to noxious cockpit fumes which can be considered a form of "tissue poisoning". The cause was attributed to a seized air conditioning fan - *not in the oxygen system.* Oxygen was also not the problem in the second incident. Initial investigation of this occurrence suggested hyperventilation (lack of CO_2) by a pilot who was believed to have been suffering from a mild undetermined viral-type condition. As valid as this may have been, the fact that he had been using acrylic paint and thinner in a relatively enclosed area at home the previous evening and in the morning immediately preceeding his flight, cannot be overlooked as a source of toxicity.

There was also a possibility that he might have drunk polluted water which resulted from repairs to the community water supply and there was a possibility of a water imbalance in his system due to insufficient water

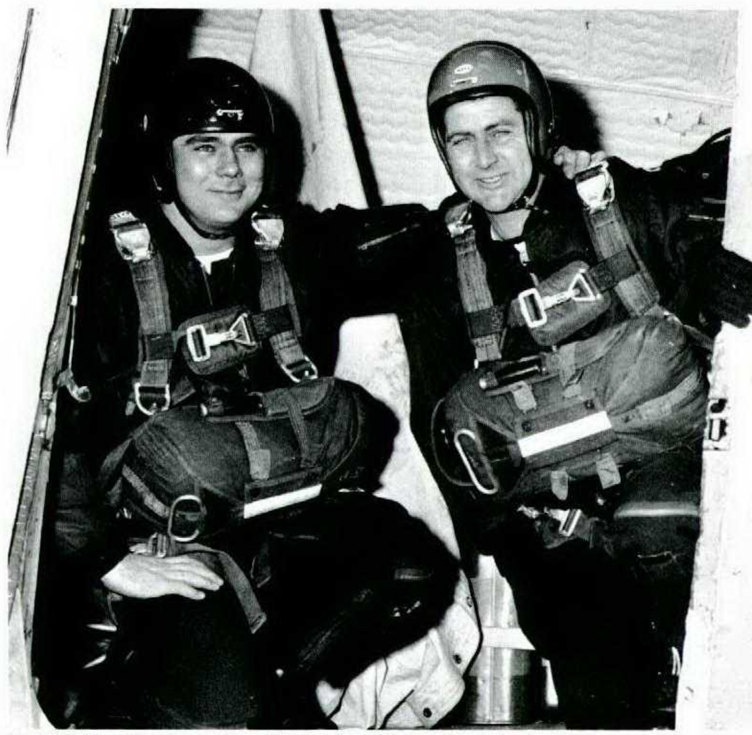
cont'd on page 21

Northern SAR Operation

On-the-spot improvisation by two para-rescue crew members of an SAR Dakota last November, facilitated the successful removal to hospital of a seriously ill man. The Dakota, from 424 T&R Sqn, Trenton, was on an Arctic training flight when it was diverted to Fort Burwell for a possible para-jump and supply drop. When the aircraft reached the area the captain decided to land at Fort Chimo because darkness was falling. Their sketchy information about the location and the rugged nature of the drop area had ruled out a night operation.

At Fort Chimo eleven fragile bottles of serum were provided to be delivered by the rescue team. The two crew members, MCpl Ireland and Cpl Clements, then set about packaging the bottles and modifying a parachute (para-rescue jumpers and supply dropping chutes are not normally carried on aircrew training flights). By making numerous modifications to a para-rescue reserve chute, the men converted it into an effective substitute for supply dropping.

Arriving at Fort Burwell next morning the crew decided that a para jump was too risky because of the rocky terrain and extensive open water, but the serum was landed unscathed using the modified chute. This relief enabled the man to await later rescue by a helicopter and a subsequent Buffalo flight to hospital in Montreal.



Cpl C.H. Clements and MCpl J.R. Ireland

Good Show


Capt B. Kadonoff

Cpl W.P. Steeves Cpl J.S. Martel


Cpl J.M. Ross


MCpl W.H. Woloschuk

CAPT B. KADONOFF

While flying a NORAD night exercise, Capt Kadonoff experienced two decompression explosions which raised the cockpit altitude in his CF104 dual to 33000 feet. He immediately descended to FL250, turned off his radar and opened the fresh air scoop. The latter action was necessary to close a hot-air duct to the refrigeration unit - separation of the duct at the unit had possibly brought on his pressurization loss. Leaking hot air could cause severe damage in the E bay and to other electrical systems. His suspicion that this had indeed happened was strengthened when he found on levelling off that his TACAN and SIF had failed.

With the aid of radar vectors from Great Falls Centre, he was able to proceed to Malmstrom AFB Montana, 90 miles away, where it was VFR. Nearing Malmstrom, as he prepared for final descent, yet another problem emerged - he was unable to lower the flaps. Now he faced the task of making a flapless, night landing on an unfamiliar base. Radar vectors from Centre aided him in positioning the aircraft for final approach into Malmstrom, and by accurately maintaining flapless approach speeds on final, he was able to touch down in the first 1500 feet of runway. Drag chute and normal braking enabled him to stop without difficulty.

In spite of his limited CF104 experience, Capt Kadonoff cooly analyzed his problems and demonstrated sound judgement in response to this emergency situation.

CPL J.M. ROSS

Cpl Ross was a crewman on a H21 assigned to rescue a seriously injured hunter near the edge of a very small lake. The lake, with a steeply sloped shoreline and ringed by 60-foot trees, had defied previous rescue attempts by a civilian float-equipped light helicopter. A doctor on the scene was of the opinion that the injured man would probably not survive an overland trek of 2-3 miles to the nearest lake large enough for operating amphibious aircraft. A hoist pickup was thus the only alternative.

When the H21 arrived on the scene, Cpl Ross directed the pilot into position over the pickup point approximately 30 feet from the shoreline and lowered the Stokes Litter to the ground where the injured man was promptly loaded on.

When he set the hoist in motion, the litter began to spin as soon as it came off the ground. This was because the rescuers on the ground, being unfamiliar with the equipment, had not released the cable from the litter when it reached the ground. (Because the cable twists when it is reeled out, the normal procedure is to release it momentarily when it reaches the ground to let it unwind itself.)

Cpl Ross now had to determine a way to raise the litter through the trees without further injuring the man or snagging in the trees. With precise instructions to the pilot, he co-ordinated their action while slowly threading the spinning litter through the thick pine trees.

By this skillful manipulation of the hoist and his accurate directions to the pilot, Cpl Ross made a successful rescue without further injury to the victim - a demonstration of professional crewman skill at its best.

CPL W.P. STEEVES CPL J.S. MARTEL

The brakes of a Buffalo aircraft had ignited during a taxi test. Cpl Martel and Cpl Steeves, both airframe technicians, noticed the fire as the aircraft taxied on to the ramp. They immediately selected the proper fire extinguishers, raced to the aircraft and brought the fire under control before the fire trucks arrived.

By their prompt action and quick thinking in response to this emergency situation, Cpl Steeves and Cpl Martel prevented the possible loss of an aircraft.

MCPL W.H. WOLOSCHUK

During a PI on a Buffalo aircraft, MCpl Woloschuk discovered an incorrectly installed bearing retainer on the flap hinge arm which prevented normal operation of the self-aligning flap bearing. The way the retainer had been mounted made it difficult to detect without thorough concentration on the task. Had this incorrect installation not been detected, the hinge arm could have failed resulting in a split-flap condition.

The discovery led to a Special Inspection and a subsequent EO amendment to prevent the recurrence of this situation.

The technical competence displayed by MCpl Woloschuk possibly prevented a serious in-flight hazard.

PTE K.W. BREAKWELL

Pte Breakwell was conducting a routine "B" check on a T33 when he discovered two hairline cracks on the under surface of the elevators. These could easily have been passed off as scratches and could have created a serious in-flight hazard had they gone undetected.

By his close attention to detail, Pte Breakwell demonstrated a high degree of professionalism.

CPL J. SIMMONS

In the course of a routine BFI on an H21, Cpl Simmons found a crack in the exhaust pipe leading from the aircraft heater. The crack was located under a floor panel, and was barely visible even with the aid of a flashlight.

Had the crack remained undetected, exhaust fumes could possibly have concentrated in the cockpit, and escaping heat could have reached vital aircraft control cables.

By the thorough manner in which he conducted his BFI, Cpl Simmons prevented the occurrence of these possibilities, either of which would have represented a serious in-flight hazard.

CPL D.J.E. DENOMME

Conducting a routine Daily Inspection on a T33, Cpl Denomme noticed slight irregularities on the rear air intake screen of the engine compressor when he peered through the starboard trunnion mount access door. Investigating further, he opened the plenum chamber access panels and found extensive damage to the rear inlet toroidal chutes, swirl vanes and rotating guide vanes. When the engine was removed, further damage was found on the exhaust nozzle guide vanes and on the turbine blades.

This discovery was obviously the work of an alert and thorough technician as there were very few indications of the damage that would be noticeable during routine maintenance. The damage to the turbine section could not be seen through the jet exhaust pipe and the view of the rear inlet screen is very restricted.

Cpl Denomme's careful attention to detail undoubtedly prevented an engine failure and the attendant hazard to the aircrew.

CPL J.R. ARSENAULT

While conducting a routine inspection on a Yukon, Cpl Arsenault noticed that the tip of a tab washer had broken off allowing the nut to back off and the landing gear bogie actuator attachment to loosen. Had this condition gone undetected – and the nut loosened only slightly more – the bogie retraction or extension would have been incomplete.

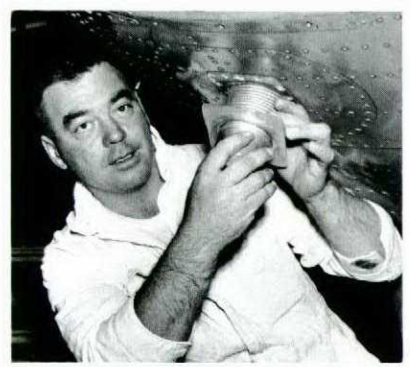
By his thorough inspection, giving attention to the smallest of components, Cpl Arsenault probably averted a situation which could have resulted in serious and expensive damage to the aircraft.

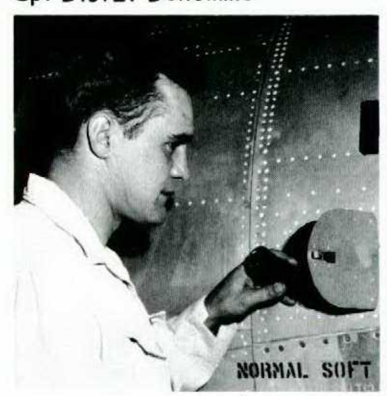
CPL D.C. HAIGHT

While conducting a routine inspection on a Yukon, Cpl Haight noticed a discolouring black stain on the casing of an engine component. Although it was located in a hard-to-get-at area, he discovered on closely examining the component that the stain resulted from a crack in the metal.

By his thorough inspection technique, Cpl Haight uncovered a metal breakdown which could have resulted in a costly aborted flight.


