FLIGHT COMMENT

ISSUED BY

DIRECTORATE OF FLIGHT SAFETY
R.C.A.F. HEADQUARTERS • OTTAWA, ONT.
MARCH · APRIL · 1956

RESTRICTED

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C O N T E N T S

Articles, comment and criticism welcome. Address all correspondence to:

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AFHQ, OTTAWA**

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QUEENS PRINTER AND CONTROLLER OF STATIONERY
OTTAWA

F/O B. E. PATTERSON

F/O H. P. LAMBRINOS

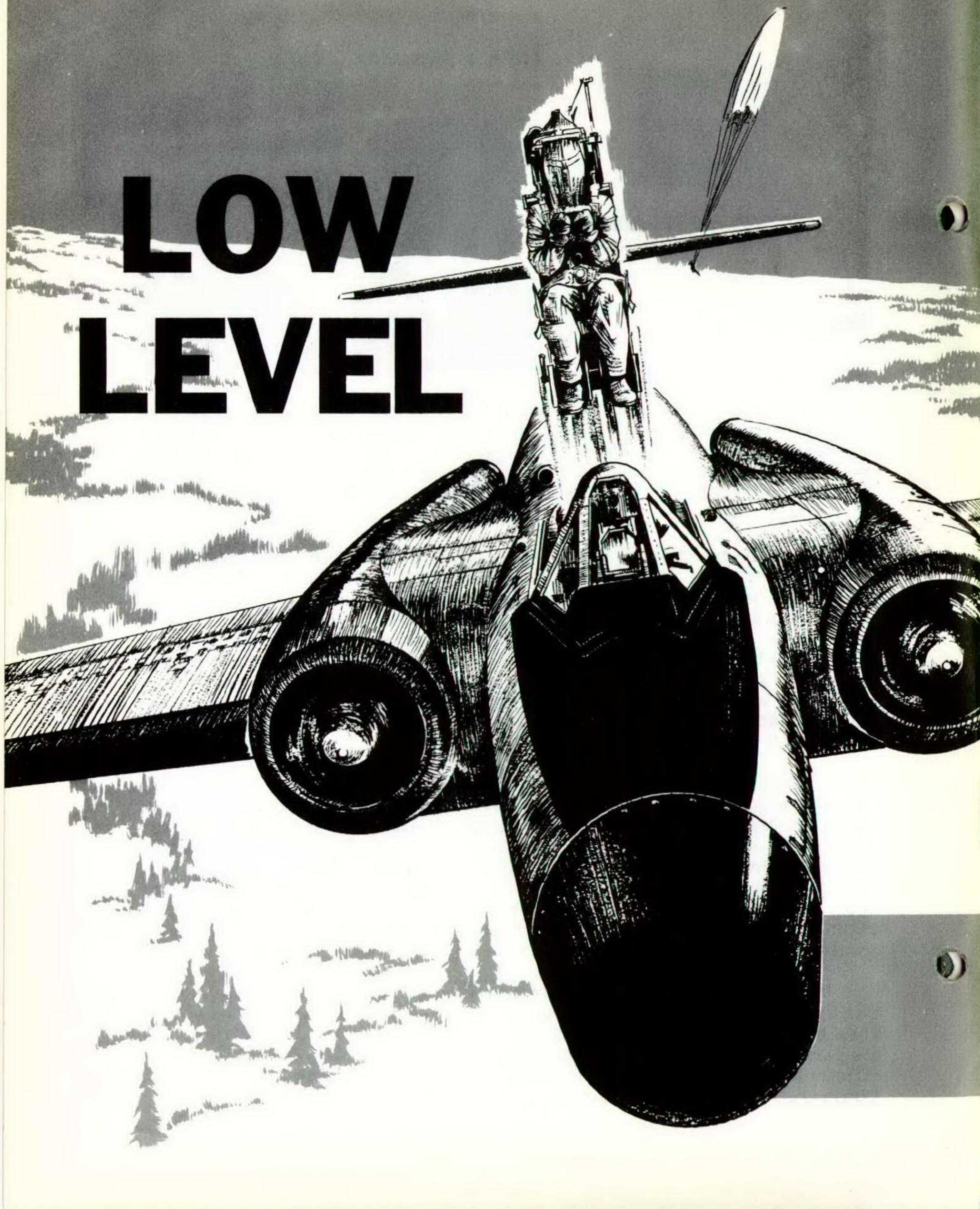
F/O Patterson was detailed as number three in a formation of four Sabre aircraft led by F/O Lambrinos. During the climb F/O Patterson experienced a flameout at 37,000 feet. He at once informed his leader and set up a glide towards base while the wingman, number four, closed in behind and told F/O Patterson that his Sabre was venting fuel from the tailpipe.

When informed of the emergency, F/O Lambrinos moved into position to assist the distressed pilot on his return to base. The latter meanwhile had turned off all unnecessary electrics and, at about 26,000 feet, attempted a relight which was unsuccessful. Subsequent relight attempts were monitored by the formation leader who radioed instructions in each case, with F/O Patterson acknowledging as he went through the procedure. At 15,000 feet over the aerodrome a further attempt was made which resulted only in a momentary rise in tailpipe temperature to 150°, while the rpm rose to 22% and then dropped back again between 10 and 15 percent.

A final unsuccessful relight was tried at 12,000 feet, after which F/O Patterson had to switch his concentration to the imminent forced landing. Here again the assistance provided by F/O Lambrinos was invaluable. A 270-degree turn brought the two aircraft to a position over the runway at 8000 feet. F/O Patterson lowered the undercarriage using the emergency system, and when he felt sure he could make the field, he selected flaps and dive brakes. Hydraulic pressure remained at 3000 pounds until the turn onto final, and a few seconds before touchdown the alternate system cut in.

Excellent teamwork was demonstrated throughout the emergency. Because of his greater experience, F/O Lambrinos was able to supply valuable assistance and direction to a student pilot in difficulties. On his part, F/O Patterson remained calm throughout, followed instructions efficiently, and succeeded in landing his Sabre on the runway undamaged. Congratulations to both pilots!

LOW LEVEL EJECTION



We are indebted to the aeromedical staff of Air Defence Command for obtaining and preparing the detailed and useful Canuck ejection report which comprises the bulk of the following article. —ED

Abbreviated Scenic Tour

Guesswork and human limitations have been virtually eliminated from low level ejections by the new automatic version of the Martin-Baker ejection seat. Dubbed the Mk 2E, it is now standard equipment on the RCAF's Mk IV Canucks. Earlier models of the aircraft are currently having their seats modified to include the 2E's automatic features.

Older versions of this and other ejection seats are adequate for safe ejections at altitudes down to about 2000 feet. Below that height, however, events in the ejection sequence are happening so quickly that there is a possibility of the average man being bounced rather alarmingly off Mother Earth's somewhat unyielding bosom.

The automatic feature disposes of the need for aircrew to perform manual functions in the face of high speed, wind blast, tumbling and alternating "G"—conditions which serve only to inhibit a man's attempts to carry out his role in the sequence. After the canopy is jettisoned, the aircrew member triggers the entire procedure simply by reaching up and pulling down the face blind. From that point on, Martin and Baker take over the show. Pulling the blind fires the seat up and out of the aircraft and sets a delay mechanism running. One second later the drogue gun fires, releasing the drogue 'chute which stabilizes the seat and cuts down its speed through the air. Next the seat harness is released; and finally the main parachute streams out.

The important aspect of the new system is that automation carries out the entire performance considerably faster than the pilot could manage it himself. Simply stated, the time element involved has been so narrowed as to actually provide the difference between life and death for aircrew who are forced to eject at low levels.

Report on the Real McCoy

Recently an RCAF crew had to bail out at low level from a Mk IV Canuck equipped with these seats. Their experience makes interesting reading and illustrates not only the effectiveness of these automatic devices but the benefits of good crew drill and discipline.

When the pilot realized that bailout was unavoidable, his aircraft, was at an altitude of approximately 650 feet above ground. He called to the navigator, "Prepare for immediate bailout and tell me when you're ready." The navigator replied, "Is that right?" The pilot answered, "Yes." Instantly the navigator put both hands up to grasp the firing handle on the face blind. He overreached by three or four inches and hit it with his wrist, whereupon he lowered his hands and grasped it in both hands without difficulty. He then said, "Ready." He cannot remember the position of his elbows, nor does he recall making any special movements with his legs or feet. However, HE THINKS HIS FEET WOULD HAVE BEEN IN THE STIRRUPS, AS HE ALWAYS ADOPTS THIS POSITION WHEN ENTERING THE CIRCUIT AND CHECKS TO SEE THAT THE RADAR IS STOWED AND HIS SEAT LOCKED FULLY BACK.

During this short period the pilot trimmed the aircraft for level flight, broke the locking wire, and raised the cover from the canopy jettison switch. As soon as the navigator said "Ready," the pilot warned "Canopy going," and the navigator replied "Roger." The radio by this time had faded to almost nothing. The pilot pulled the switch and saw the canopy out of the corner of his eye as it left the aircraft. Dust rose in the cockpit but did not get into the pilot's eyes. Wind buffetting was negligible. A fraction of a second after jettisoning the canopy the pilot heard the explosion as the navigator ejected. He re-trimmed the aircraft, then glanced at the instruments and noticed that his height was approximately 500 feet above ground, the indicated airspeed 200 knots.

At approximately 400 feet and 200 knots he reached for the face blind firing handle with both hands. Experiencing no difficulty in grasping the handle, he gave it one swift pull to the full extent of the blind. Recollecting the incident later, he seemed pretty sure that his feet were not in the stirrups and does not recall taking the time to obtain a good position for ejection. (At that height we don't blame him!) The shoulder straps of the seat harness had been slackened for formation flying, and the pilot cannot recall tightening them again, although it's likely he did so automatically.

After pulling the face blind his only impression was that of leaving the aircraft. He felt no jolt as the seat ejected. The next sensation was one of tumbling forward in a vertical plane. This continued until he felt a tug as the seat stabilizing drogue opened, after which the tumbling motion was replaced by rotation of the seat on the drogue line axis. The pilot then slid the blind from the side of his face and saw trees right in front of him. It is presumed that at this moment the seat was almost horizontal and facing the ground. He then heard a "whoom" which was likely the parachute opening. Almost immediately he felt himself hitting the trees.

The pilot does not recall the seat harness releasing; he had no sensation of leaving the seat, and did not feel any shock when the parachute opened. After ejection he saw neither his seat nor the aircraft. The next thing he remembers is being suspended in a sitting position about six inches off the ground. The seat, which had broken a fairly large tree, was lying on the ground about eight inches from his right foot.

Both pilot and seat landed in dense bush. Trees in the area averaged about 25 feet in height and there was a lot of thick underbrush. While still hanging in the harness he checked himself for injuries but did not find any. He then actuated the parachute harness release box whereupon only the shoulder straps released. However, as he got to his feet by pulling on the risers, the leg straps also let go.

The navigator's story follows a similar pattern. He heard a loud "whoof" as his canopy went. At almost the same instant, and in one swift movement, he pulled the face blind firing handle which he had grasped before the canopy was jettisoned. The next thing that he remembers is tumbling forward, alternately seeing trees and sky. He does not recall moving the face blind. Nor did he see either the pilot or the aircraft after ejection. He then wondered if the automatic seat was going to work—and at that instant noticed it falling away below him and to his right. No stabilizing drogue opening shock was felt, and he was unaware of his seat harness releasing and of leaving the seat. He then felt something flying from his head (probably his protective helmet), and saw the trees coming straight towards him. The next thing he knew he was hanging in his parachute harness in the trees, suspended about a foot off the ground. No parachute opening shock was felt. He too landed in dense bush consisting of thick undergrowth and trees approximately 25 feet high. Releasing himself from his harness he made a quick check of his person. It was a heartening discovery—nil aches, nil pains, nil injuries.

The remainder of this narrative is incidental. The pilot was picked up by helicopter via a winch and sling. The navigator showed his independent spirit by taking Shank's Mare out to a road and thumbing a ride back to base.

*

Much of the credit for the fortunate outcome of this ejection is obviously due the new Martin-Baker seat. However it would be foolish to underestimate the contribution made by three acts on the part of the crew:

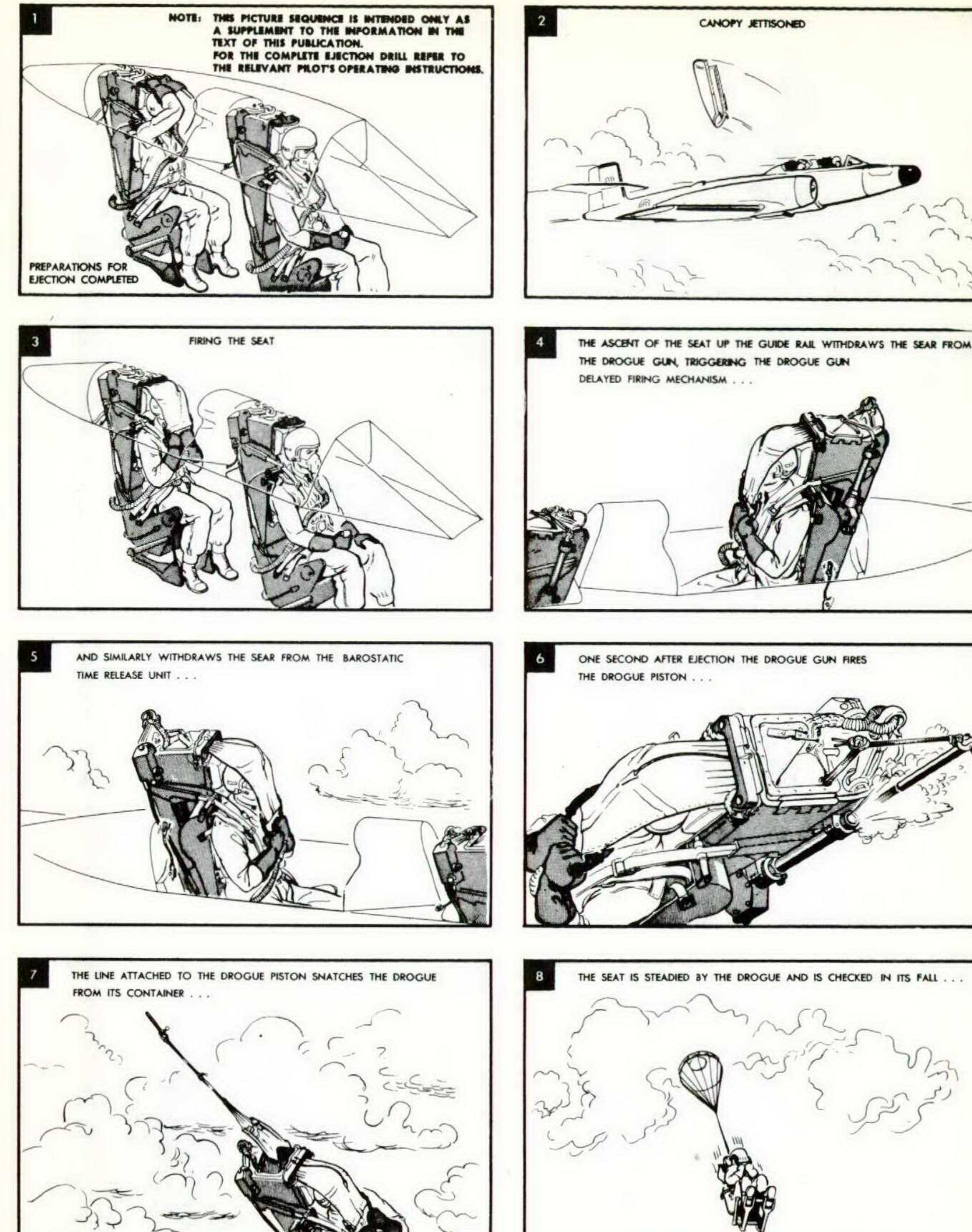
- The pilot's prompt decision to abandon the aircraft
- The teamwork shown by both pilot and navigator
- The speed and precision with which the ejection drill was performed.

Perhaps the pilot could have used his 200-knot flying speed to better advantage by gaining a little height before putting the ejection sequence in motion. But who are we to criticize? After all, the "seat" we "fly" is a mere office chair at Air Force Headquarters. It was just a thought that occurred to us after we had reviewed the accident. This crew did a good job—and incidentally provided all RCAF aircrew personnel with a fine display of the human elements that compose a successful low level ejection. They're worth repeating:

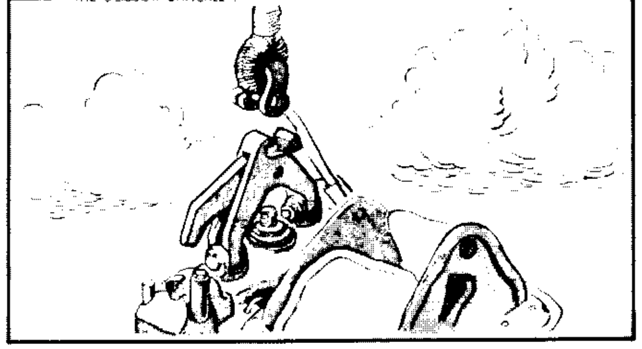
- PROMPT DECISIONS
- SMOOTH TEAMWORK
- FAST PRECISE DRILL

EJECTION SEQUENCE

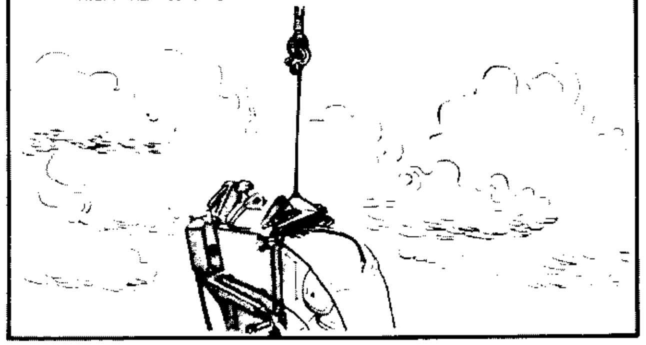
The following sketch treatment of the ejection sequence appears in EO 55-50-2A and is supplementary to the information in the text of that publication. For the complete ejection drill, refer to Pilot's Operating Instructions.



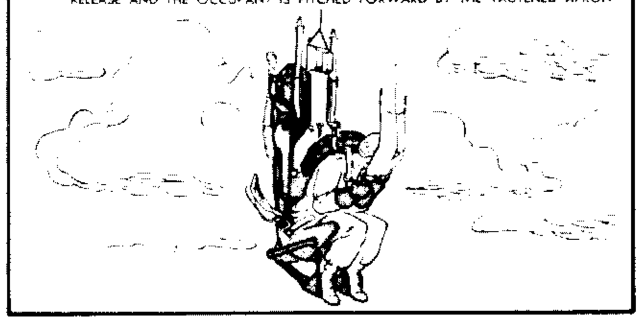
9 WHEN BELOW 10,000 FEET THE TIME RELEASE UNIT OPERATES AND OPENS THE SCISSOR SHACKLE . . .



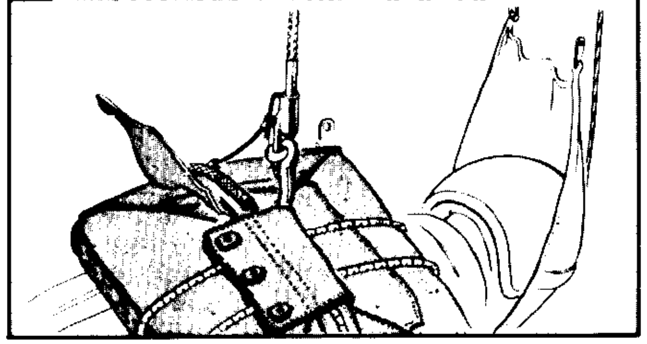
10 THE DROGUE, NO LONGER ATTACHED TO THE SEAT, RIPS THE LIFTING LINES FROM THEIR CLIPS TO FREE THE FACE SCREEN . . .



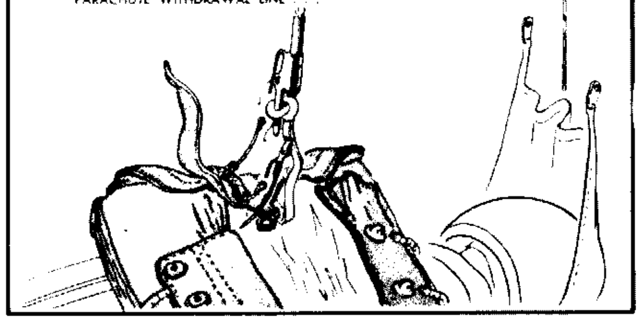
11 AND PULL THE APRON TAUT BEHIND THE OCCUPANT OF THE SEAT. SIMULTANEOUSLY, THE TIME RELEASE UNIT OPERATES THE SAFETY HARNESS RELEASE AND THE OCCUPANT IS PITCHED FORWARD BY THE TAUTENED APRON



12 THE PARACHUTE WITHDRAWAL LINE (ATTACHED TO THE APRON) PULLS THE PARACHUTE STATIC LINE AS THE OCCUPANT LEAVES THE SEAT

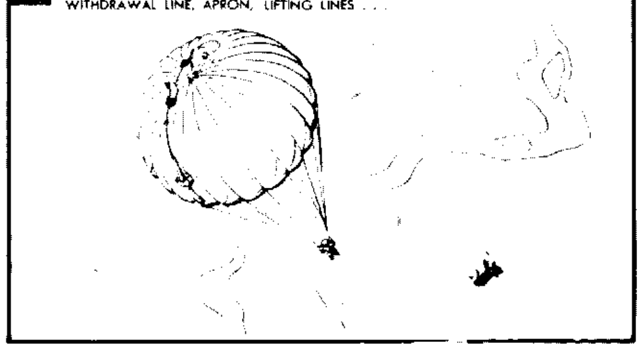


13 FREEING THE MANUAL OVERRIDE CABLE, WHICH IS PART OF THE OCCUPANT'S PARACHUTE HARNESS, FROM THE SLIDE DISCONNECT PIN ON THE END OF THE PARACHUTE WITHDRAWAL LINE . . .

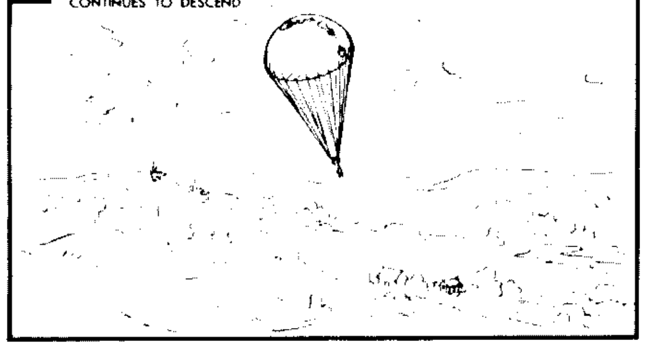


14 THE PARACHUTE STATIC LINE PULLS THE PARACHUTE FROM ITS PACK, ARRESTING THE FALL OF THE OCCUPANT, AND AS THE PARACHUTE DEVELOPS THE PARACHUTE HARNESS RESTRAINING STRAPS PULL FREE OF THE SEAT AND . . .

15 THE SEAT FALLS AWAY FROM THE OCCUPANT WHO WITH PARACHUTE WITHDRAWAL LINE, APRON, LIFTING LINES . . .

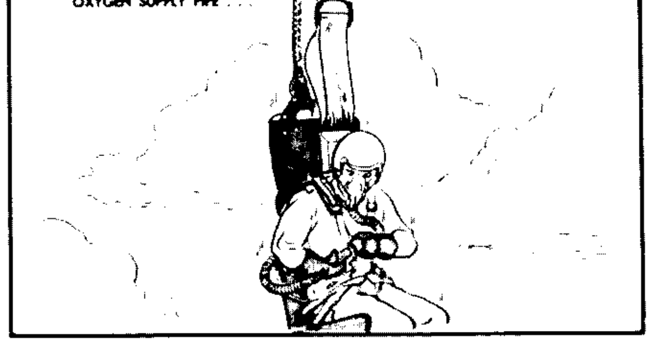


16 AND DROGUE STILL ATTACHED TO THE STATIC LINE ON HIS PARACHUTE CONTINUES TO DESCEND



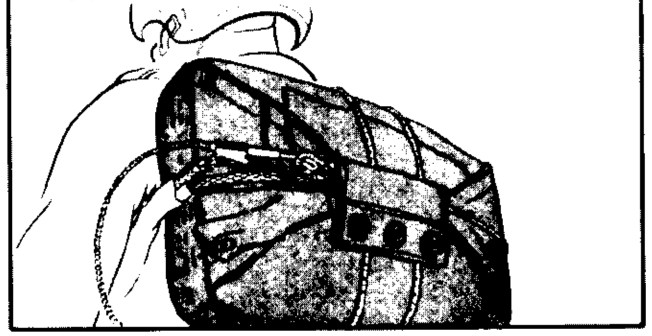
17 IN THE UNLIKELY EVENT THAT THE AUTOMATIC FACILITIES ([illegible] to [illegible]) FAIL FOLLOWING SEAT EJECTION THE DROGUE CHECKS THE SEAT, THEN . . .