Pte K.W. Breakwell


Cpl J. Simmons



Cpl D.J.E. Denomme


Cpl J.R. Arsenault


Cpl D.C. Haight

Cpl G.Q. Knudsen

Cpl G. Hunter

Cpl E.P. Fournier

Cpl J.A. Jobin Cpl J.M. Ferland

CPL G.Q. KNUDSEN

While carrying out a check inside the fuselage of a CF104 prior to engine installation, Cpl Knudsen noted several broken strands of wire on a stabilizer control cable where it passed through a bulkhead. Further checks revealed almost twenty broken wires in the cable. Cpl Knudsen then checked the other control cables in the area and found damage on two more. Had one of these cables severed in flight, the stabilizer would then have been operative only by electrical control, through the trim - a hazardous situation which could cause a pilot to eject.

Corporal Knudsen's attention to details not specifically prescribed for this check, and the thoroughness of his investigation, demonstrated his high degree of professional competence.

CPL G. HUNTER

While working on the flight deck of a Hercules during a periodic inspection, Cpl Hunter noticed an unusual mark on the side of a pulley. Investigating further he found a 5/16-inch socket lying on the pulley bracket between the condition lever pulleys for number 3 and number 4 engine. Even when it was pointed out, the socket was difficult to see.

Had this FOD gone undetected it could have created a serious in-flight hazard by jamming the condition levers which provide a mechanical means of feathering the propellers.

While it was part of his inspection to check for cockpit FOD, Cpl Hunter's thoroughness in following up his initial suspicion resulted in a significant contribution to Flight Safety.

CPL E.P. FOURNIER

While performing an inspection on a CF100 prior to its departure on an exercise, Cpl Fournier noticed a black line running approximately three inches around the edge of the locking plate which holds the nose fairing on the port engine. Closer investigation revealed a crack in the fairing, and when he removed the locking plate, Cpl Fournier found extensive cracking and fractures underneath.

Had this metal breakdown gone undetected, it would eventually have led to FOD ingestion by the engine. Cpl Fournier's comprehensive inspection and follow-up action prevented what could have developed into a serious in-flight hazard.

CPL J.A. JOBIN CPL J.M. FERLAND

Cpl Jobin and Cpl Ferland were testing the afterburner of a Voodoo engine in the Bagotville test cell. When the A/B was selected, a fine spray of fuel coming out of a cracked fuel line assembly ignited on contact with the hot metal of the afterburner section.

Quickly attributing the situation to a fuel leak, Cpl Jobin immediately told Cpl Ferland, at the engine controls, to bring it out of afterburner, but to keep it running at idle speed. Cpl Jobin then went into the test cell and with the fire fighting equipment there, extinguished the fire before any damage was sustained by either the engine or the test cell.

The speed and alertness with which Cpl Jobin and Cpl Ferland correctly reacted to this emergency situation prevented not only fire damage to the engine and the test cell, but also prevented hot section damage that could have resulted had the engine been brought out of A/B and immediately shut down. This was an excellent demonstration of technical know-how and outstanding teamwork.

Hey You!

Yes, you over there in the corner. Did you know that a new and revised edition of the Manual of Flight Safety for the Canadian Forces was issued last month? Well, it was, but although all bases got copies we're not so naive as to believe that everyone involved with all the aspects it covers has read it yet. Now, we're always spouting that flight safety is everybody's business, so why don't you make it your business to see what advice the new book has to offer? What's that? Oh, yes, its name. It's called CFP135(B) and can be obtained from your friendly BFSO.

Any grease will do

...or will it?

Capt L. E. McClare
QETE

A Buffalo aircraft was climbing through 100 feet on a VFR STOL takeoff when the left wing suddenly dropped three times in succession. The pilot responded by quickly raising the flaps and then continued the climb to an altitude where the crew could trouble-shoot. They soon determined that the wing drop had been caused by improper flap actuation, and the flight was aborted. Back at base the pilot flew a flapless approach and landed without further incident.

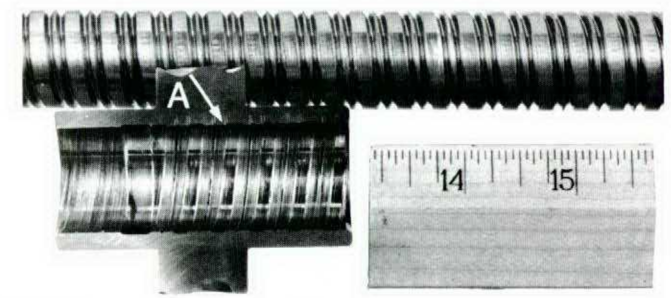
On the ground, an inspection of the flap located the problem in the screw-jack assembly, which they found stripped of its threads. The assembly was removed and forwarded to QETE for analysis in the metallurgy lab.

The lab found that the aluminum-bronze thread in the female section had suffered excessive wear damage and that the remaining thread had finally sheared under load. Stereo microscopic examination of the lead screw of the screw-jack showed severe pitting on the thread faces. When normal metallurgical tests were performed on the steel and aluminum-bronze components, both met the required specifications. Grease samples, sent for analysis to QETE'S chemical laboratories, showed the characteristics of 3GP-689a, MIL-G-25760 (grease, aircraft, synthetic), under infra-red spectographic testing. The grease specified by DeHavilland was 3GP-606a, MIL-G-23827 (grease, aircraft, synthetic, extreme pressure).

It is essential that technicians comprehend the necessity for using two different type of greases which may have many of the same properties. As this case shows, it can prove critical. Grease designed for use on components subjected to extreme mechanical pressures contains certain additives, such as molybdenum disulphide which adhere to the metal when high pressure is applied. This allows lubrication during all phases of operation. Normal general purpose grease that does not contain these additives will be squeezed out under high pressure, allowing metal-to-metal contact. This results in pitting, local welding, and rapid breakdown of the mating surfaces.

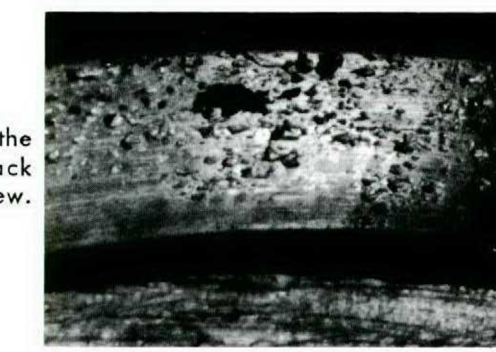
In the Buffalo incident, improper lubricant caused pitting on the thread faces of the male steel screw which then, acting like a file, slowly cut away nearly 90% of the thread in the softer aluminum-bronze female component until it ultimately failed. An assymetric flap condition resulted, with the subsequent dangerous roll.

Reach for the right can!



Buffalo screw jack actuating screw and the sectional aluminum-bronze mating female thread. Arrow points to the worn area of the V-thread.

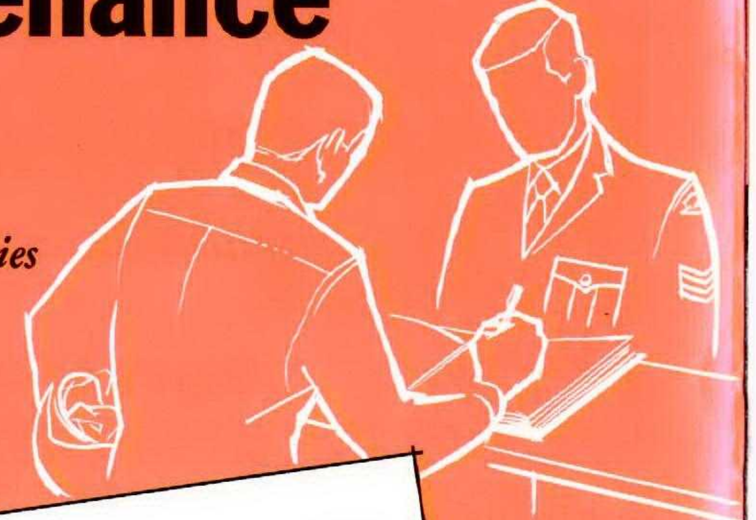
Pitted face of the screw jack actuating screw.



Did someone decide that a substitute was in order because the proper grease was not available from oil stores? Or was the wrong grease in the right can? Had this failure occurred just at lift-off or just prior to touchdown, the consequences could have been tragic. Hopefully the incident will create a greater awareness of this inherent hazard. Careful checking to ensure you are using the right lubricant should be SOP.

Aircraft Maintenance Record Set

...pilot's responsibilities



A recent incident brought to light the need to review pilots' responsibilities regarding the Aircraft Maintenance Record Set (Logbooks - Old RCAF L14). The review was prepared by Capt W.B. Siegner, BFSO, CFB Gimli.

AIRCRAFT INFORMATION RECORD(CF339).

This form is normally the first white sheet in the LOG Set and should be checked for the following:

- the time to the next inspection. (Is there enough time left for your proposed flight?)
- miscellaneous data entries.
- any operational restrictions which could affect your flight.

AIRCRAFT REPAIR CARD CF349 OR AIRCRAFT UNSERVICEABILITY RECORD CF337 (PINK SHEET).

Ensure there are no outstanding major entries and take note of recent entries that have been cleared.

AIRCRAFT MINOR DEFECT RECORD (BLUE SHEET CF336).

Note entries and ensure that the centre column ("Checked By") is signed. If this column is not signed the entry could constitute a major unserviceability and therefore the aircraft cannot be accepted by the pilot. However, when an aircraft is operating from its parent base, the column may be signed by the captain of the aircraft, the flight engineer or the technical crewman.

DAILY AIRCRAFT MAINTENANCE RECORD CF335 (GREEN SHEET).

There are several important items on this sheet to be closely checked:

- fuel quantity, oil, anti-icer, hydraulics and oxygen state and the time of certification;
- ensure the primary inspection (PI) is valid. A PI validity period commences with the first flight and is valid for a full Primary Inspection period (which varies with aircraft type) provided the flight occurs before the PI time span for that aircraft terminates. (AMO 00-20-3).
- ensure the daily inspection (DI) is valid. The DI is valid for 24 hours from the time the inspection is completed.
- if the aircraft has flown since the DI, an "A check" (after-flight check) must be completed and signed off. This check must be completed after each flight.
- a before-flight check ("B check") is completed by the ground crew before each flight and does not require a signature. This inspection is basically an external check.

From this information you can see that before signing as having accepted the aircraft it must have a valid PI, DI, and if the aircraft has flown since the DI, it must have an "A check".