18 THE OCCUPANT DISCARDS THE FACE SCREEN AND DISCONNECTS THE OXYGEN SUPPLY PIPE . . .

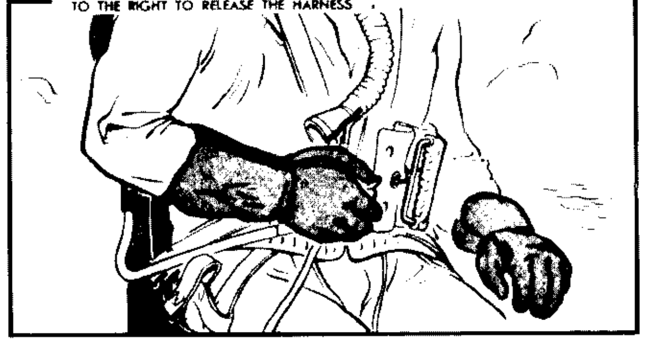


19 PULLS THE MANUAL OVERRIDE D-RING TO DISCONNECT THE PARACHUTE FROM THE SEAT BY . . .

20 WITHDRAWING THE SLIDE DISCONNECT PIN TO FREE THE PARACHUTE STATIC LINE FROM THE PARACHUTE WITHDRAWAL LINE . . .



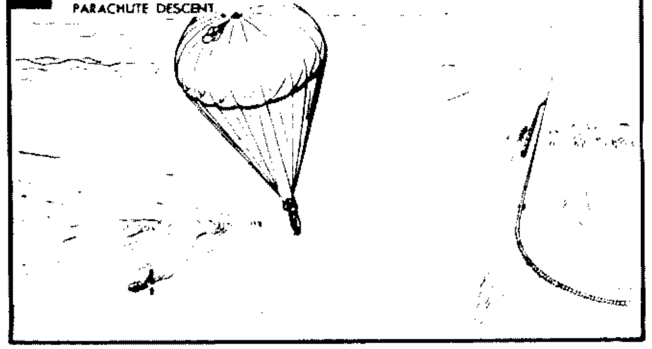
21 HE THEN ROTATES THE SAFETY HARNESS QUICK-RELEASE FITTING LEVER TO THE RIGHT TO RELEASE THE HARNESS . . .



22 DISENGAGES THE SIDE RESTRAINING STRAPS OF THE PARACHUTE HARNESS FROM THE SPRING CLIPS ON EACH SIDE OF THE SEAT PAN . . .

23 LIFTS THE FLAP ON HIS PARACHUTE HARNESS TO EXPOSE THE PARACHUTE RIP CORD D-RING AND FALLING CLEAR OF THE SEAT . . .

24 PULLS THE PARACHUTE RIP CORD D-RING TO MAKE A NORMAL PARACHUTE DESCENT



MISTAKEN CLEARANCE

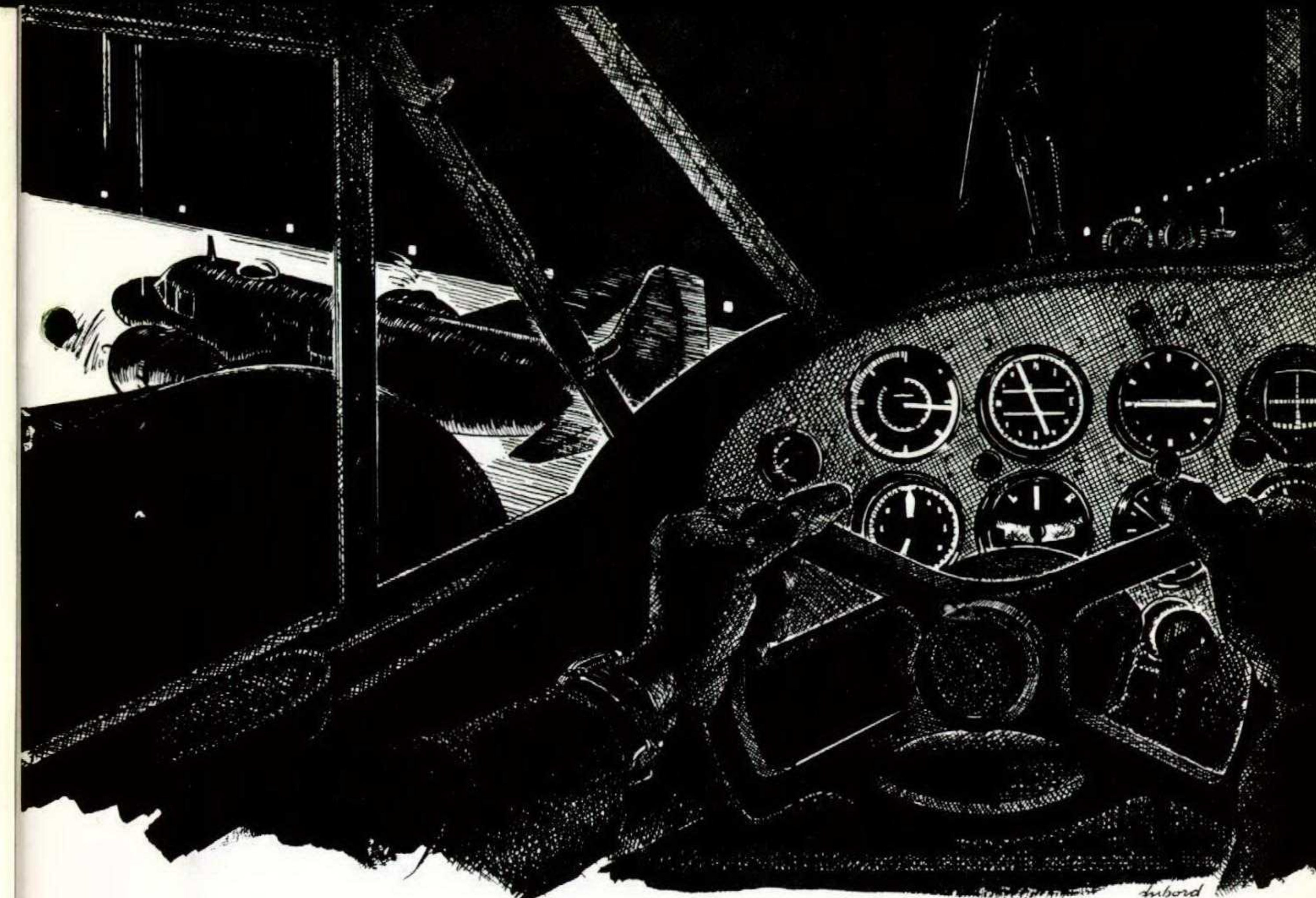
We had filed a DVFR flight plan for a night flight in an Expeditor from a civilian field to our home station. The weather check showed borderline VFR conditions caused by smoke and haze in the vicinity of the airfield.

At 2210 we were cleared to taxi to the runway where checks and runup were completed. When takeoff clearance was requested we were cleared to position. Up to this time transmissions from the tower may have been numerous, but we had not paid attention to them since we were busy taxiing and doing the runup and were listening only insofar as our own identification was concerned. After getting into takeoff position we heard transmission between the tower and an RCAF transport aircraft which was approaching the airfield. During a quiet period we again requested takeoff clearance and were told to "hold". Shortly afterwards the tower operator came on the air and said he regretted the delay.

There followed a series of transmissions between the RCAF transport and the tower which culminated in the pilot reporting out of the area and changing to Centre frequency. By this time we had been in takeoff position for more than ten minutes, so when the airborne aircraft changed frequency we anticipated immediate takeoff clearance. It came through and we acknowledged, reporting our identification number (the last figure of which was "one"), and started to roll. The Expeditor was lightly loaded and became airborne after a short run.

As we crossed the intersection at a height of about 50 feet, a commercial airliner flashed underneath, apparently taking off on the intersecting runway. In the ensuing conversation with the tower operator we learned that the commercial aircraft also had an identification number whose last figure was "one", and that the takeoff clearance had applied to it and not to us.

No transmissions to or from the airliner were heard so it must be assumed that the tower was working the civil aircraft on a different frequency and not on simultaneous broadcast until the takeoff clearance



As we crossed the intersection at a height of about 50 feet, a commercial airliner flashed underneath

was given. Consequently we could not know that another aircraft was preparing for departure. After some 20 minutes' waiting we erroneously assumed that the clearance was ours.

Our Near Miss has led us to make the following recommendations:

- No aircraft should be cleared to takeoff position unless it is next in turn for takeoff.
- All aircraft should be worked on the same frequency in order that crews may be aware of the presence of others.
- Landing lights should be used for night takeoffs to indicate to the control officer than an aircraft is moving or about to move. (We took off without switching on our landing lights.)
- Tower operators should exercise care in monitoring acknowledgments especially if identifiers are in any way similar.

Had the tower operator recognized the fact that the wrong aircraft was acknowledging takeoff clearance he could have immediately broadcast a warning for aircraft taking off to hold their positions. Only he was aware that there were two aircraft awaiting takeoff clearance on separate runways. He should have recognized a dangerous situation when acknowledgment came from the wrong one. Likely he heard two replies to his transmission, one from each aircraft involved.

[There is an additional significance to this report that is worth noting. The two pilots who sent it in have a combined flying time of nearly 10,000 hours! Also, both possess instrument ratings. One is an Air Vice-Marshal, the other a Squadron Leader. Thus, neither rank nor experience will preclude the possibility of a Near Miss. Furthermore if personnel of this calibre can take the time and trouble to prepare and submit a Near Miss Report that all may benefit, why not you?—ED]

WHY THE DISCONNECT ?

A Sabre pilot experienced dimming of vision and nausea while flying at 47,000 feet with a cabin altitude of 24,000 feet. Noticing that the blinker was not working he switched to 100% oxygen. When the blinker still failed to operate he reduced altitude to 15,000 feet. A cockpit check revealed that his oxygen hose bayonet fitting had become disconnected.

The unit FSO remarked, "It is gratifying to know that the aeromedical course is paying dividends. Pilots are now able to recognize symptoms of hypoxia and take corrective action before it is too late." [To which we say, "Hear! Hear!" But why the disconnect? Was the fitting not properly connected to start with? Readers are referred to "Got a Good Connection", which appeared on page eight of FLIGHT COMMENT for Jan - Feb 1955.—ED]

REMEMBER THIS ?

SAFE MAINTENANCE

Directorate of Maintenance Engineering

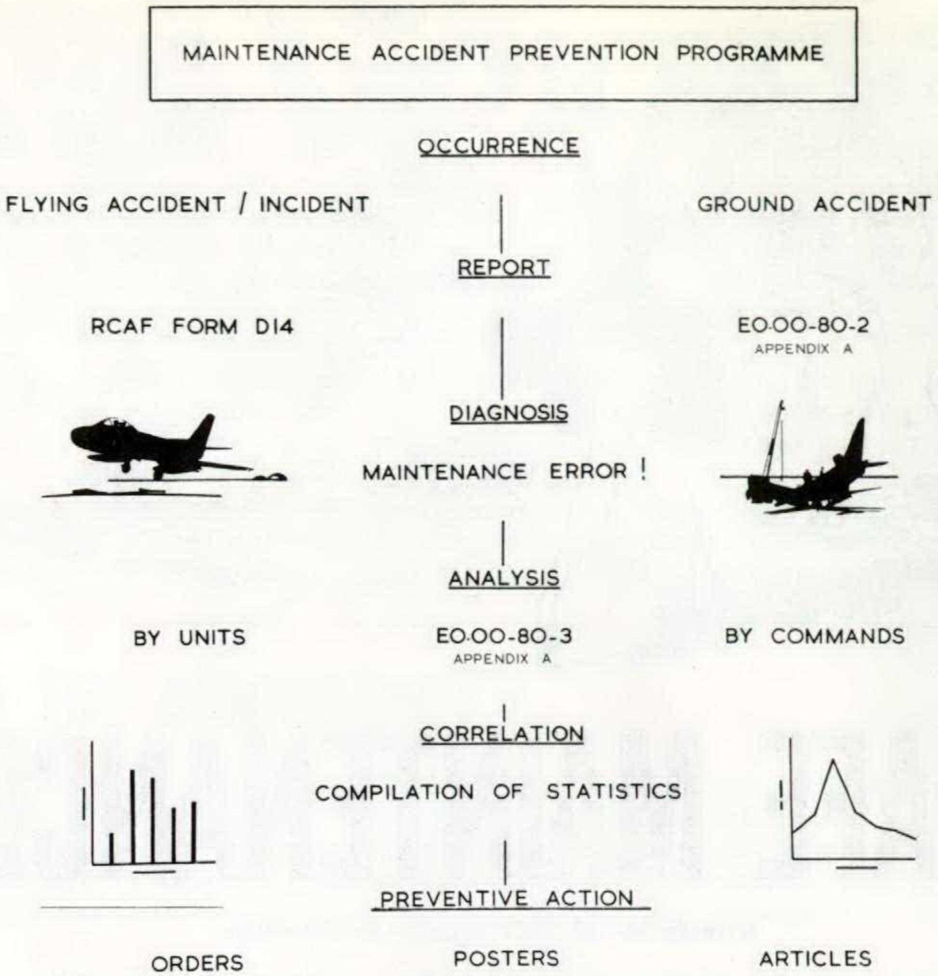
The Maintenance Record

Ten percent of all accidents involving RCAF aircraft are attributable, directly or indirectly, to maintenance. When we consider the problems imposed upon our maintenance organization over the last few years, this degree of responsibility seems relatively low. On the other hand it does not provide grounds for complacency. Why? Because ALL maintenance accidents are avoidable!

Room for Improvement

Lives and aircraft are being lost because of errors committed, not just in the sections or at units, but right up the line of our maintenance organization. An inadequate instruction issued by a headquarters can cause an accident just as easily as a wrench left in an aircraft by a technician. A shortage of self-locking nuts can be just as dangerous as indifferent supervision by Sgt Lax. How can these errors be reduced?

First of all, the accidents themselves must be reported. The Form



D14 for flying accidents has recently been revised. To supplement it, a procedure and a form for reporting ground accidents have been introduced by EO 00-80-2. These forms provide the basic information: What happened? Who and what was involved? Why? However, when maintenance is implicated it is usually necessary to dig deeper, because the error which causes an accident rarely occurs simultaneously with the accident. The error may have been committed three days ago on an inspection, or last week in workshops, or last month at a headquarters. These occurrences—and the reasons behind them—are the root of the problem.

One D14 reads that an aircraft crashed because a cotter pin was left out of a control connection. How did this happen? Another explains that an aircraft lost a cowling in flight because the wrong procedure was used in locking it. Why? When the error was made by the LAC AF Tech involved, was he distracted by some personal problem? Had he been given adequate information? Was he really competent to do the job? Did he have the proper tools? Was he cold or wet because of inadequate clothing? Did he care? And what about his supervisor? Was he there?

Or was he checking an inventory or the bar stock in the Sergeants' Mess? Perhaps he was at Supply; or maybe he was Orderly Sergeant. Did he know what was being done on the aircraft? Obviously this sort of detective work cannot be performed at AFHQ or even at Commands; it must be done on the spot by those directly concerned.

The New Program

EO 00-80-3 introduces a new concept, a new procedure for the analysis of maintenance errors. The analysis is to be originated by the unit concerned and then submitted on all aircraft accidents or incidents which involve maintenance, regardless of whether or not other reports have been made. It will contain a description of the maintenance error, what happened, what trades were involved, and an analysis of why the error occurred. Finally the report will conclude with an assessment of the origin of the trouble. All of this information will be compiled in the field by the personnel who are closest to the problem. Further up the line comments and action taken may also be added; but basically the report will consist of a field analysis. Thus the opinions of maintenance personnel in the field will be of the utmost importance.

Correlation and compilation of statistics will be done at AFHQ. If and when trends start to appear, remedial action will be initiated. This action may involve recruiting, training, establishments, maintenance procedures or scales of equipment. It may involve buildings or clothing—or even pay and allowances. Right now, nobody knows. Nor is it yet known whether EO 00-80-3 and its appendix are adequate. They may require revision. That is why the initial issue is "Advance", and why units have been saddled with reproducing the appendix for themselves. Comments and suggestions from the field in UCR form will be most welcome and of considerable help in establishing the program on a truly effective basis. However, it should be realized that some time will elapse before the results begin to show.

Inauguration of the new maintenance accident prevention program was set for 1 Jan 56, so it may be well into the summer before the defects appear and before the system starts to indicate our weaknesses. Much of the data will likely be embarrassing to our maintenance organization, but it is infinitely more embarrassing to kill people and destroy aircraft through neglect. The new program deserves your enthusiastic support. Your own life may be involved.

An analysis of why the error occurred

MOUNTAIN WAVES

L. L. PRIMEAU

Senior Weather Officer
RCAF Station Claresholm

The standing waves which form in the lee of mountain ranges can present flight problems of a serious nature. The consequences of encountering them unexpectedly have been fatal at times—even for very experienced crews. Because these waves are of vital concern to all pilots flying in the vicinity of the mountains, we have asked Mr. Primeau, Senior Weather Officer at RCAF Station Claresholm, to prepare an article on the subject for FLIGHT COMMENT. As you will see from what follows, Claresholm has a grandstand seat for some spectacular displays of wave phenomena.— **ED**

*

How Are They Formed?

We are all familiar with the standing waves set up on the surface of a fast, smooth-flowing stream by stones and boulders on the bottom. Similarly the atmosphere often reveals the same phenomenon. Our knowledge of it has been derived from many sources, the most revealing of which were the investigations made with sailplanes in Europe, the United States and elsewhere. There have also been special research studies; and we have on file as well the accounts of pilots who encountered wave phenomenon unexpectedly—but successfully—together with other reports concerning pilots less lucky. From this variety of sources we have today a pretty good idea of what is involved and what precautions should be taken in dealing with these waves.

Standing (or mountain) waves result when an air stream, on crossing a mountain range and starting down the other side, begins an undulating motion. There are several conditions for the development of such waves on a significant scale. The optimum wind direction, for instance, is perpendicular to the line of the mountain ridge (though waves may form when the wind is as much as 50 degrees off the optimum direction). The wind speed will be at least 25 knots at the mountain crest and increases rapidly with height in the next several thousand feet, remaining strong and steady from there to the tropopause. In general, the stronger the wind the more vigorous the wave formation. Lapse rate in the air stream is also a factor, for the air must be stable. Finally, topography is important. While 300-foot hills will cause standing waves, the higher the barrier the greater will be the vertical and horizontal dimensions of the waves formed.

In a well developed system the first waves in the lee of the range may well extend to above the tropopause. As we proceed downstream the amplitudes of the waves become smaller until finally no wave motion is apparent. Such a series of waves, with crests from five to ten miles apart, may die out within a few score miles. However, where the mountain barrier is on the scale of the Rockies, standing waves will still be evident several hundred miles downwind through typical cloud formations—sign posts in the sky warning pilots of possible upwind dangers.

How Are They Detected?

Mountain waves have their own characteristic clouds: lenticular clouds, roll or rotor clouds, and cap clouds. The lenticular—named for their peculiar lens-like shape (see Fig 1)—are the sign posts just mentioned, and they are always striking evidence of wave motion in the atmosphere. They are formed in the standing waves and are stationary, their windward edges in a constant state of formation, their leeward edges in a constant state of dissipation. Sometimes these clouds are observed in layers, one above the other, extending to the tropopause—an indication of moisture stratification in the air stream. The mother-of-pearl cloud reported at high latitudes (in Alaska and Norway, for example) is also of wave origin, and striking proof that the influence of mountains on the air flow extends to heights of from 80,000 to 100,000 feet. The famous "Chinook Arches" of southern Alberta are actually lenticular clouds (see Fig 2).

In appearance, lenticular clouds give one the impression of a strong, smooth, laminar flow. The roll or rotor clouds are quite different. Occurring in stationary lines of cumulus or cumulus fractus parallel to the mountain range, they appear to be (and are!) highly turbulent. Sometimes they merge with the lenticular clouds, their tops occasionally reaching 30,000 feet or more. The cap cloud is different again; looking almost like a waterfall, it is a sort of stratus deck pouring over the mountain crest in the first downsweep of the wave. The characteristic cloud gap appearing immediately to the lee of the mountains is evidence of a downdraft.

Fig. 1. Lenticular clouds over RCAF Station Claresholm. The wavelength is approximately half a mile.

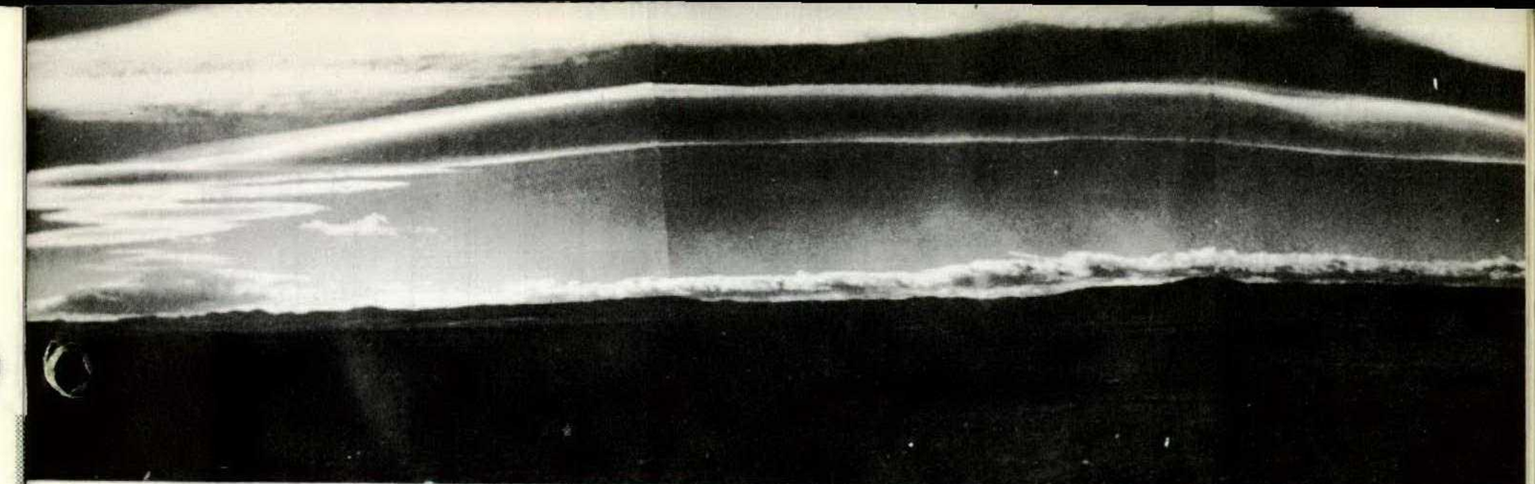


Fig. 2. A "Chinook Arch" over RCAF Station Claresholm. The wavelength here is approximately 10 miles. Note the line of rotor clouds beyond the near hills.

There are two situations in which the wave does not advertise its presence with these characteristics. The first occurs when the air is too dry to produce cloud, the second when the air is so moist that there is a solid overcast, with low ceilings completely obscuring everything else. In either case, however, the wave may be just as violent—and perhaps more hazardous for not being visible.

Effects At Altitude

For the pilot, mountain waves contain three special hazards: extreme turbulence and drafts, jet-like winds, and the possibility of major altimeter errors. The severest turbulence occurs in rotor clouds. In a strong wave condition, penetration of these clouds will almost certainly result in at least temporary loss of aircraft control. Turbulence is usually found just above the tropopause as well, and occasionally throughout the wave. In this latter case the lenticular clouds have ragged edges rather than the usual smooth outlines. In the up- and downdrafts, conditions can be quite smooth, although the vertical velocities may be as high as 5000 feet per minute. One illustration of the strength of these drafts is the case of the P-38 which, with both engines feathered, soared on the Sierra Wave over Bishop, California, from 15,000 to 30,000 feet! Another example is the disconcerting experience of a BEAC Viking over Spain which sank at 1000 feet per minute despite full climbing power, and shortly afterward, with power off, climbed at 1000 feet per minute.

Jet-like winds are found over and just to the lee of the mountain ridge line and may also occur in the down-flowing parts of the waves themselves. These localized winds are especially hazardous to aircraft flying into them. For one thing, they can cause navigational errors, with the result that a pilot may think he is safely across the "hump" when he is actually descending right into it; for another, they are associated with the descending currents. Together these two hazards make a prize-winning combination for pushing an aircraft into the ground.