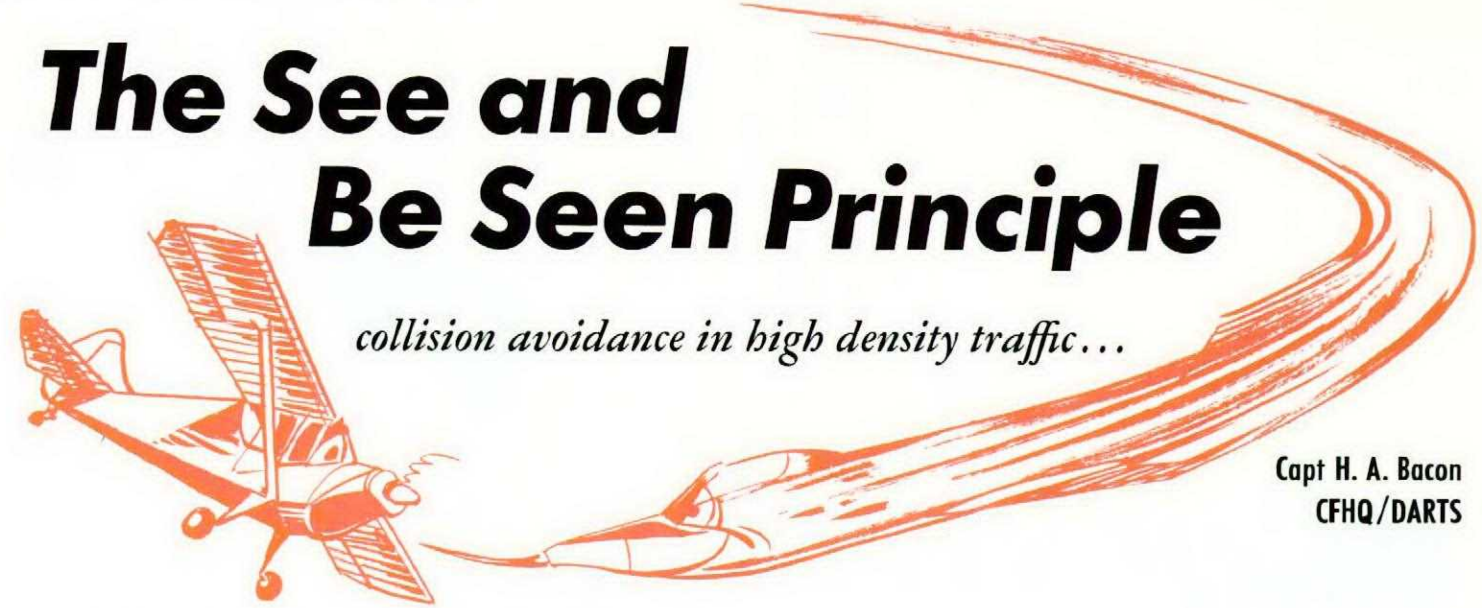
In addition to these requirements, if the aircraft has had any major unserviceabilities written against it, another "A check" is required - even if the aircraft did not fly.

When using a traveller (Aircraft Travelling Set - Old RCAF L14T) the pilot must ensure that all the information mentioned above has been properly transcribed.

If there is any doubt about the aircraft's serviceability or inspection validity, the time and the place to make certain is before signing out the aircraft, at the NCO's desk.

The See and Be Seen Principle

collision avoidance in high density traffic...



Capt H. A. Bacon
CFHQ/DARTS

In these days of ever increasing air traffic density, especially in terminal areas with the presence of both IFR and VFR traffic, collision avoidance becomes a problem of grave concern. We as pilots can take certain action to reduce this problem.

When weather precludes VFR flight and pilots are locked on to instruments guiding the bird through the murk, collision avoidance is mainly a matter for air traffic control. However, when flying either VFR, or IFR in VFR weather conditions, collision avoidance becomes very much a matter for pilots. Under these circumstances a good lookout or visual scan must be maintained. It is this principle of collision avoidance known as the See and be Seen Principle that we are discussing here.

Clearly, the See and be Seen Principle of collision avoidance can only be effective if the other aircraft is detected in time to avoid it. It follows that the lower the speed, the more time the pilots have to see another aircraft and if necessary take evasive action. CFP100A (Article 654) states that "In order to reduce collision hazard, aircraft shall not be flown in the vicinity of a controlled aerodrome at speeds in excess of those required to manoeuvre the aircraft safely".

Recent studies indicate that small aircraft such as light civilian craft or jets in the CF104 or T33 category, can be seen at a maximum distance of about 6.5 nautical miles (39000 feet) on a head-on course. However, only under ideal circumstances, such as bright daylight with the pilot looking in the exact direction of the other aircraft with his eyeballs focused on infinity, will this maximum distance prevail. As we all know, these ideal conditions rarely apply; hence, it is extremely unlikely that detection will take place at the maximum possible distance. Factors such as dirty windscreens or canopies, blind spots, cockpit duties, poor scanning, and less than ideal light conditions, all serve to reduce the detection distance.

In fact, tests done in the United States reveal that on the average, pilots fail to detect an aircraft approaching head-on until it is at roughly one third of the maximum detectable range, that is, about 13000 feet.

Collision courses other than head-on may be regarded as equally dangerous. They should however, permit a longer time period for avoidance as the closing speed is less and the silhouette of the oncoming aircraft is larger.

When he detects another aircraft, a pilot cannot react the instant it comes into his field of vision. Studies show that he requires about 3.5 seconds to decide what action to take and then to take it. Allowing another 2 seconds for the aircraft to change its flight path, the basic reaction time becomes 5.5 seconds or a nice round figure of 6 seconds if an extra half-second "fudge factor" is thrown in. Of course, this is an ideal time and requires everything to be going for you. Additional factors such as variations in experience, the degree of alertness, and possible difficulties in determining the plane of the opposing traffic can add seconds to the reaction time. Doubling the ideal reaction time of 6 seconds should cover these factors. A 12-second reaction time becomes therefore, a practical figure for planning purposes.

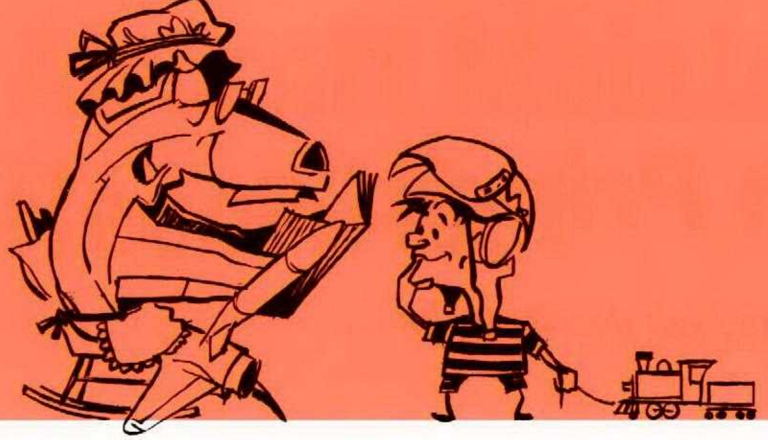
Accepting 13000 feet as the normal detection range and 12 seconds as the normal reaction time, it is possible to arrive at a maximum combined speed for collision avoidance purposes. For example, if two aircraft approach each other head on at the same speed and the pilots detect each other when 13000 feet apart, both have 6500 feet in which to avoid the collision and this must be done within 12 seconds. This works out to a maximum closing speed of 650K and therefore a maximum airspeed for 325K for each aircraft.

From this information, we can see that considering 13000 feet and 12 seconds as a realistic acquisition distance and reaction time, 325K is the maximum airspeed which should be flown in high density traffic conditions associated with terminal areas. Of course, much lower speeds are desirable, for then the safety margin becomes greater. It is plain common sense for all pilots to fly at the lowest airspeed consistent with safety when entering areas of high traffic density.

Still a Problem

If firm information on adequate supplies of flying gloves is not forthcoming, all other means of obtaining them will be investigated. The feasibility of obtaining flying gloves from some of the closer USAF bases will be studied.

- Flight Safety Committee



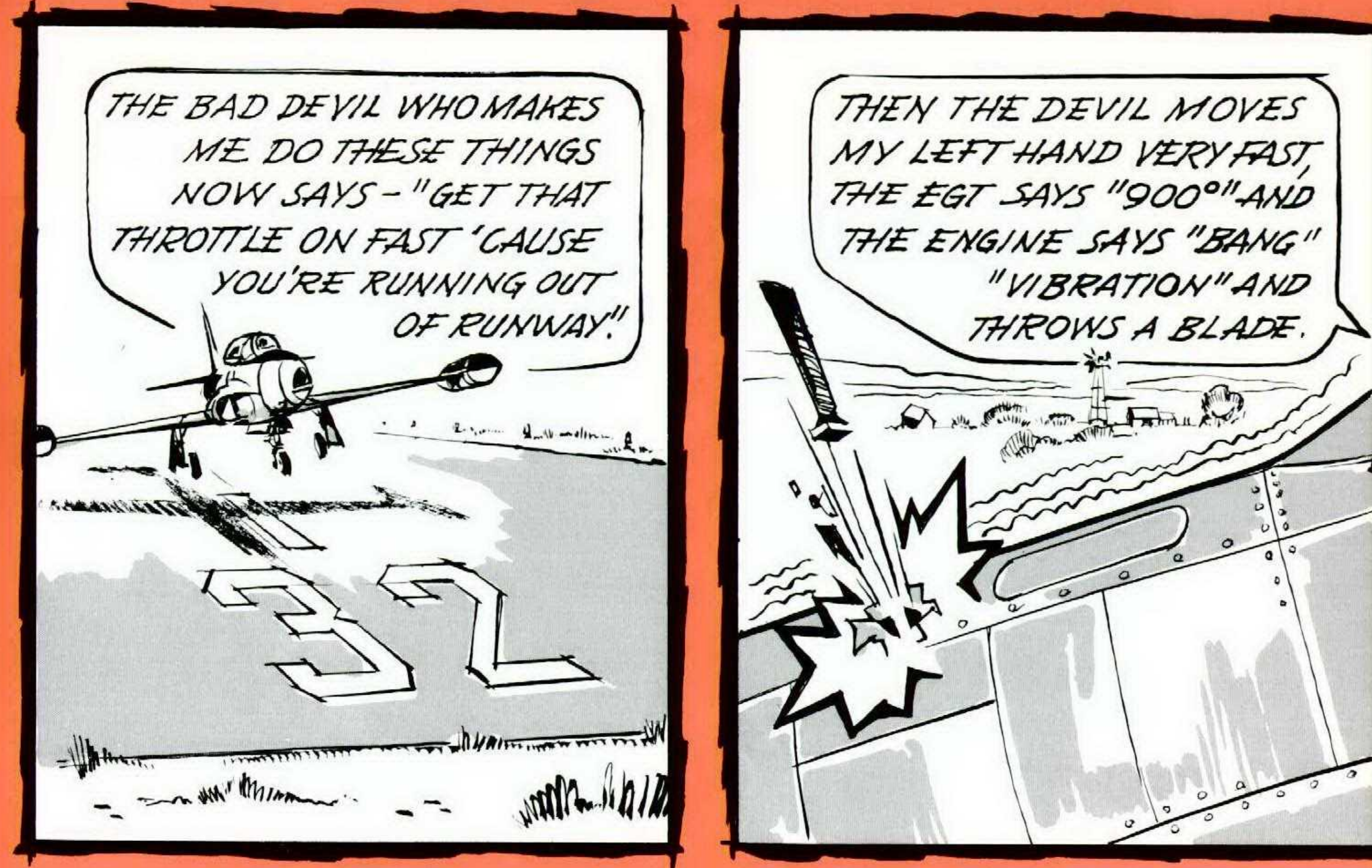
AIRSOP'S FABLE

The devil makes me do it.

OR

THE THROTTLE BASHER'S LAMENT

Maj S. O. Fritsch

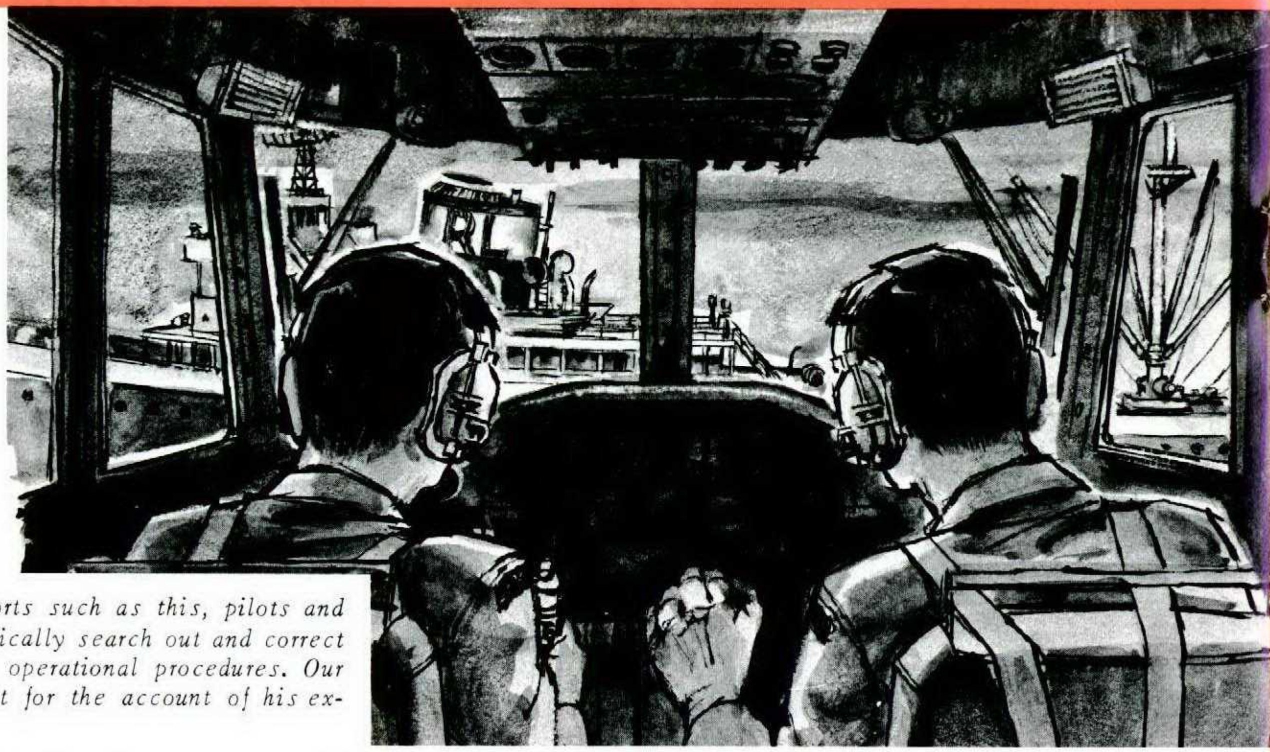


MORAL:

- GET THAT DEVIL OFF YOUR BACK
- SHOW SOME AIRMANSHIP ON APPROACH AND LANDING.
- EDUCATE THAT LEFT HAND - THERE ARE HUNDREDS OF T-BIRD DRIVERS WHO NEVER OVERTEMP AND WHO ARE WILLING TO SHOW YOU.

CLOSE CALL / OPERATIONAL HAZARD / SAFETY SUGGESTION

Close Call at Sea



In the light of reports such as this, pilots and their crews can critically search out and correct flaws in their own operational procedures. Our thanks to this pilot for the account of his experience.

We were on the return leg of an overseas antisubmarine patrol, searching an area in the mid-North Atlantic. I was aircraft commander and occupied the left seat of the Argus. We were flying at three thousand feet in daylight conditions over an area that was blanketed with a dense layer of stratus and fog. Intelligence gathered to the point indicated the strong possibility of an unfriendly submarine in the vicinity so we were employing continuous radar policy.

Then one of the radar operators reported the sudden appearance of a *medium-sized* target at a range of twenty-two miles. I turned immediately, began homing to the target, and descended into the undercast. I levelled the aircraft six miles from the target at three hundred feet where visibility was zero to one-eighth of a mile in drizzle and fog and the water surface was just visible. At this point I instructed radar to off-set the homing so as to have the target pass starboard of the aircraft, and in an attempt to gain better visibility I descended further, remaining on instruments. When radar reported the target starboard of track at two miles I instructed the operator to give no further heading corrections. We selected the windshield wipers on at this point but quickly turned them off again because of the distracting flailing of the unserviceable one on the co-pilot's side. Radar then reported the target at one mile slightly starboard. Approximately ten seconds later a large *surface vessel* loomed out of the fog directly in front of us. We crossed over it amidships in a climbing attitude with precious few feet of clearance.

I continued the climb back to search altitude and we undertook no further investigations for the remainder of the sortie. The intercom was noticeably quiet, for a long time. Although the time lapse from initial sighting of the vessel to overflying it was only a few seconds, the whole picture remains engraved in my mind and, I am sure, in the minds of the rest of the crew.

How did we get ourselves into such a dangerous situation? There are many factors, but I consider the following most important:

- The sudden acquisition of the radar contact combined with our intelligence, led me to assume the target to be a submarine, and hence I disregarded the assessment of the operator.
- The drift at the time was approximately ten degrees starboard and target movement was right to left. Hence, although the target was to the starboard at one mile, the resultant track took us directly over the vessel.
- The failure of the radar operator to advise of the intercept course was because of my order.
- The most significant factor, however, was the attitude of "pressing on regardless" to accomplish the mission. In this instance it meant descending below prescribed minima in an attempt to gain better visibility and a visual sighting. Those who are involved in this type of operational flying can undoubtedly recall parallel situations in their low-level experience.

Three hundred feet is more than adequate to overfly most ocean going vessels safely, but what if our target had been an iceberg extending five hundred feet above the surface?

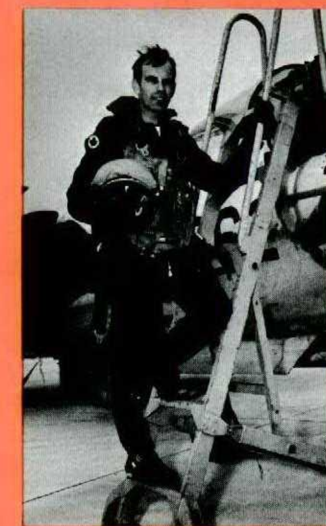
An FSO Speaks

Capt R. R. Simpson
FSO, 1 CAG

As Canadian military presence in Europe has been reduced, so, quite naturally has the size of the flying operation. Not many years ago we had five bases in three countries - today our fighter force is flying exclusively from what was Number 4 Fighter Wing, now Number 1 Canadian Air Group. In the change of posture lies a challenge to us, both collectively and as individuals.

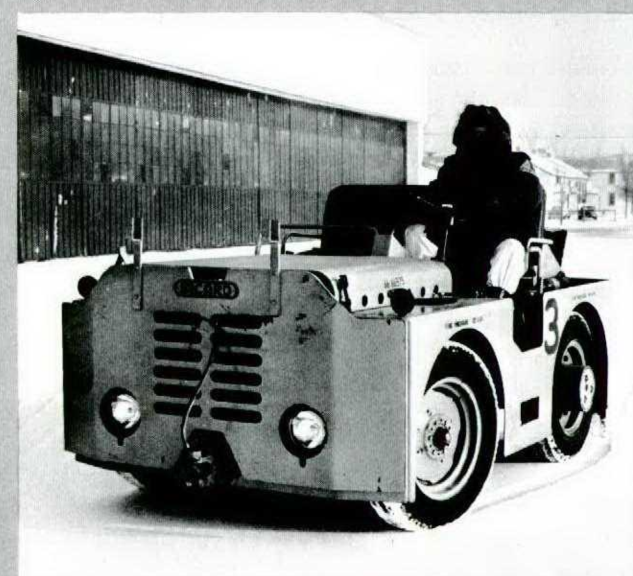
In the past we have been proud of the efficiency with which we operated the CF104 in Europe. Our force has always been small compared with that of other nations and that in itself has left us free of the tight controls and restrictions that are placed on the larger operations. Where others' size has resulted largely in the loss of individuality and identity, we thrived on exactly the opposite and to this we probably owed a large part of our success. At the same time we had sufficient size and scope that there were always elements of the operation that were far enough apart to visualize each other almost as outsiders and see the situation perhaps more as it really was.

With the significant change in the last year, the size reduction and the centralization of all CF104 flying at one base, we must exploit even more the advantages of a small operation. Having no longer the competition and rivalry from other bases, motivation has to come from within. We must extricate ourselves mentally to objectively evaluate our systems and procedures; they must not become the products of tunnel vision. The challenges which face 1 CAG are very much those that face all CF personnel as individuals, as well as many portions of the western world as we become increasingly conscious of cost and efficiency. First line supervision and discipline must now become self-generated commodities to stem the rising tide of "professional complacency". Each organization must now bear the responsibility for somehow being both its own slave and master. Herein lies the challenge in Europe - to reduce in size yet maintain and perhaps even broaden our scope.



Capt Simpson joined the RCAF in 1962 while attending the University of Toronto. After receiving his MASc in Aerospace Sciences, he went to Gimli for flying training and received his wings there in 1967. Early the following year he joined 439 Squadron at Lahr, flying the CF104. A year later, Capt Simpson participated in the annual NATO Royal Flush reconnaissance competition. As the reduction and reorganization of Canadian Forces Europe took place, Capt Simpson became the WFSO at 1 Wing, Lahr in April 1970, then moved to Baden-Soellingen as WFSO at 4 Wing in May and subsequently 1 CAG FSO in July.

What Beats This?



FOR THE ANSWER SEE PAGE 20

What's a TCU?

Those strange new symbols that have been appearing on hourly wx reports lately are not the machinations of an aberrant forecaster as some people have suggested. They are official changes which were introduced at the beginning of the year.