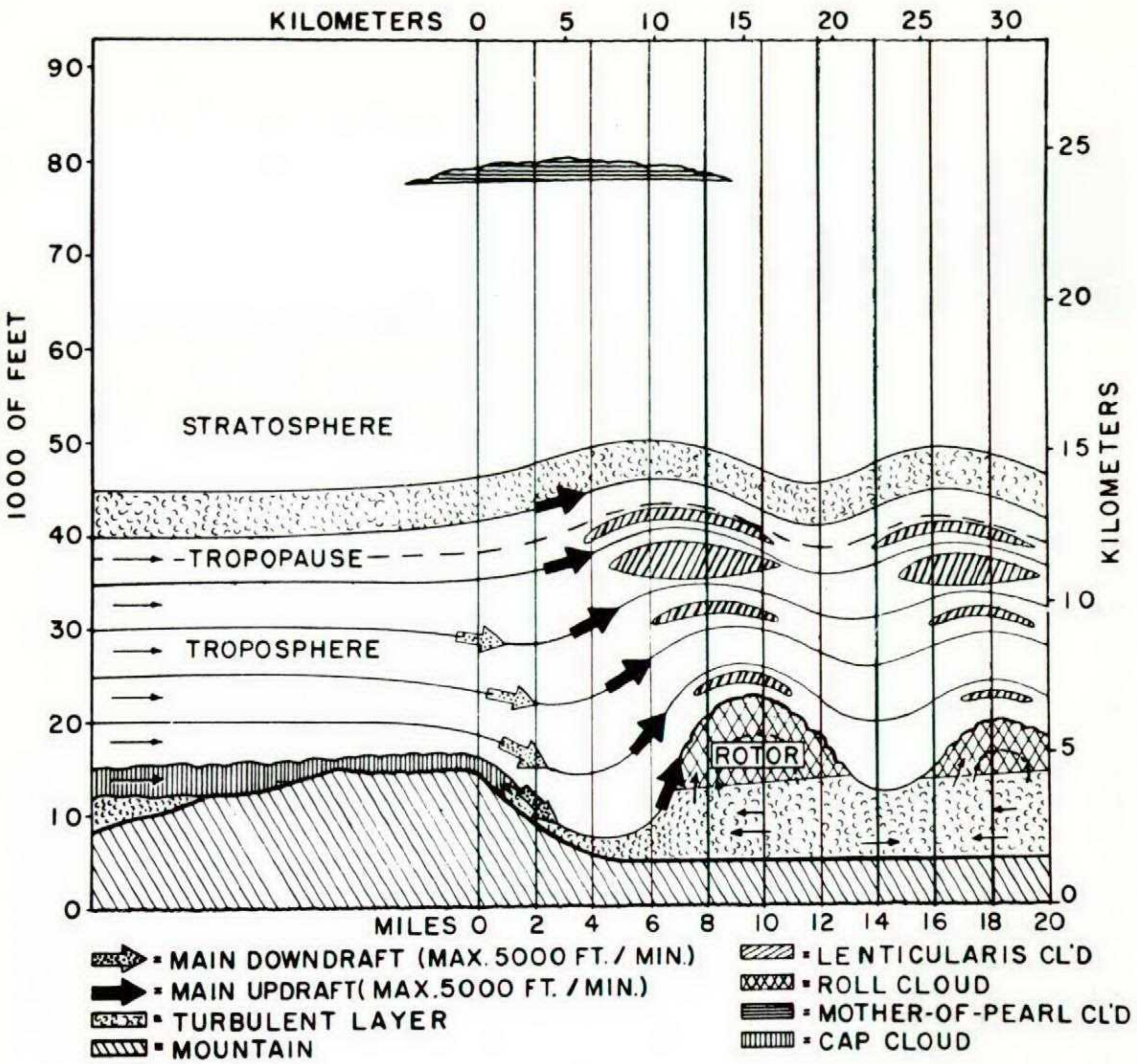


Fig. 3. Cross-section of conditions associated with a typical mountain wave

Altimeter error may result from a combination of factors. High velocity flow across a mountain ridge produces a reduction in air pressure which will cause an altimeter to read too high. In the winter months, when mountain waves are most frequent, low air temperatures contribute to errors in the same direction. Computations have shown that readings may be out by as much as 1000 feet; and pilots have claimed inaccuracies as high as 2500 feet. Obviously a pilot in these circumstances may be fooled by his altimeter into feeling secure, even though his aircraft is actually lower than the safety height for the particular route.

Effects Near Ground

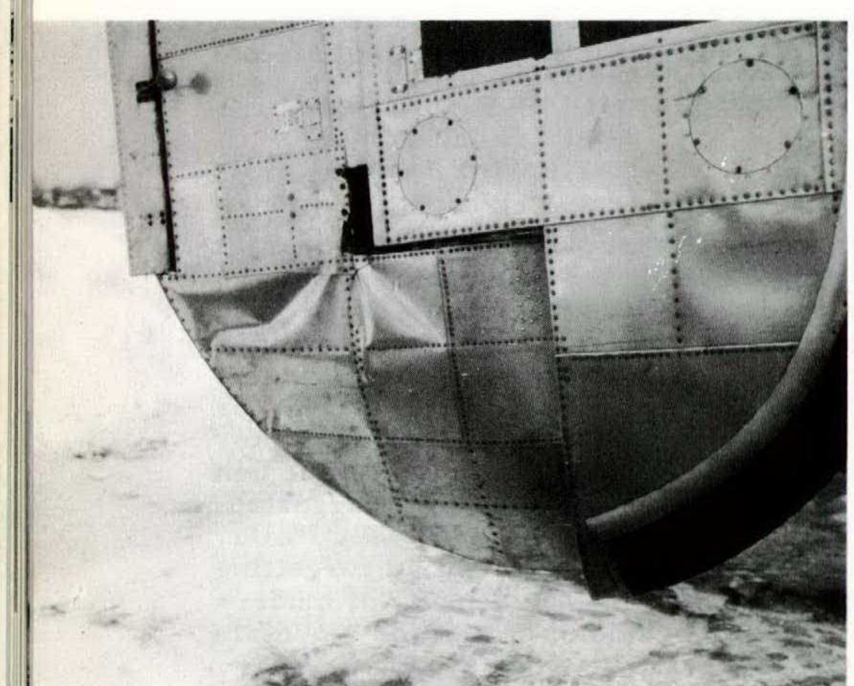
On the ground there are hazards too, as borne out by experience at Claresholm. Figure 3 shows the location of Claresholm relative to the Rocky Mountains and indicates why mountain waves are to be expected whenever the upper flow is from south-southwest through to west-northwest. Since the mountains are some forty miles away, it is likely to be the fourth wave (or a later one) in the standing wave series which overlies the station. Now, one feature which has been observed is the slow working down of a wave trough until it finally reaches the ground. (The actual height of this trough is indicated by an area of turbulence which is the result of shear between the fast moving air in the wave and the comparatively stagnant air beneath). When it arrives at the ground, there is an abrupt increase in the surface wind speed.

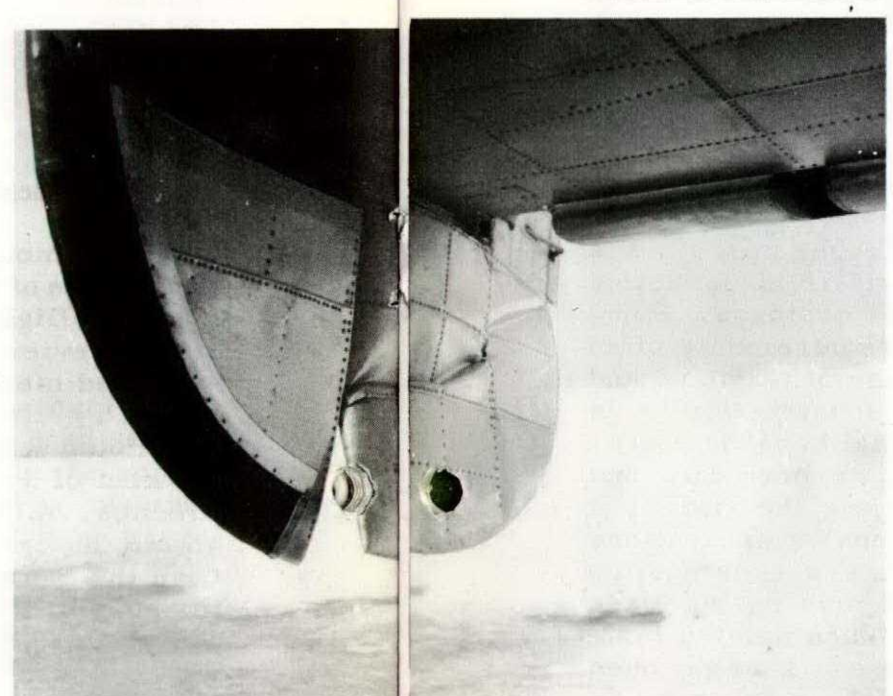
A good example of this occurred in the Fall of 1954. Lenticular clouds indicated a wave condition aloft and the morning's first flights reported heavy turbulence in a layer from 7000 to 10,000 feet MSL with smooth air above and below. Within an hour and a half after these reports were received, the base of the turbulent layer lowered gradually to 4500 feet; and half an hour later it was within 500 feet of the ground. Meanwhile the surface wind remained light and variable. In another 15 minutes the wave had reached the ground and the surface wind was blowing to a small gale, gusting to 40 miles per hour. Sometimes—and this happens particularly at night—a wave will lower to within a few hundred feet of the ground and stop there. Pilots experiencing considerable drift on final will break out of the strong wind zone to find their correction carrying them off the runway. Their reports on such conditions are indispensable not only to the forecaster but also to their fellow pilots taking off later.

Kid Gloves Recommended

With mountain waves as with other weather phenomena, the correct application of knowledge and experience is the best guarantee of safety. If the preflight weather check reveals a wave condition along your route, review in your mind the hazards you can expect, and consider ways and means of avoiding them. Select an altitude which provides a healthy clearance of the highest terrain. The 'Safety Height' or 'Minimum Route Altitude' won't be much insurance if you encounter the kind of downdrafts or turbulence that a vigorous mountain wave can produce. An altitude half again that of the highest ground is suggested, and in the case of the Canadian Rockies this means 15,000 feet PLUS. Give the cap and rotor clouds the long view from high up, not forgetting the possibility of turbulence at all levels and the advisability of moderating airspeed, just in case. Finally, remember that the mountain wave doesn't have to be visible to be real. If in the clear, be wary. If in the soup.....well.....no descents into mountains, please.

airfield HAZARDS





"During the period 1 Jul 53 to 30 Sep 55, the RCAF experienced 97 aircraft accidents in which airfield obstructions either caused or contributed to the damage sustained."

That is the opening paragraph of a recent analysis made by DFS on airfield accidents. The analysis includes the fatalities and the cost in dollars. The nature of the obstructions is such that they can be segregated into seven different classes. We will analyze them here in order of their importance as accident cause factors.

- **Soft or rough ground in infields and overshoot-undershoot areas; rock piles; mounds of earth; and soft spots.**

These particular conditions constitute a major hazard to aircraft which have not landed on the hard surface and to those which pilots have been unable to keep on the runway. An ideal situation would be one in which our pilots all had the skill or the ability to put and keep an aircraft on the runway, which is the primary landing area. Unfortunately this is not the case. Student pilots, pilot fatigue, mechanical failure of brakes or flaps, wet or slippery runways, crosswinds, aircraft landing characteristics and weather conditions are some of the factors which contribute to aircraft landing on or running onto the areas adjacent to hard surface runways.

Experience indicates that aircraft will continue to run off the runways and undershoot or overshoot the runways. In many cases, aircraft not on the runways encounter the hazards mentioned, sustaining damage in varying degrees.

- **Inadequate snow clearance or rolling; snowbanks.** Because of the control limitations previously listed, aircraft occasionally encounter hazards caused by improper treatment of snow on airfields. Taxiway and parking areas are sometimes cleared by plows only, and the resulting snowbanks constitute a threat to wing tips, tail planes and even propellers. The reduced braking action on snow makes banks of snow an additional hazard.

The practice of clearing runways by plow and blower, with no thought given to overshoot

Soft, rough ground in the overshoot and undershoot areas constitutes a grave hazard

Rock piles and mounds of earth will wreak havoc with an undercarriage

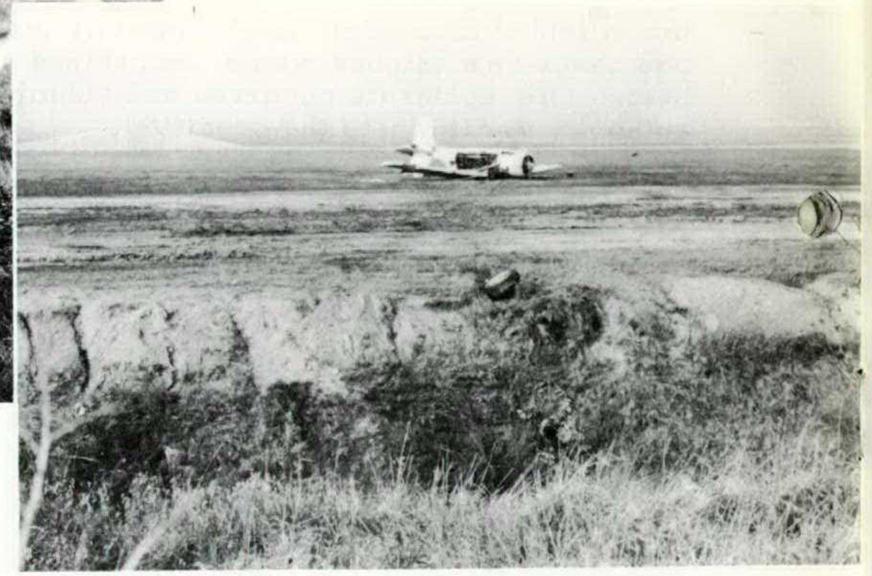
and undershoot areas and adjacent infields, is quite general. Snow that is left to pile up or drift in these areas becomes a hazard to an aircraft undershooting or overshooting. It is the equivalent of very soft ground in that it can quickly overturn an aircraft.

● **Excavations, open ditches and soft fills.** These hazards are usually the result of construction or a provision for drainage. Since operational requirements often necessitate the use of taxiways and runways while construction is in progress, potential hazards exist where ditches have been dug and left open pending the arrival of cable. Often extensive excavations are made for drain construction along the edge of runways and are left unfilled or uncompleted for a considerable time. Large open ditches on undershoot areas or in the infield of an airfield have caused writeoff damages and fatalities. In two cases the ditches were recognized as unacceptable hazards long before the accidents occurred and submissions were made to higher authority to eliminate the condition.

The burden of responsibility for these accidents rests with the whole Air Force, but the responsibility for initiating corrective measures lies with the unit commanders. If the station is unable to eliminate them itself, it is the responsibility of local authorities to press for corrective action and to ensure that the operational staff of the controlling headquarters appreciates the significance of such hazards. Undoubtedly their elimination will often be expensive—but negligible when compared to the cost of replacing a high performance aircrew and aircraft.