The changes:

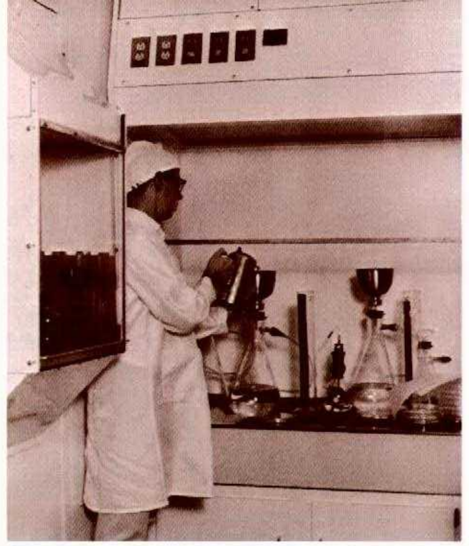
Ice Pellets are now identified by the abbreviation IP rather than E;

Ice Pellet Showers become IPW rather than EW

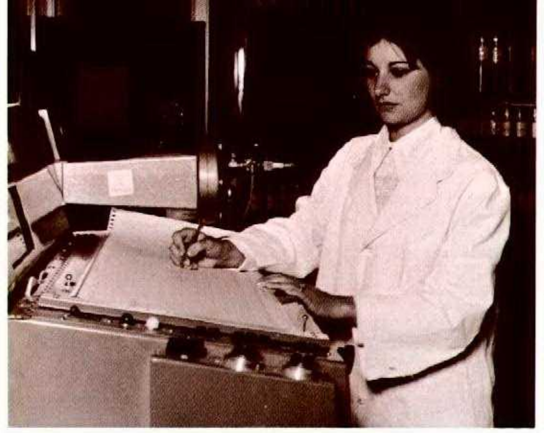
G replaces the Gust symbol, +;

Towering Cumulus (heavy Cu) is identified by a symbol TCU which replaces CU+;

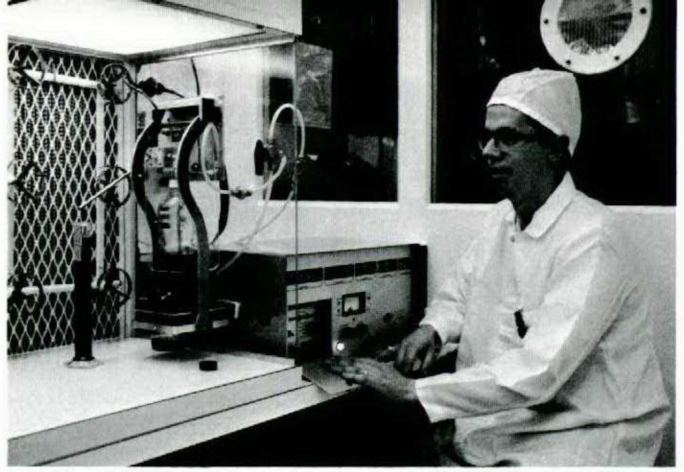
Precipitation previously referred to as ICE PRISMS is now identified as ICE CRYSTALS.



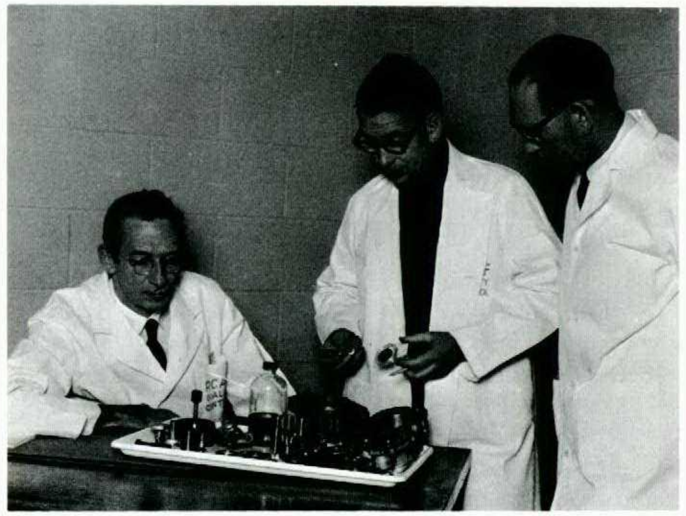
Filtering in a clean-station to separate solid contaminants for identification.



An Infra-Red Spectrogram indicating the level of contaminants in an aircraft O_2 supply is checked by QETE chemist, Dianne Kirkpatrick.



John Thompson, a QETE Fuels and Lubricants technologist, monitoring the operation of the electronic particle counter which automatically classifies and counts particles in five separate size ranges, from 100 microns down to 5 microns. One inch equals 25,000 microns. In addition to the digital readout, the counter has a printer which is located outside the clean room because no paper or other linty material is permitted inside. Clean-room operators wear special lint-free outer clothing.

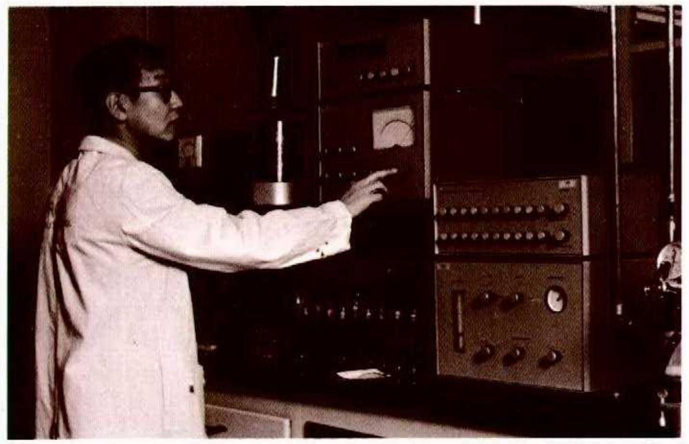


Mr. R. Clark of Special Projects (centre), Mr. C. Bowen and Mr. J. O'Connor of the Contamination Analysis, and Fuels and Lubricants groups, discuss a hydraulic fluid pump recovered from a crash site which is being examined for contamination.

QETE

Chemical Laboratories

An overall view of QETE's Clean-room where ultra firm particulate contaminants in hydraulic fluids, fuels and air are counted, separated and examined by microscope. A flow of specially conditioned and filtered air provides the room with a complete change of atmosphere every minute. A technician is entering through the air-shower and another, inside, is adjusting the binocular microscope used for particle examination. The instructions by the door relate to operating the special shoe cleaning machine to prevent dirt tracking in.



Technologist Ken Tanino, with hydraulic fluid samples being analyzed for wear metals by QETE's Atomic Absorption Spectrophotometer. Concentrations as low as 0.1 parts per million can readily be measured.

Previous articles in this series outlined the contributions to flight safety by Quality Engineering Test Establishment (QETE), through its support of the Directorates of Flight Safety (DFS) and Aerospace Maintenance (DAM) in accident investigation and prevention. They described the cooperative relationship between DFS, DAM and QETE, and showed how QETE'S Special Projects group coordinates activities between laboratories within QETE.

This third article deals with QETE's Chemical Laboratories. The various groups in the section (Contamination Analysis, Fuels and Lubricants, and Rubber and Plastics), each very active in accident investigation, also have expertise in many other fields such as protective coatings, textiles, solvents and cleaners, foods and pharmaceuticals. The Laboratories are equipped with very modern and sophisticated instruments but the real capability lies in the experience and resourcefulness of the scientists who do the planning and testing and who interpret the results.

For instance, when a Tutor was involved in an air incident caused by intermittent failure of a D.C. Master Switch, the switch was sent to QETE. X-ray examination of the sealed switch did not reveal the problem, so the switch was opened. Two faulty contacts were found contaminated with a greasy material - the remaining six, which functioned properly, were clean. Because a lubricant is used on the switch pivot, it was suspected as a possible source. To find out, the switch was sent to the Contamination Analysis group where the traces of contaminant and the lubricant on the pivot were compared by infrared spectroscopy. They were found to be entirely different composition, indicating that this contamination was an isolated manufacturing defect rather than a potentially inherent problem of lubricant migration. The pivot lubricant apparently does not migrate.

When the "Red Knight" Tutor crashed and burned in 1969, and investigation at the crash site did not reveal the underlying cause, numerous components were forwarded to QETE for detailed examination. The Special Projects group immediately assigned samples of fuel, engine oil and hydraulic fluid to the chemical laboratories where analysis showed them to be the proper fluids with normal wear metal content and free from contamination. Later, sediment was discovered in the fuel pump, but this was identified by chemical analysis as "dry chemical" used by firemen at the crash site. Frustrating? Not really. These efforts, though they didn't establish the accident cause, definitely excluded certain areas from suspicion, a very important contribution since the extensive damage resulting from the crash, made it very difficult to distinguish crash effects from crash causes. In this accident, failure of a metal linkage in the fuel controls was finally established as the cause and Metallurgy recommendations for a less brittle alloy were made.

Problems revealed by accident investigations sometimes give rise to projects in which elements of QETE and DAM work directly together. Typical are two projects arising from troubles with hydraulic systems. The Fuels and Lubricants, and Contamination Analysis groups monitor DAM's Hydraulic Systems Flushing Program, and are working jointly with DAM to evaluate a spectrometric analysis scheme. Like the SOAP program for engines, this program is monitoring the wear metals in hydraulic systems. ■

Technician Paul Legault examining a CF101 mainwheel tire which failed on its first takeoff. Failures of this sort led to the development in QETE laboratories of a method and the necessary equipment for detecting poor adhesion between tire plies. In this case the failure resulted from poor adhesion between the tread material and the fabric of the tire carcass.

The Circuit Breaker and You

Capt J. H. Belanger
CFHQ/DAE

Here is the set up. You are in the cockpit, cruising along quietly, watching the clouds slip by, and all is well with the world! Then it happens. One of those standby systems has cut in and you're wondering what the dickens happened to Number One. A casual glance over to the side, and there it is, just as you guessed. The Circuit Breaker has popped.

So there you are, with a popped breaker and you are one pilot who is probably puzzled about those rows of hard nipples that you may pull or press, or simply tease with your fingertips, to see that they are all even. The question is - what do you do about it?

This article concerns the standard push-pull thermal type circuit breakers (CBs) normally used in CF aircraft Some other types are discussed briefly.

A circuit breaker is a circuit protection device which automatically opens to protect the circuit when excessive overloads occur. In their operation they are much like the rocker-type breakers which are gradually replacing old-fashioned fuses in the electrical panel of the home. (Be careful however to distinguish this device from the generator contactors - also called Generator Circuit Breakers - which in some systems, such as the Argus, are actually large power relays.)

CHARACTERISTICS

The functions of a standard aircraft circuit breaker are as follows:

- to open when excess overloads occur. This protects the circuit or its components from damage, and also indicates when the CB is tripped.
- to remain closed on *normal* overloads, preventing opening during *normal* circuit surges.
- can be manually reset.
- have a manual-trip provision.
- be "trip-free".
- be reliable, safe, standard, compact and accessible.
- may be identified for rating and in the circuit function in which it is used.
- keep the voltage drop in the CB to a minimum.

Aircraft circuit breakers are (normally) thermal devices. They contain a spring latch which holds a set of contacts closed. The current passes through a bi-metallic element which bends when heated by overcurrent. At the rated overcurrent level, the spring latch "trips" the contacts. This thermal effect gives the CB a characteristic time/current response which is essential in avoiding nuisance tripping due to short, high transients such as the starting current surges of lamps, motors and gyro erection cycles. Figure 1 is a schematic of a thermal trip device, and Figure 2 shows a typical trip band.

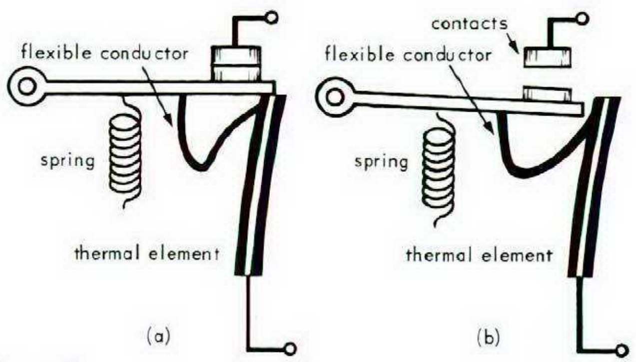


Figure 1

Basic construction of a thermal circuit breaker. Contacts are held closed (a), under normal load condition. With overload (b), the bimetallic element deforms to unlatch the contact mechanism.

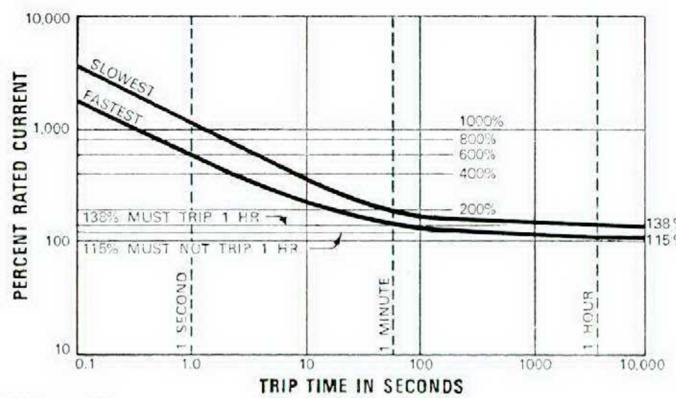


Figure 2

The prevalent military circuit breaker is the push-pull reset/trip, which in later designs is very compact. The CB rating is marked on the end of the plunger button. When tripped, the button protrudes approximately 1/4 inch and exposes a 1/4-inch white band. A tripped CB is therefore conveniently noticeable.

In ac multiphase circuits, or in installations where two or more breakers should be operated at the same time, they are usually ganged. In such multipole breakers, a circuit fault sensed by one unit will cause the ganged assembly to trip. Another type of multipole breakers is the single assembly which incorporates a single actuating push-button.

MANUAL TRIPPING

Most circuit breakers are not normally built strong enough to be used as control switches and cannot withstand frequent ON-OFF selections. However occasional use of a circuit breaker as a switch will not harm the CB. Also, the manual trip device lends itself to limited use. The typical trip/reset off-load endurance rating is about 5000 cycles.

The standard push-button type CB can be pulled by the fingertips. This manual operation is allowed in an emergency or for isolating a circuit for a specific reason. It is noteworthy that some circuits, for example, engine and flight instrument circuits, indication circuits, and caution and warning circuits cannot be practically controlled. The relevant circuit can be isolated by pulling the breaker in an emergency, provided that the effects are known. Pulling a breaker manually can in some cases have undesirable consequences. In some circuits, opening a CB may eliminate a related warning or an interlocking function. This could lead to unwanted situations.

There are special types of toggle circuit breakers which also function as simple ON-OFF switches, and which can be advantageously used in suitable circuits, particularly in installations where the distribution point can be placed at the switching station. They have the advantage of being easier to operate manually. However, they have the disadvantage of bringing the main circuit current into the switch console area.

THE TRIP-FREE BREAKER

A trip-free breaker is one which remains free to trip if an overload exists, even if it is manually held in the reset position. In contrast, an overload current cannot trip a NON Trip-Free CB (still in limited use) when it is held manually in the reset position. This feature detracts from the CB protective function in the latter.

The trip-free breaker has been the standard CB installed in new designs for at least ten years. The pull-to-trip, push-to-reset feature has also been generally used on most aircraft manufactured during that period. The white band on the CB plunger is standard. This standardization, along with the safety provided by the trip-free design, has decreased the need for repetitive instructions in AOIs for modern aircraft.

Circuit breakers are highly reliable devices, and there are few reports of malfunctions. However, since they are thermal devices, the time for a breaker to open is longer at low temperatures than at ordinary temperatures. If a circuit breaker fails to trip when a circuit fault exists, it may lead to burning wires or to component damage.

TRIPPING

The procedure to employ when a breaker has tripped is as follows: Reset the circuit-breaker once, in case the tripping was caused by a spurious condition in the circuit. When resetting the CB, check to see if the service is restored. In some large-amperage circuits the loadmeter pointer may show relevant load change.

If after resetting, the CB trips again, it must be assumed that a fault exists, and that rectification is required. In a vital circuit or in an emergency, the pilot may reset trip-free CBs more than once if he thinks it is necessary.

The NON Trip-Free circuit breaker as we have said, can be manually held closed against a circuit fault. This is the type which is installed in the T33, Otter, Dakota, and in H34 Helicopters. NON Trip-Free breakers are sometimes used in propeller control circuits. The rule to follow when a NON Trip-Free CB trips is this: Reset once if required, preferably after an interval of approximately one minute. Do not hold the CB in, except for a brief period in emergency situations, where AOIs so instruct.

WARNING: Holding a NON Trip-Free CB manually in the closed position for more than a few seconds when a severe short exists, can cause the circuit wires to overheat and burn, and in some cases can cause failure of the power source.

OTHER TYPES:

Various other types of circuit breakers are also in limited use. The Magnetic Type CB which is quicker acting than the thermal type, can be used in certain surge-free applications. The remote indicating CB carries auxiliary contacts through which a warning light circuit may be passed. The reverse-current circuit breaker used in some dc power systems trips on reverse current only.

Finally a word about fuses. These are usually of the screw-in type. They are quicker acting than CBs and are usually found in the output circuits of inverters where the limited power available is insufficient to trip a thermal breaker.

THE FUTURE

A forthcoming variant of the present "trip-free" breakers, is the "recycling trip-free". In these breakers, holding the manual reset against a fault current will result in the CB contacts cycling ON and OFF until the button is released.

Work is being done to use semi-conductors for circuit protection. However because of high cost and low power efficiency, it will be some time before these can replace the safe, compact, efficient and simple circuit breakers.

When a circuit breaker is suspected of malfunction, an entry to that effect must be made in the aircraft logbook. A circuit breaker must always be replaced by one of the same current rating. If nuisance tripping is experienced in a circuit, the circuit-breaker may be marginal for the installation, and an Unsatisfactory Condition Report should be raised.

In resumé, remember this: you can hold a "trip-free" breaker pushed in, and it won't do you any good. But if you hold a "NON Trip-Free" breaker in, you could be sorry. So the moral is not to hold any CB in.

Mr. Belanger is a retired RCAF officer working as an Aircraft Electrical Design Authority in the CFHQ Directorate of Aeronautical Engineering (DAE). During his service career he spent several years as an aircraft logistics electrical support specialist at Materiel Command. An earlier article by Capt Belanger, dealing with aircraft fire detection systems, appeared in the Jan/Feb 67 issue of Flight Comment.

On the Dials

In our travels we're often faced with "Hey you're an ICP, what about such-and-such?" "Usually, these questions cannot be answered out of hand; if it were that easy the question wouldn't have been asked in the first place. Questions, suggestions, or rebuttals will be happily entertained and if not answered in print we shall attempt to give a personal answer. Please direct any communication to: Commandant, CFFTSU, CFB Winnipeg, Westwin, Man. Attn: ICPS.

Frequency Changes on Departure

The subject of frequency changes during critical phases of flight has again been raised. Most pilots agree that the takeoff phase is as critical as the landing if not more so.

When departing under minimum IFR conditions or for that matter on any IFR flight where a departure frequency has been issued, or is to be used in conjunction with a departure procedure, the frequency change should be made prior to departure so that the pilot is in contact with centre before getting airborne.

Conversation with MOT controllers indicates that they too would prefer to have aircraft on their departure frequency as early as possible so that radar identification can be made and any SID or radio failure departure procedure can be cancelled and guidance can then be given by radar. In this way the flight can be fitted smoothly into the traffic flow.

There are many controlling agencies throughout the world who have employed this procedure for some time, and who will in fact issue a clearance to change to departure frequency before commencing the takeoff roll. It is a proven procedure and works well under heavy traffic conditions.

It may take our Canadian controlling agency a while to adopt such procedures so possibly we as drivers can help to speed things up. We can do one of two things:

- we can advise the tower we are switching to departure during line up; or
- to be more subtle we can request a change to departure frequency.

Changing to departure before takeoff could possibly raise some controversy regarding emergency procedures during takeoff, however the "pros" outweigh the "cons". Any comments on this or any subject will be most welcome.

ADVANCE NOTICE

The target date for the new Instrument Rating Exams, is 1 Apr 71. In this new issue both Met and Regs will be an open book exam.

QUESTION

In the event of radio failure during missed approach procedure, what routing and altitude would you fly to your alternate?

Any correspondence on this subject will be appreciated at the ICP school.

This!

Enclosed cabs for hangar line mules were in use at CFB Gimli during the past winter. The severe weather conditions encountered at prairie bases make the cabs a practical piece of equipment for the servicing line crews. The driver protected from the elements can devote his full attention to the job. He is freed from the distracting parka hood, goggles and other apparel normally required for protection. The cab enclosure is manufactured from fibreglass with windows to provide good visibility. A heater defroster system keeps the windows clear and the cab interior warm.

Owed to a Mae West

There once was a pilot from one of the Wings
Who never did wear his Mae West;
It was useless in Europe (he always knew best)
To fly around strapped in such things.

But one day from his dual he had to eject
(And no sweat, 'twas over the ground')
But his place of landing he couldn't elect
And a river was all that he found.

He floundered and struggled to get to the shore
('Least that's what the autopsy said')
For he didn't quite make it (his swimming was poor)
And he ended up drowned and quite dead.

His friend in the back seat was better prepared
For although it was land where he hit,
To fly without Mae West was more than he dared
And to save him it still did its bit.

Though the temperature fell on that dark dismal night
His inflated life-jacket was warm;
From its pocket removing his flashing strobe light
He attracted his rescuers ere dawn.

The moral of course to this sad little rhyme
Is that, though it may chafe you and bind -
Your Mae West is far better worn every time:
One day it might save your behind!

Capt D.W. Rumbold

cont'd from page 5

consumption. These possibilities could have contributed to his obscure malady but were likely not the main cause. One thing that the case does underline is the value of a truly comprehensive aeromedical investigation in assisting the board in arriving at the correct conclusions.

SPECIAL INVESTIGATIONS

The concern about the question whether there is something seriously wrong with our oxygen equipment, was such that two special investigations were conducted (CF210s) to identify this suspected 0_2 problem. The results were negative, showing in one case poorly fitted oxygen mask, and in the other a burned out air conditioning fan. Among the other incidents of suspected 0_2 problems which we have discussed and for which physiological incident reports (Annex A to CFMO 4203) were completed, only one case actually involved a malfunction of the MD2 oxygen regulator.

As thorough an investigation as was possible was made of the aircraft and their oxygen systems. Samples were taken from aircraft 0_2 systems, from servicing containers and from the cockpit. In one case the in-flight 0_2 delivery to the pilot's mask was evaluated. This provided demonstrable evidence that the oxygen system is certainly capable of fulfilling its role and, in the particular test situation examined, it was doing its job.

Regrettably, our study of the aircrew view of the 0_2 system was restricted to available reports and a limited number of pilot interviews. It did become apparent however, that there is some disparity among aircrew in oxygen habits and practices in flight.

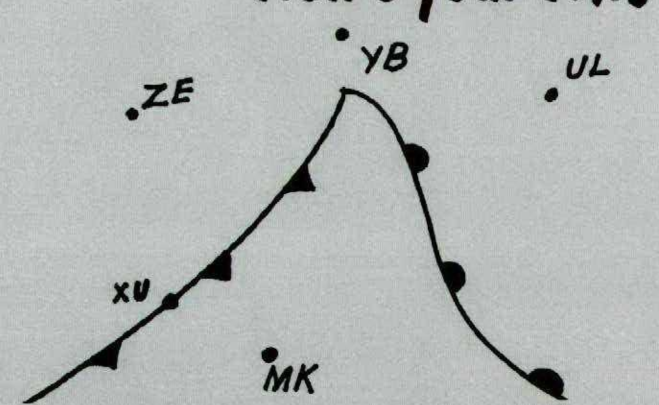
CONCLUSION

Flying is your business. It is vital that you learn all you can about yourself. Make certain that you are not shortchanging yourself when it comes to getting every bit of support possible in doing your job. What actual role does oxygen play in our accidents? No one really knows, but there is no doubt that it has shared in some - perhaps a guy you knew back at FTS.