Temporary obstructions are sometimes marked with flags which are not durable and at times cannot be seen when streaming downwind from the pilot. Markers which should be used are those of a more permanent structure whose visible area, in all directions, is greater than that of flags.

Snowbanks, like soft ground, will quickly overturn an aircraft



Open ditches are best avoided

Very often ditches and excavations are filled and left to settle naturally. Then a soft depression develops and a dangerous hazard exists. Further filling will progressively reduce the depression until it has settled firmly and turf is formed on the top.

• Exposed runway threshold lips and drain covers. A number of expensive accidents have occurred when aircraft landing short have struck the edge of the runway projecting above the ground. Similarly, aircraft running off the edge of a runway have struck the concrete work surrounding a manhole. In one instance this concrete projected six inches above soft ground and succeeded in wiping off a complete undercarriage leg. The earth was not capable of supporting the aircraft and it was already below the level of the concrete.

As long as we expect aircraft to leave the runways, care must be taken to ensure that no obstructions exist and that the ground is maintained so that it can support the weight of an aircraft. Runway edges and the concrete structure of manholes should be sloped to below ground level so that abrupt vertical edges will not exist.

• Runway marker trees and runway lights. These items, although a hazard, have not caused any serious accidents so far. Threshold lights sometimes constitute a minor obstruction during low approaches, but this condition must be accepted because of the necessity of having adequate threshold lighting.

In arguments with an undercart, exposed runway lips have the last word

Winter runway markers such as evergreen trees are usually firmly imbedded in snow or frozen into the ground. When the trees selected are too high they foul wings or tailplanes, and contact with them usually dents or tears the metal or fabric surfaces of an aircraft.

• Rough runways. Rough runways have been a contributing factor in a minor number of accidents. They may be acceptable in operations with conventional, low performance aircraft, but the effect of rough surfaces on the heavily laden, high performance aircraft currently in use (and those envisaged for the future) could be critical enough to cause serious damage or preclude the use of the airfield.

• Buildings in the overshoot areas. One of our fatal accidents occurred when an aircraft struck a building in the overshoot area. The aircraft was airborne after overshooting from an unsatisfactory landing. Although this is an isolated case, the building was known to constitute a dangerous hazard long before the accident occurred.

Once again, the need for removal of these hazards must be emphasized until correction is obtained. Operational staffs must also be made aware of them so that correction may be expedited. ILS installations present a similar hazard although to a lesser degree.

*

Well, there they are. Did you know that all these adverse conditions existed at many airfields? The situation is not good and most of the faults are being corrected. The responsibility for recognizing and correcting them or requesting funds to do so lies with the unit. The responsibility for realizing that these hazards do exist and ensuring that the means for correction are provided also rests with commands and AFHQ.

This manhole succeeded in wiping off an undercarriage leg

Do you know what the hazards are at the next airfield you intend to visit? Do you know what to do to avoid them? Staying on the ground would be one way, but that wouldn't be sporting. Flying is our job—so let's think about what we can do to avoid these hazards. The first step is to find out what they are and where they are. Have a look at your own airfield first. Run down the list we have given and measure the safety of your airfield against it. If you are going to land somewhere else, check the NOTAMS for information about your destination. Check them every time you plan to fly somewhere. By taking this precaution you will be aware of what to expect when you arrive.

Now that we know what to expect, let's have a look at what we should do. Normally there is no hazard on the runways or taxiways except for ice, snow and water. Ice will make it difficult to control the aircraft while taxiing or landing, particularly if there is a strong cross-wind. If safe control cannot be maintained, don't try to taxi. A couple of hours' delay while sanding is being done is far better than getting stuck off the side or running into another aircraft or snowbanks which shouldn't be there. The same problem will be encountered in landing. Make sure braking action is adequate before landing. The tower will advise you of the condition of the runway.

Snow and water may affect the takeoff run. If you must take off, make allowance for the extended run required. This can be done by using the longest runway, bearing in mind the wind direction and strength, or lightening the aircraft load.

*

Most of the hazards are encountered off the landing or taxi surface. To avoid these, we must remain on the hard surface. To do this, we must be capable of maintaining proper control of the aircraft and of putting it down just where we want it. Look what happened to the Harvard that landed short of the ditch! The pilot was a long way from the runway. True, if the ditch hadn't been there, the damage would have been less. If he hadn't been there, the damage would have been less. If he hadn't undershot, there wouldn't have been any damage! The same applies to the exposed edge of a runway when an aircraft touches down even a few feet short. Aircraft just aren't built for that kind of treatment.

Spring construction and repairs to airfields always increase the hazards. Ditches, soft spots and piled earth or gravel all present obstacles to an aircraft that wanders off the hard surface. We must make sure that we stay on it. If on your approach you find that drift is excessive, go around and try again. Perhaps the tower will give you a runway more into wind. Don't be afraid to ask for one. The controller's job is to get you down safely.

Make your approach so that you will land on the runway—but not so far down that you will run off the end. Landing on the button is fine if you can be that accurate, but never let the aircraft touch down before the runway is under you. We hope the undershoot area is well maintained—but what if it isn't? If you're in doubt, go around again. The fuel and your time are cheaper than the repairs that may be required.

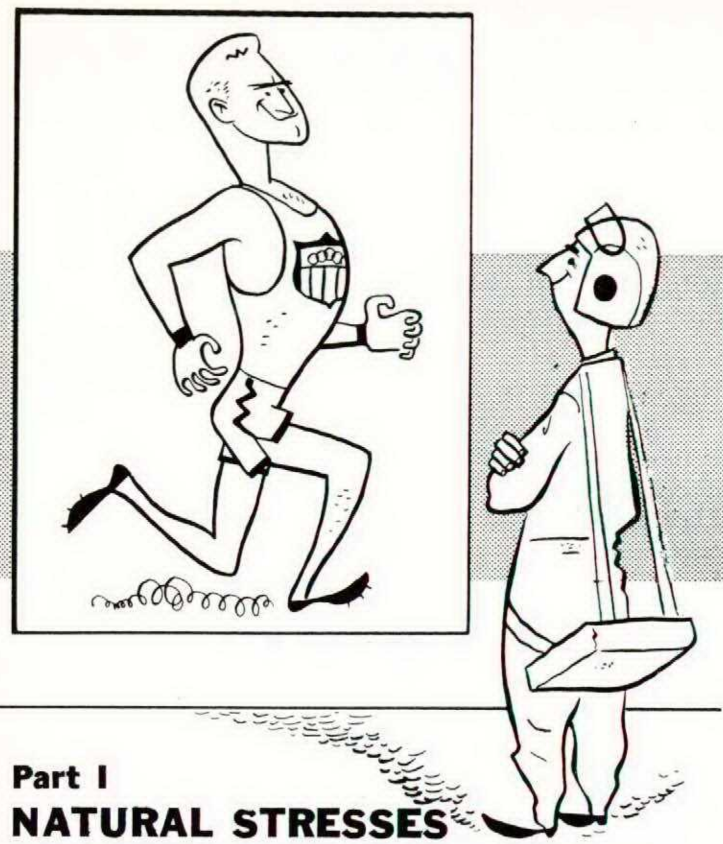
Efforts are constantly being expended to improve the airfields and lessen the chances of damaging aircraft that don't stay on the runways. You can help by knowing what to expect and by flying your aircraft accordingly.

BETWEEN-FLIGHT INSPECTIONS

The importance of between-flight inspections on aircraft as complex as the Canuck cannot be overstressed. On one occasion an airframe technician was making a BFI when he noticed a crack in the oleo leg. Closer inspection revealed that the crack was approximately nine inches long. The oleo leg was immediately replaced and the aircraft returned to service. Complete leg failure would have resulted in time had not particular attention been paid on the between-flight inspection. The technician's thorough inspection was the means of averting a serious accident.

For the Birds

Our inside back cover now carries a new feature entitled "Bird Watchers' Corner". Introduced in our Jan - Feb issue, it will continue to depict many familiar breeds—"birds" you will recognize at once. Accident files are the source for these creatures; and by presenting them in this way we hope to keep you from becoming one. If you happen to know a member of the species yourself, and would like to see your "bird" idea in print, send it along and we'll see what we can do with it. Your contribution will be credited to you. Our address appears on the contents page.—ED



FLIGHT FITNESS

Part I
NATURAL STRESSES

Prepared by the Engineering Department of the Douglas Aircraft Company at El Segundo, California, this article is intended to familiarize you with certain factors affecting the human body which will assist you to carry out your flight missions safely and efficiently. Most of this information is contained in various medical publications but is not readily available or expressed in simple terms. It is hoped that this consolidation, despite briefness, will be of benefit in improving safety and combat effectiveness. While this report pertains to flight fitness for pilots of all combat airplanes, it is especially intended for pilots of high performance aircraft of the fighter and attack bomber type.

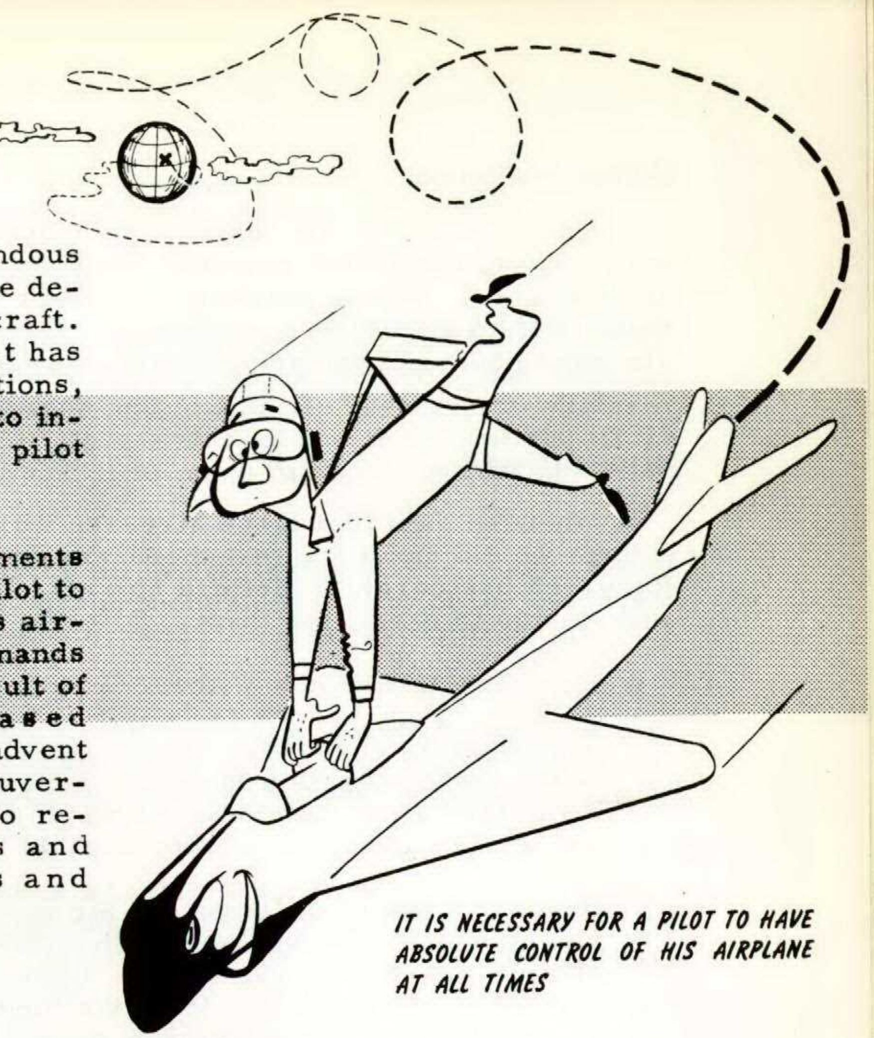
Your Missions

Your mission may call for fighting, ground support, high altitude bombing, dive bombing or other specialized missions. Whatever it may be, it can only be as successful as you, your airplane and your weapon operating as a team make it. Thus, it is essential that you as a member of this team care for yourself and train yourself with the same degree of care that is exercised by athletes competing for Olympic Games or other athletic events.

A Little About Your Airplane

In recent years, tremendous strides have been made in the development of combat aircraft. Technological advancement has brought about many innovations, most of which are intended to increase the efficiency of the pilot and airplane.

In spite of these advancements it is still necessary for the pilot to have absolute control of his airplane at all times, and the demands upon the pilot have, as a result of these advancements, increased rather than decreased. The advent of the jet and increased maneuverability and performance also require increased alertness and awareness of restrictions and limitations.



IT IS NECESSARY FOR A PILOT TO HAVE ABSOLUTE CONTROL OF HIS AIRPLANE AT ALL TIMES

What About Your Restrictions?

Your pilot's handbook contains certain restrictions determined by design limitations and loading conditions. They are for your protection. Remember them because they are built-in to preserve the best that fine engineering and construction can provide for your airplane—your best friend.