THINK OF THIS...

Ne'er has the pilot been born, who, by virtue of his princely and superior quality of psyche and soma, has been rendered immune to even the most basic of stresses occasioned by flight. To think thusly is the mark either of the ignoramus or of the fool. What then YOU!

How's your Wx?



Here we have a set of actual weather situations. Your problem is to match the weather reports with the stations on the map.

16 Sept 1970 0600Z

A. M1⊕2½L-F 144/45/44/1005/992/SF10 826

B. M20⊕2RWF 179/68/67/2609/005/NS10 505

C. M6⊕8L-R- 162/53/51/1307/000/SF10 741

D. -X25⦶E80◑2½F 178/67/66/2308/004/F1SC2AC6 805

E. M3⊕4F 153/52/51/3208/996/SF10 322

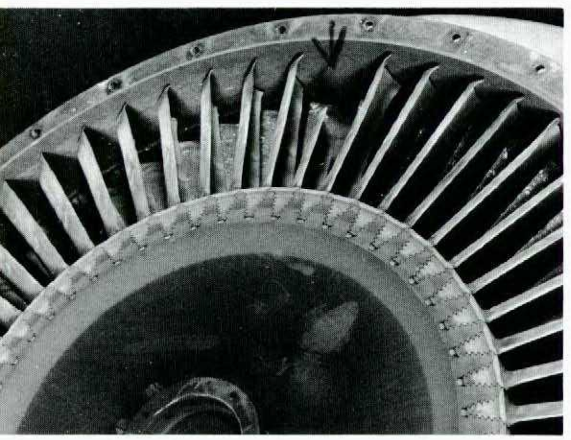
Answers page 24

Gen from Two-Ten

CF5, MID-AIR COLLISION A 3-plane section was engaged in high-level formation and air combat training. Following a number of formation turns, the section split, with lead and number 2 remaining one element and number 3 heading off at 90° as the second element. During the second of the ensuing intercepts, the lead (who was carrying a centreline tank) found himself unable to match the turn radius of the target (number 3) and cleared his wingman to attack. The lead did not have number 2 visual at this time, and as number 2 pressed in on the attack he lost sight of his lead. At that point the target reversed and as number 2 was reversing, he and the lead collided.

The collision sheared off nose, canopy and forward cockpit of number 2's aircraft. His lapbelt had somehow become undone and was thrown out of the cockpit unhurt. At very low altitude he deployed his parachute by means of the D-ring and received only minor injuries on landing. He was rescued by a helicopter approximately eight hours later. The pilot of the lead aircraft was killed in the collision.

This accident brings home the fact that as air fighting is being relearned in the Canadian Forces, air combat regulations must be continually reviewed to ensure that various procedures, such as the laws of visual contact, are clearly described and given proper emphasis during training.



T33, OVERTEMP The pilot's uneventful cross-country was interrupted by a loud bang as he was cruising along at FL270. The bang was followed by a light airframe vibration, but otherwise all indications were normal. The pilot obtained clearance to descend, levelled at 8000 feet and completed the flight to his destination at a reduced airspeed. The vibration continued until he shut down the engine.

On the ground a preliminary investigation quickly revealed the problem - one third of the turbine blades had vanished. Further investigation uncovered indications that the engine had been repeatedly and extensively overtemped over a period of time. Many of the blades still in place were warped, and displayed the classic discolouration resulting from overtemping.

This occurrence indicates that persistent efforts to impress upon pilots the dangers of throttle mishandling, are well justified.

OTTER, STRANGE LAKE, STRANGE TAKEOFF Two pilots had been detailed for a training mission which involved operating in and out of unfamiliar lakes. When they arrived at their destination the captain inspected the landing and takeoff area - first from 1000 feet and then from 500 feet. After this he made a low pass over the landing area and takeoff path. Then he flew a circuit and landed. Following anchoring and mooring practice, he moored the aircraft to the shore and shut down.

After a rest period the crew prepared for takeoff, this time with the co-pilot at the controls. While they taxied out the captain briefed the co-pilot on the intended takeoff.

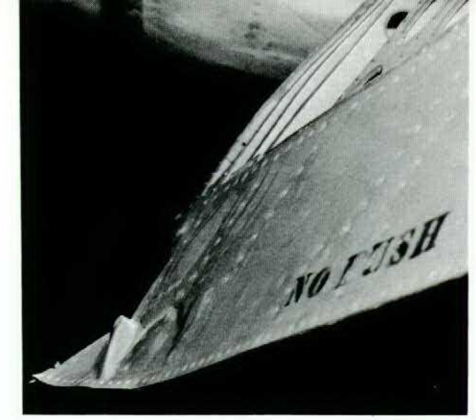
Shortly after getting airborne, the captain saw two wires directly ahead. The Otter went underneath them, however the wires struck the vertical fin. When the crunch sounded, the co-pilot abandoned the takeoff and landed straight ahead. The crew inspected the damage, then beached the aircraft.

Reconstructing the takeoff sequence, the two pilots found that they had used the wrong channel - about 30° off the intended heading. The co-pilot had become disorientated because of the similarity of the channels and because the intended channel was hidden by a headland. During the turn to takeoff heading, the captain had been busy with pre-takeoff checks.

This incident demonstrates once again, that the omission of routine cockpit checks such as cross-checking compasses when lined up for takeoff, is often the operational gap leading to accidents.

VOODOO, SCRAPED RUNWAY During takeoff on a practise scramble, the pilot rotated early and the aircraft left the runway without proper flying speed. After the landing gear was raised, the aircraft mushed and one flap and the data link antenna scraped the runway for approximately 100 feet.

Inattention to surface wind conditions and indicated airspeed, along with improper takeoff technique almost combined to bring disaster to this crew. Procedures outlined in AOIs are designed to give maximum performance and safety - experience of others has shown that there is no room for complacency.



T33, LOSS OF CONTROL ON TAKE-OFF The aircraft was number two, flying echelon left on a two-plane formation. During the latter part of the roll the pilot encountered difficulty maintaining directional control, and as the formation was becoming airborne he found himself overlapped on the lead with his right wing down. To avoid a collision, he pulled up and passed over the lead, but during this evasive action, the aircraft stalled. To recover from the stall, he had to set the aircraft down in the infield - on the right side of the lead. The pilot now found that he was heading straight for a taxiing aircraft, so he selected the landing gear up. The aircraft came to a stop in the infield between the runways.

Investigation revealed that the pilot had lined up with only "a foot or two" of lateral wingtip clearance. When he realized during the roll that he was too close to the lead, he failed to use rudder to move out. Finding aileron ineffective, he nevertheless continued the takeoff.

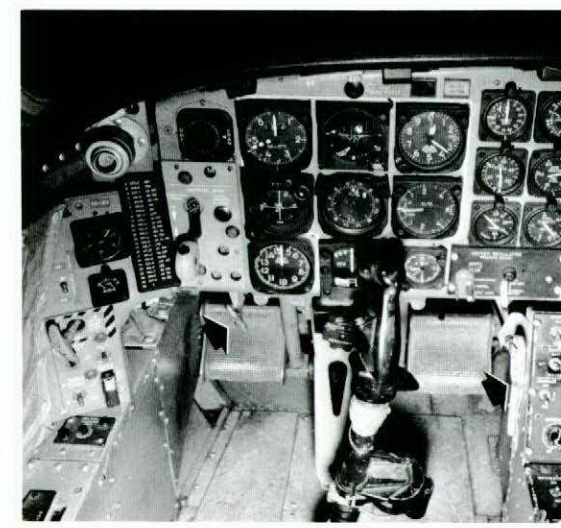
The accident illustrates a tendency among many pilots to reduce the margin of safety to the point where an error or an emergency will have catastrophic consequences.

In the aftermath of the accident, renewed emphasis has been placed on ensuring that pilots make proper use of brakes and rudders to maintain directional control during the takeoff roll.

TUTOR, CANOPY JETTISONED Two pilots were strapping in for a training flight. The first pilot (in the left seat) lowered the canopy to about one inch above the rails, adjusted his rudder pedals and then, intending to set the parking brakes, he pulled the canopy jettison handle. The canopy jettison system immediately functioned as advertised. The departure of the canopy caused extensive damage to the airframe around the canopy hinges because it was fired from a partially opened position. No one was injured. The 'first pilot' later explained that he thought he was "setting the T33 brakes".

This marked the fourth time in less than three years that a pilot had pulled a Tutor canopy jettison handle in the act of setting the parking brakes. Although the handle differs in shape from the one in the T33, positioning is such that reflex action and habit patterns developed in setting T33 parking brakes can cause pilots to pull the wrong handle.

Renewed efforts are being made to prevent such accidents. Pilots converting to the Tutor from the T33 are being given blindfold tests. As an interim measure the canopy jettison handle has been fitted with a paper shield to warn pilots that they are about to jettison the canopy.



Parking brake handle, left canopy jettison, right.

Comments to the editor

New Protective Clothing - but when?

In the Gen from 210 item, Voodoo Static Electricity Fire, Nov/Dec 70, you castigate an aircraft technician for wearing an unauthorized civilian windbreaker, and his supervisors for being unconcerned. The point is well taken, but to my mind you completely missed the root of the problem.

Was it because he had nothing else to wear that the technician was allowed to wear the windbreaker? We magnanimously provide the aircraft technician with three articles of environmental and protective clothing; a rain suit, a parka, and coveralls. The humidity was 26% - obviously it wasn't raining. It was May - too warm for a parka. Again the low humidity - it was probably bright but chilly, too chilly to wear only coveralls for line servicing duties.

In the previous issue of Flight Comment you tell us that *new protective clothing* based on a systems concept *is on the horizon.* I am willing to wager that many moons will rise and set beyond that horizon before we see improved protective clothing on general issue to the field. In the meantime we wait and make do. And next time maybe we'll not be so lucky - maybe we'll burn up a shiny, multi-million dollar aircraft. Think how many warm, confortable intermediate jackets that would buy!

Systems concepts are nice things to have, but you can't wear them. Let's have that long overdue intermediate jacket, without trials - NOW!

Maj R.F. Cowie
BAMEO
CFB Summerside

The improved intermediate jacket design (similar to the blue aircrew jacket) that was shown in the Sep/Oct 70 issue has since been abandoned in favour of an entirely new design which will at long last provide a distinctive jacket for groundcrew. In spite of the fact that the jacket will first go on user trials, this move is a step in the right direction in that with a jacket of their own, groundcrew will no longer provide a convenient disposal for threadbare aircrew castoffs. However, they will have to rely - as they have for years - on the "buckshee" system of second-hand aircrew jackets, until the new jacket becomes available - and that, as you predict, may take many moons.