Just as there are restrictions on your airplane, there are restrictions on what you can do. You might say they were determined by design limitations practised by the Almighty when he built you. These are built-in and must be remembered just as well as those in your airplane. When all is said and done, there is only one way that the two of you can function effectively and that is as a team.

The real purpose of this pamphlet is to bring sharply to your attention that you can put additional restrictions on your team. These are under your deliberate control and you can't blame the Almighty or science for failures due to your own deeds or misdeeds. You can't get everything that is designed and built into the team if you deliberately complicate the picture by destroying the basic rules for preserving your own fitness.

Human Restrictions

Restrictions on the human body can best be expressed in terms of the power to overcome physical stresses. These vary depending upon environment. Flying presents a number of these stresses which are found only in the flying environment. One group is classified as natural stresses because they are built-in and not induced by our own efforts.

Natural Stresses

When we said that these stresses were not introduced by our own efforts we did not mean that there was nothing we could do about them. Research has carefully defined them. Development has provided us with means to overcome them. Briefly, here they are:

- Exposure to Altitude Without Oxygen

  Oxygen is as necessary for the functioning of the human body as it is for the combustion of fuel. Your body uses oxygen in much the same fashion by combining it with a carbon compound to produce energy and giving off carbon dioxide as a waste.

  Oxygen is removed from the air in the lungs in tiny sacs called alveoli which are interlaced with a network of blood vessels. These alveoli transfer oxygen to the hemoglobin in the blood cells and transfer carbon dioxide from the blood to the air. The partitions are so thin that any difference of pressure on either side will cause gas to pass through. The difference in partial pressure of alveolar oxygen and the pressure in the blood forces the oxygen from the air into the blood. At sea level the partial pressure of alveolar oxygen is about 103 millimeters of mercury. The oxygen partial pressure in the returning blood is about 40 millimeters. This pressure difference results in a normal 95% oxygen saturation of the hemoglobin as it leaves the lungs. Below this percentage oxygen is deficient.

  As the total pressure of the air decreases at altitude the oxygen partial pressure drops even though its percentage remains the same. There are only two answers: raise the pressure of the air (pressurization) or raise the percentage of oxygen in the mixture. Adding oxygen will bring the partial pressure to a level which will saturate the blood.

  But this has a limit. Above 35,000 feet 100% oxygen will not saturate the blood. From this altitude up, 95% saturation can only be accomplished by pressurization. Night vision is one of the first functions to be impaired by oxygen deficiency. At 12,000 feet it is reduced by one-half. Oxygen should be used from the ground up on

night flights to altitude. Be sure to review your technical directives on the use of oxygen at frequent intervals and carry them out.

- Exposure to Carbon Monoxide

  Carbon monoxide when absorbed by the blood can be extremely dangerous. It reduces the amount of hemoglobin available for carrying oxygen to the tissues and makes the transfer of whatever oxygen is present difficult. It is absorbed by the blood 300 times more readily than oxygen and it is more difficult to dislodge from the blood.

  For example, when breathing air at sea level it takes about 3 hours to eliminate one-half the carbon monoxide content of the blood and only one-half of the remainder will be eliminated in the next 2 hours.

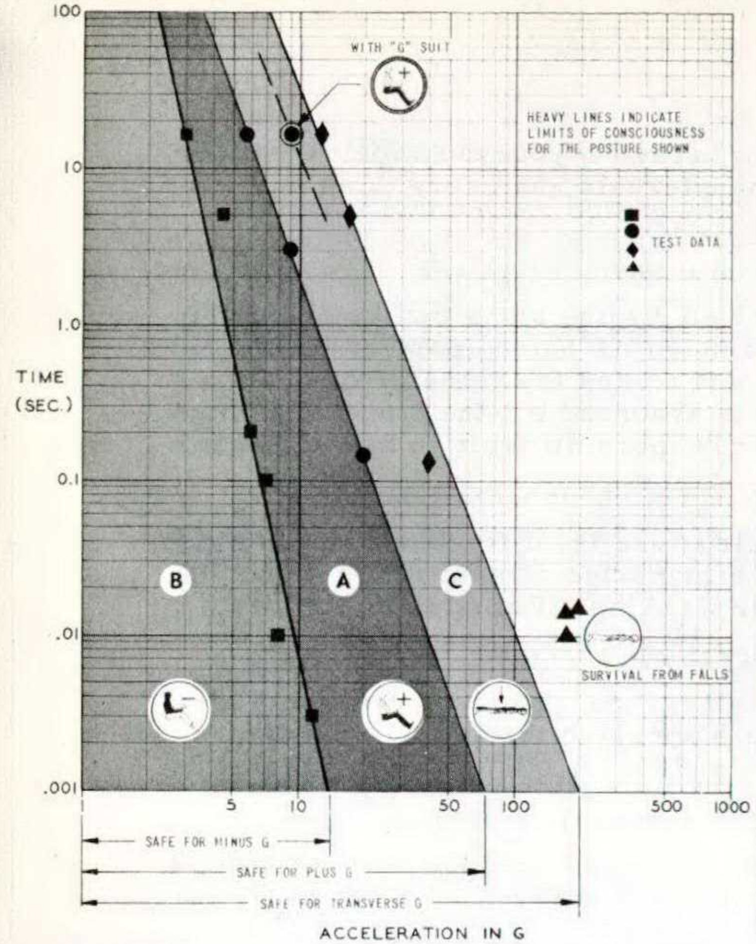
  It is impracticable to eliminate all carbon monoxide from some airplanes. Present specifications have established that a concentration greater than .01% CO (1 part in 10,000) is unacceptable in aircraft.

  Actually, CO concentrations of .01% may produce adverse symptoms after four hours of exposure at sea level. At altitude the effects are more severe. The combined effect of oxygen deficiency and CO may prove disastrous.

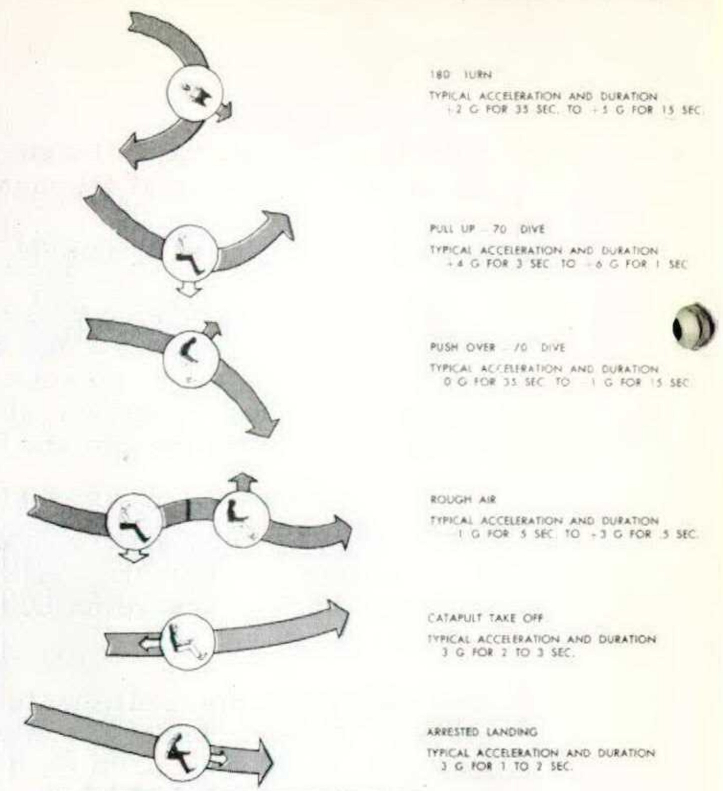
  The danger of carbon monoxide, especially in combination with lowered partial pressure of oxygen at altitude, can not be overemphasized. There is no doubt that a considerable number of the "unexplained" crack-ups were caused by carbon monoxide or this combination.

  To eliminate the effects of carbon monoxide you have several recourses open to you:

  - Stress to your maintenance personnel the importance of keeping compartment sealing in tip-top shape.
  - Whenever exhaust fumes are detected, air out the cockpit by opening the canopy occasionally. If fumes persist, take 100% oxygen and land as soon as possible.
  - It is recommended that, in aircraft subject to carbon monoxide contamination, oxygen be used at altitudes above 7000 feet.



HUMAN TOLERANCE



THE CHART INDICATES THE TOLERANCE OF THE AVERAGE MAN TO ACCELERATIONS FOR A GIVEN PERIOD OF TIME. THE "B" AREA INDICATES TOLERANCE TO NEGATIVE ACCELERATIONS; THE "B" PLUS THE "A" AREAS, TOLERANCE TO POSITIVE ACCELERATIONS, THE "B" PLUS THE "A" PLUS THE "C", TOLERANCE TO TRANSVERSE ACCELERATIONS. FOR EXAMPLE THE AVERAGE MAN CAN WITHSTAND SAFELY AN ACCELERATION OF 10 G FOR A PERIOD OF ONE SECOND IF IT IS APPLIED IN A POSITIVE OR A TRANSVERSE DIRECTION, BUT WOULD FIND IT DANGEROUS IF APPLIED IN THE NEGATIVE DIRECTION.

MANEUVERING ACCELERATIONS

- Exposure to Accelerations (G)

There are four kinds of acceleration that threaten the aviator:

(1) Moderate G lasting for some time. This is the kind encountered in pulling out of a dive. It amounts to several Gs lasting for several seconds. This causes the blood to be thrown into the lower part of the body and, if it lasts long enough, the heart does not get enough blood to keep up the circulation. "Black-out" and unconsciousness result. Effective use of your anti-G suit is the answer to this problem.

(2) High G of short duration—less than a second. This is unavoidably built into the ejection seat in order to get a trajectory that will clear the empennage. Values as high as 18G lasting for a tenth of a second have been recorded. The threat is to the skeleton. If the body is not correctly positioned, broken necks or broken backs may result. Carry out the instructions that go with your ejection seat.

(3) Sudden forward deceleration. This is encountered in crashes. The threat from this kind of acceleration is the chance of smashing your face against the instruments or worse. One answer is adequately stressed seats and the use of the best kind of restraint harness.

(4) Tangential G of short radius. This is encountered in tumbling and buffeting. We don't know all about this kind, but the best answer so far is to keep away from it.

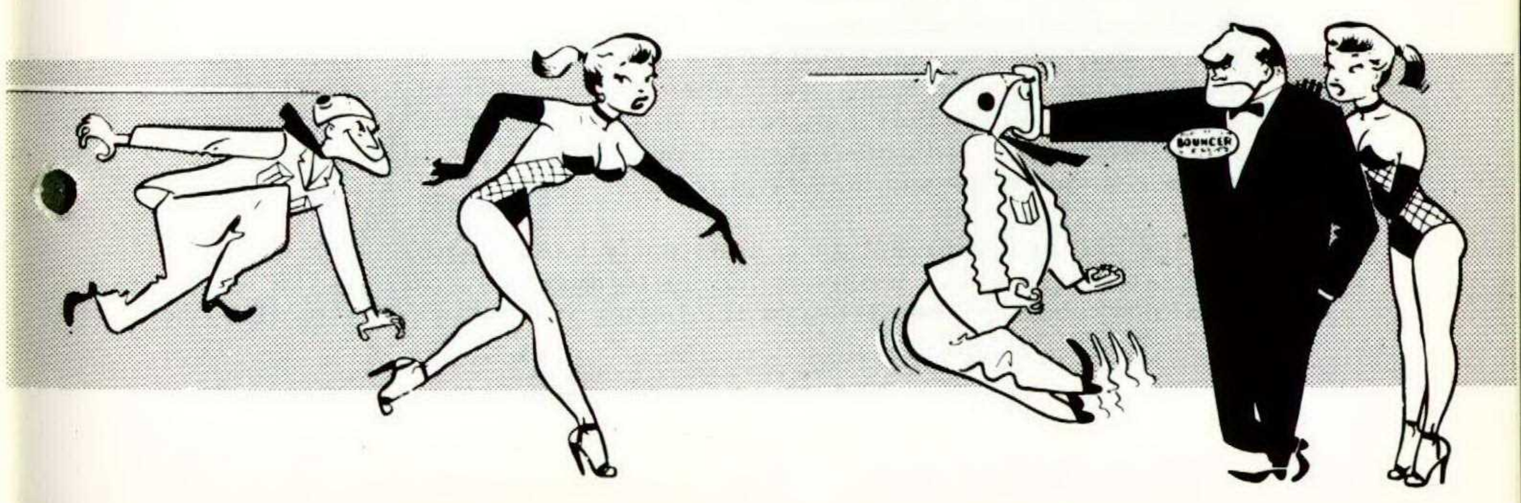
Improvement in protection against G is a job for the research and development people. Keep abreast of this work and use it when it becomes operational.

- Exposure to Rapid Altitude Changes

Rapid pressure change, incidental to changes in altitude, presents no problem if you are in good physical condition, since normal "clearing of the ears" will permit balancing the pressure between the middle ear and the outside air. The problems arising from exposure to rapid altitude changes will be presented in a later section under self-induced stresses.