448 Sqn Overlooked

I usually find Flight Comment articles interesting and informative; however, something was missing in the article "Visual Phenomena in Flight" (Nov/Dec 70). This article failed to mention that 448 Test Squadron was responsible for obtaining the required film footage for the terrain illusion and snow illusion phenomena. 448 Squadron is responsible for instrumenting the aircraft with cameras and for flying repeated missions to obtain the necessary film footage. As well as film sequences from aircraft-mounted cameras, film sequences from hand-held cameras are also required. This is a demanding task not only for our squadron photo technicians, but also for our pilots who have to fly in the actual conditions. Aircraft that may be required from outside this squadron are supplied by 417 Sqn and 434 Sqn only if our own aircraft are involved in other test flying.

As engineer on this project, I felt obliged to inform you of the role played by 448 Test Squadron in producing this vital film.

Lt L.G. Riegert
448 Test Sqn
CFB Cold Lake

We're pleased to give credit to 448 Sqn for their valuable input in the production of this film. We assumed (incorrectly) that the list of participating units we received along with the article was complete.

Icing Inhibitor in Jet-A1?

We enjoyed the article "You can't fool the pros", in your Nov/Dec issue. We felt it was about time someone explained the differences between our F-40 (turbo 2, JP4) and the various commercial types of turbo fuels which are available.

The legend taken from GPH 205 however, seems to have an error in that it states F-34 (jet A1) contains the additive FSII fuel system icing inhibitor. As far as we can determine there are no commercial turbo fuels which contain this additive. Although FSII is not a component of commercial turbo fuels, it can, as the article says, be requested from the tender driver and is available at most major airfields in this country.

As a point of interest, an additive that is now included in most turbo fuels at the refinery is the Anti-Static Additive (ASA). This is for safety purposes as the refiners have a great respect for turbo fuels and have tried to reduce static buildups in their storage and dispensing equipment.

MWO J.K. MacLeod
Aircraft Fluids Handling School
CFB Winnipeg

P.S. You can't fool the Pros!

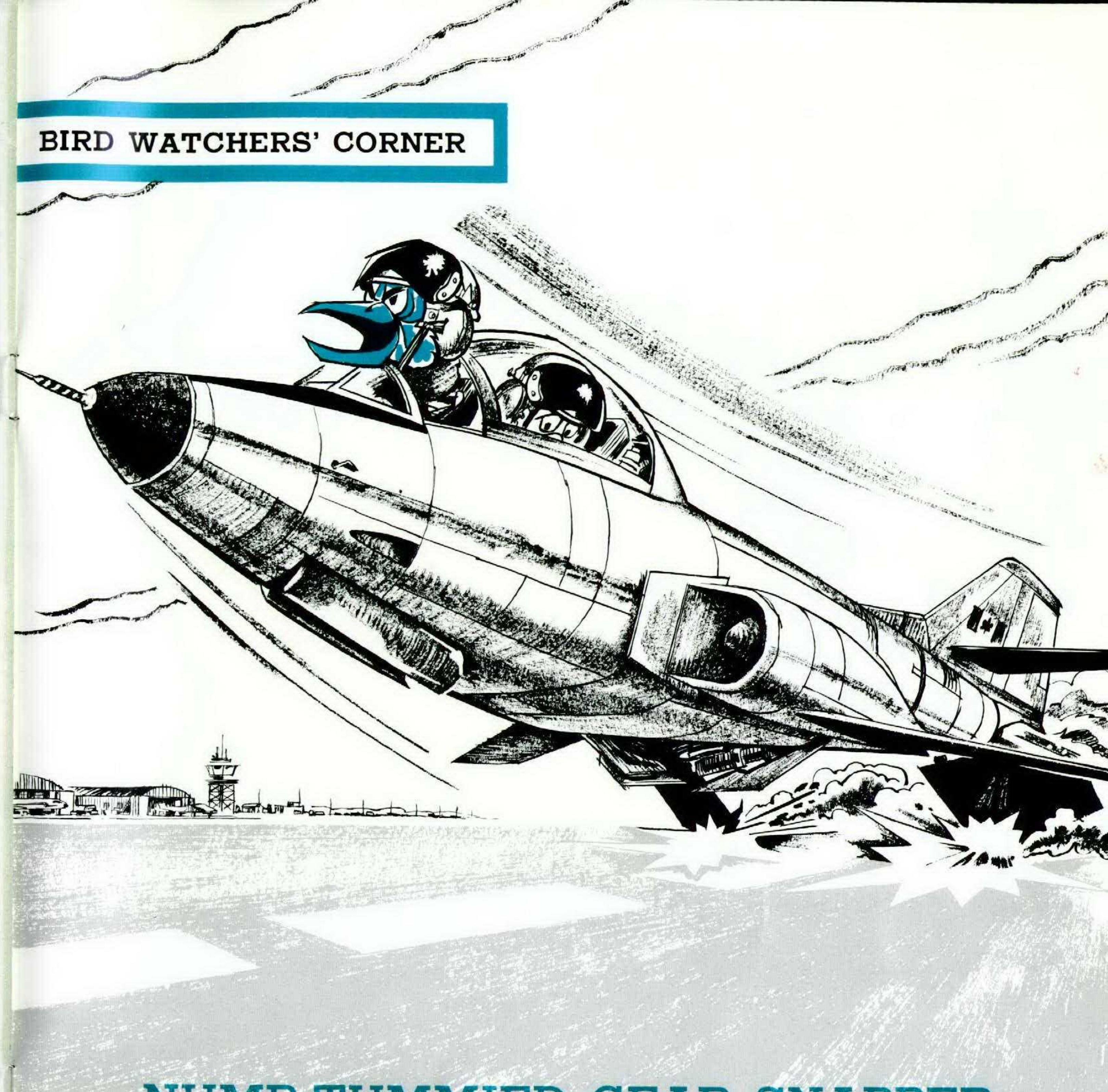
Admittedly no commercial turbo fuels are produced which contain a fuel system icing inhibitor. However, some suppliers mix in the additive at their main storage tank, others mix it in at the tender, while others only have the inhibitor available for direct supply into the aircraft. If the additive is mixed in at the storage tanks or at the tender then NATO F-34 is being delivered to the aircraft. If the additive is mixed in at the aircraft, then F-35 is being delivered.

Your point is an interesting one and your concern for the accuracy of the fuel code is appreciated.

- how's your wx?

A-YB
B-XU
C-UL
D-MK
E-ZE

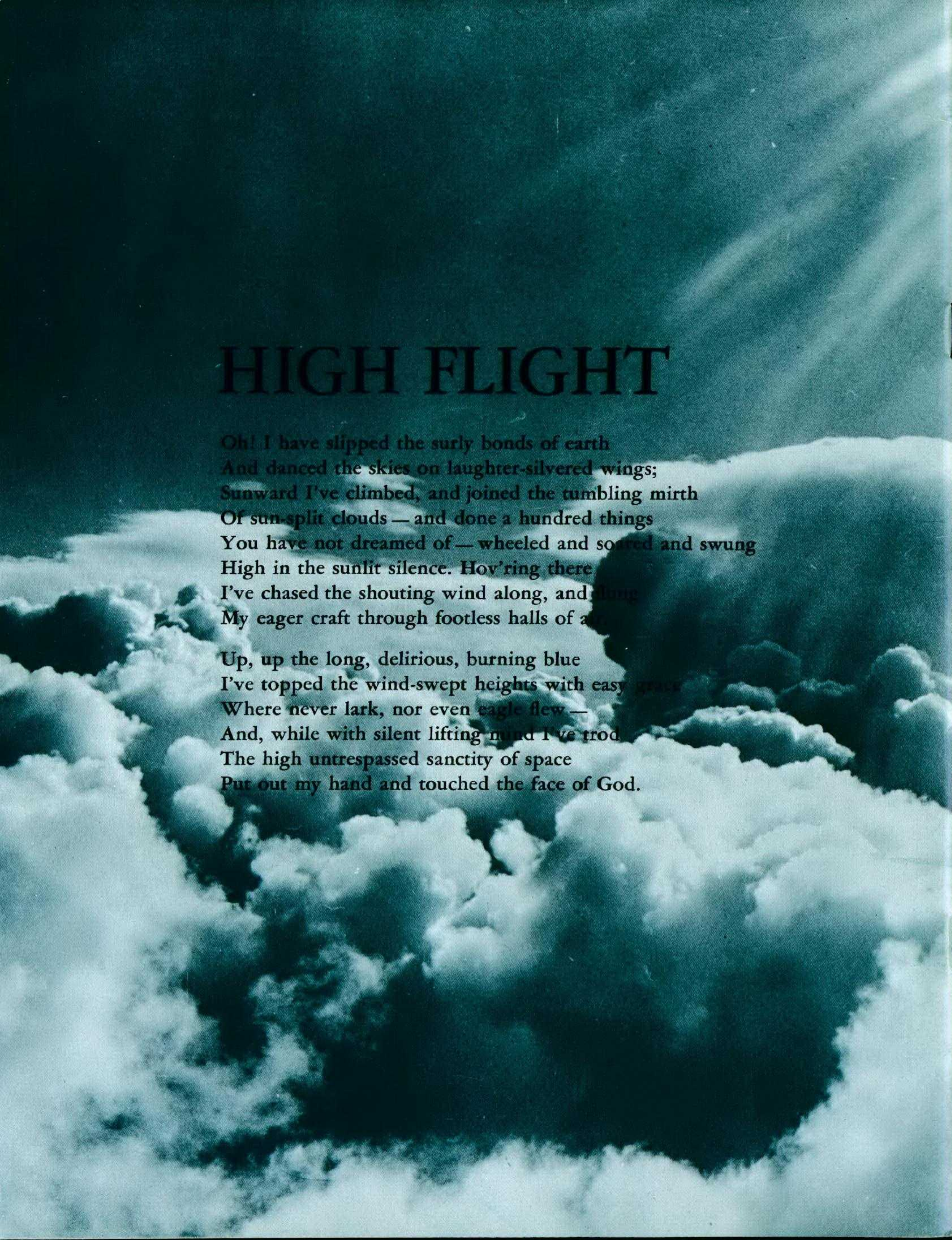
BIRD WATCHERS' CORNER



NUMB-TUMMIED GEAR SNAPPER

For incomprehensible reasons this avian oddity believes that observers will look upon him as one of the Feline Species (specifically, Tiger, although the connection often seems rather tenuous) when they see repeated demonstrations of his dominant flight characteristic — a tendency to tuck in his ambulatory apparatus on takeoff before his weight has been fully transferred from gear to wings. Unhappily this is often accompanied by a belly-rending crunch, a prelude to an unscheduled return to the runway. The Gear Snapper's peculiar ritual has aroused much scientific interest among ornithologists, most of whom attribute the behaviour to a solid cranium made of hickory. His curious birdsong rises above the sound of tearing metal:

IT'S-REALLY-QUITE-FUN 'CEPT-MY-TUMMY'S-ALL-NUMB



HIGH FLIGHT

Oh! I have slipped the surly bonds of earth
And danced the skies on laughter-silvered wings;
Sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds — and done a hundred things
You have not dreamed of — wheeled and soared and swung
High in the sunlit silence. Hov'ring there,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air.

Up, up the long, delirious, burning blue
I've topped the wind-swept heights with easy grace
Where never lark, nor even eagle flew —
And, while with silent lifting mind I've trod
The high untrespassed sanctity of space
Put out my hand and touched the face of God.