- Exposure to Noise and Vibration

Noises in aircraft are derived principally from the propeller, engine exhaust, moving parts in the engine itself, and aerodynamic sources. Noise level or intensity is measured in decibels. Research indicates that a noise level of 116 decibels, when sustained over a period of 6 hours for 8 successive days, might be sufficient to cause irreparable hearing loss. The use of helmet and close fitting earphones reduces the effect on your ears considerably. On long flights you may be somewhat fatigued from exposure to a high noise level.



RAPID DECELERATIONS CAN BE DANGEROUS

Determination of the vibration patterns present in aircraft and their potential physiological effects need further exploration. From evidence that is available it does not appear that any permanent injury results from them although there seems little doubt that they contribute to fatigue. The solution of this problem is the application of appropriate damping to vibrations which may be injurious.

THE GAMUT OF POTENTIAL CAUSES OF AIRSICKNESS HAS NOT BEEN EVALUATED ADEQUATELY

- Exposure to Motion

The gamut of potential causes of airsickness has not been adequately evaluated. There is no one single cause for all cases. The symptoms are very clear and unmistakable. If you are susceptible, you will learn for yourself what your best course of action should be, what food items to avoid, and how much of what kind of motion you can take. Consult your flight surgeon and work out together the best plan for you.

- Exposure to Visual Disturbances

There are a number of disturbances and distortions that can occur during flight. Haze, color distortion, motion parallax and "vertigo" are familiar to all fliers. Certain illusions, particularly at night, are not so clear and should be reviewed with your flight surgeon during night vision training.

In considering the harmful effects of natural stresses the most important thing to remember is that they are additive. Altitude alone may not cause significant oxygen deficiency. The carbon monoxide level may be tolerable for considerable periods of time. Accelerations may have a value you know you can take any time. Your night vision may be fine. But, when two or more of these stresses act simultaneously they can result in a total value that will tax your total tolerance. You can't depend on checking the tolerance limits of each separately and be complacent.

Design and development are constantly battling to reduce these natural stresses and increase human tolerance to them. The more you know about these stresses the better you can resist them.

The Directorate of Flight Safety is indebted to the Douglas Aircraft Company for permission to reprint their pamphlet, "Flight Fitness". The concluding half, entitled "Self-Induced Stresses", will appear in the May - Jun issue of FLIGHT COMMENT. — ED

PYXing

LETTERS TO THE EDITOR

Maintenance and Methuselah

Dear Sir:

In the Jul - Aug 1955 issue of FLIGHT COMMENT, I read the article by W/C H. Bryant ("According to Methuselah") and the article entitled "Maintenance" with a great deal of interest. W/C Bryant mentions that "we have become an air force of offices" and suggests "let's have a back-to-the-floor movement". These are noble sentiments to which every positive-thinking person will subscribe.

The "Maintenance" article follows the same line. Its author apparently feels that for junior supervisors the paper work must be reduced to the bare minimum. These are nice platitudes to air—but is any concrete action being taken to do something about it? Maintenance officers in the field cannot do much about it. It has to start with AFHQ. I would like to give you three illustrations which I feel will explain why we are not getting the supervision we are entitled to:

Compiling unnecessary forms. The most glaring example of this was Stats 311 on the consumption of POL. Fortunately this form, except in special cases, has now been discontinued. But it should never have been instituted. Observations were constantly being made about the figures that were going in from this unit. I put up with this for a while, making a few official complaints. Then I started to "cook" the report. Lo and behold—no more observations! I was now giving the recipients the information they wanted to get. Here was a form that required figures which were almost impossible to obtain accurately; and yet there were easier ways of getting the same figures. But some person (without too much commonsense, it would seem) instituted the form, accepted no criticism, and left the field to suffer with it.

Too many personnel reports to be completed. Not only is there the annual R211 and two promotion reports a year if a man is eligible, but "request" R211s are constantly being asked for by CHQ without any reason ever being given for the request. Career narratives have to be submitted after civil convictions, on release for DVA, and sometimes when a man is heavily in debt. Anyway it seems to me and my senior NCOs that we are always making out personnel reports.

Engineering officers hampered. Those available are tied to their desks because of the Tech/AE officer shortage. I am supposed to have four officers on my staff besides myself. I have one. With RCAF regulations and practice what they are concerning the signing of letters, reports and other documents, I just can't get out of my office as much as I would like to. Yet I must not let the paper work fall behind or I get a "blast from CHQ or elsewhere.

Now that I have that off my chest I hope you will receive this letter in the spirit it is intended. Keep up the good work. FLIGHT COMMENT is one of the better service publications.

(Name withheld)

Dear Sir:

Referring to your article, "Maintenance", I would like to make the following annotations on the present too high accident rate. It was said to be a point of wonder how a technician could possibly repair a complex system and yet fail to secure a line or attend to other so-called minor details. The answer lies in the fact that with a craftsman this situation would not occur; with him, every step has the same degree of importance attached to it so that his final product is one hundred percent correct. It is felt that there are no true craftsmen in the repair field, for the atmosphere of high speed production would not be tolerated by them. Under the pressure of time limits and deadlines the work of even the most reliable technician will suffer.

The accident rate attributed to faulty maintenance appears to fall under three main headings:

- Omissions directly caused by the pressure of work.
  When an aircraft becomes unserviceable the immediate question is, "How soon can we have it?" Or worse still, it must be serviceable within a stipulated time. This deadline maintenance must cause much of our accident rate, for as time runs out, last-minute details tend to be overlooked.

  Lack of supervision of inexperienced personnel.
  Establishment statistics may show a well balanced NCO rating, but in practice—especially in the aero-engine and airframe trades—many NCOs are far removed from the floor, employed on such related jobs as Tech Stores, Logbook Room, Station AID and Technicial Library. These jobs, although essential to the maintenance picture, are a drain on the technician establishment, requiring that junior technicians undertake inspection responsibilities greater than their experience allows. Also, the majority of the work is unsupervised with little or no on-the-job training under experienced personnel. The return of NCOs to their basic trade would result in a higher standard of work and an easing of the work load.

- Complacent maintenance discipline.
  This covers all the many rules which, if not ignored, are quietly modified to suit existing conditions. Following is a list of the duties ignored or treated most lightly:

  - The L14 entry under the column "inspected and passed".

  - The Daily Inspection list for an aircraft. It is doubtful if any technician can list every requirement of a DI without reference, yet it is unhesitatingly signed for. Our DI standard is quite lax.

  - Insufficient use of our fine set of Engineering Orders, especially those concerning general engineering practices. One EO states: "....Fibre insert nuts are to be used on a once-off basis...." This is far from common practice.

  - Some technicians use screwdrivers as crowbars, pound bolts with ball pein hammers, and generally violate established engineering rules.

- Pride of workmanship seems to be lacking. We know how a job should be done, but for speed (and to mollify the CTrainO) we do it the "other" way.

Our maintenance routine has undergone little change from the war years and does not appear to be geared to cope with modern aircraft. AMC has efficiently modernized our Engineering Orders and Equipment Vocabularies, and it is suggested that a review of the maintenance system be made using an agenda comprising the following headings plus other ideas gathered from replies to the FLIGHT COMMENT article:

- Aeronautical Inspection Department

  - Expansion of our present RCAF Quality Control system so that all phases of maintenance may be controlled by setting minimum permissible standards, ensuring good engineering practices, and constantly checking by visual inspection.

  - Technicians in QC would need to be coded as such and should be NCOs of generally wide experience.

    A Control NCO would be required to do an independent check after an unserviceability has been rectified—with a final check on aircraft considered complete after the periodic inspection.

  - Special inspections and UCRs could be controlled by QC. In general their personnel would be supervisors of a high maintenance standard who would reprimand forgetfulness and poor engineering practices. Their presence would ensure "deadline" maintenance of a high calibre.

I believe that a well-founded Quality Control will allow technicians more time to concentrate on their rectifying, the experienced men a better chance to work with the junior technician, and the senior NCOs more time to attend to spares procurement and the efficient running of their crews.

- Technical Manpower Revue

  - If possible, an increase in the technical establishment is desirable. The alternative is for other trade structures to handle part of the work.

  - Supply Branch requires an establishment for technicians having a general mechanical knowledge, trained in the use of Aircraft Spares EOs, and able to handle the stores routine presently operated by technical personnel.

  - Clerks Admin assisting in Log-book Control Rooms and Technical Libraries.

- For Increased Maintenance Efficiency

- Wider circulation of Engineering Orders whereby those of a general nature are signed, as read, in a flight and section order book.

- Daily Inspection Schedules reviewed with the idea of condensing them and producing an approximate 12-point system for each trade that is common to all aircraft, and a maximum 5-point vital DI action peculiar to each type. A system based on this idea would give a stricter control of DIs and simplify the work of a technician who is engaged on more than one aircraft type.

- Introduction of a group 4 rating not dependent on the rank of Flight Sergeant. After a minimum number of years served in one's trade the opportunity of either a course in the allied trade (with subsequent Trade Board) or an advanced board in the current trade. A third method might be the requirement of a Group 4 standard for entry into the proposed enlarged Quality Control field. The incentive of a Group 4 rating earlier in his career would require that a technician Group 3 keep abreast of trade advancement—a prime requisite for efficient maintenance.

Our modern aircraft, with their critical limits and complex systems, call for a higher degree of maintenance care than we at present allow. In our role of peacetime Air Force, added inspection precautions by well trained personnel must take precedence over flying-hour commitments. A careful study of the problem will surely produce a workable balance between them. In this way we could achieve a minimum maintenance accident rate, comparable to that of any airline, with a maximum overall efficiency—and definite savings to the Canadian taxpayer.

Cpl J. Cockerell
Station Flight, Canadian Joint Staff
London, England

[We agree that unnecessary forms and returns should be eliminated, and to this end the Director of Statistics has a study underway. Nevertheless certain reports and returns are essential for the proper functioning of the Air Force. For example, in the maintenance field UCRs, Stats 315s, etc., are required by AFHQ, AMCHQ, and civilian contractors; and unless these reports are accurately compiled, they are useless. It is quite possible that certain stations are imposing an extra workload on their maintenance organizations by requiring them to compile returns which, because of their nature, are the responsibility of other sections.

Technicians are often employed on other than technical work but with so much work to be done—and only so many trades and so many people—the RCAF is doing the best it can with available resources. Effort is being directed toward the operation of tech stores and tool cribs by supply technicians, and to the setting up of a trade in the technical-clerical field for log books and other technical records. Trade structures are continually under review, and training has been improved through the introduction of longer, more detailed courses—all aimed at producing a better technician. In addition maintenance schedules are constantly being revised in the light of changing requirements. The personnel field is an important one in the maintenance organization, and for this reason no maintenance officer can divorce himself completely from personnel matters. To assist the aircraft maintenance officer to better carry out his responsibilities in this field, DOE has included a personnel administration officer in all maintenance organization establishments. The shortage of officers in the Tech list is very real and has been of considerable concern to headquarters for some time. Although immediate relief is unlikely, the ROTP is gathering momentum. Provided there is no increase in the establishment, most of the vacancies should be filled by 1960. In the interval the RCAF continues to enrol direct entries and to commission a number of airmen annually.

We are indebted to these two readers for their highly informative and constructive letters. This is the sort of exchange of opinion which we like to see developing between our readers and the Directorate of Flight Safety. Cpl Cockerell's letter is the first we have received from a technician in the field—one of the key people on whom the success of our flight safety program depends. Let's hear from more of you. Your comments and criticism are always welcome. For the information contained in our reply we wish to thank the Directorate of Maintenance Engineering and the Directorate of Personnel Manning here at AFHQ.—ED]

Survival Equipment

Whenever you climb into your aeroplane and sit on your seat pack or check the stowage of the survival gear, do you wonder what is really in it? Perhaps you have a vague idea about socks, sleeping bags and quick energy pills. But do you really know what is there and how to use it so that you will get the most out of it?

Here are a few questions on various items of the emergency gear. How many of them can you answer?

▲ How do you use the snare wire in the kit?

▲ What problems may occur with the hatchet and how do you overcome them?

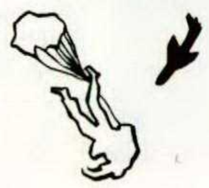
▲ What limitations should you observe in the use of the snow knife-and-saw combination and the collapsible ice chisel?

▲ How do you open the sleeping bag container and what can the container be used for?

▲ Do you know how to assemble the Hornet rifle contained in survival kits?

These are a few of the many questions that could be asked on survival gear. Those of you who have undergone a survival course could probably answer them all, but many aircrew haven't had the course and are not experienced bushmen. A little knowledge gained may be very useful if you ever find yourself stuck in the bush or barren lands.

Where can the information be obtained? One place, of course, is the Safety Equipment Section. Make a date with them and go over the actual equipment carried in your unit's kit. If they are on the ball they will have a kit available for demonstration and instruction. Another source is a new EO being issued under Section 30 entitled, "Instructions for the use of Survival and Emergency Equipment". Advance copies have been issued to Commands for wide distribution. Have a look at them—and like the Boy Scouts, "Be prepared"!

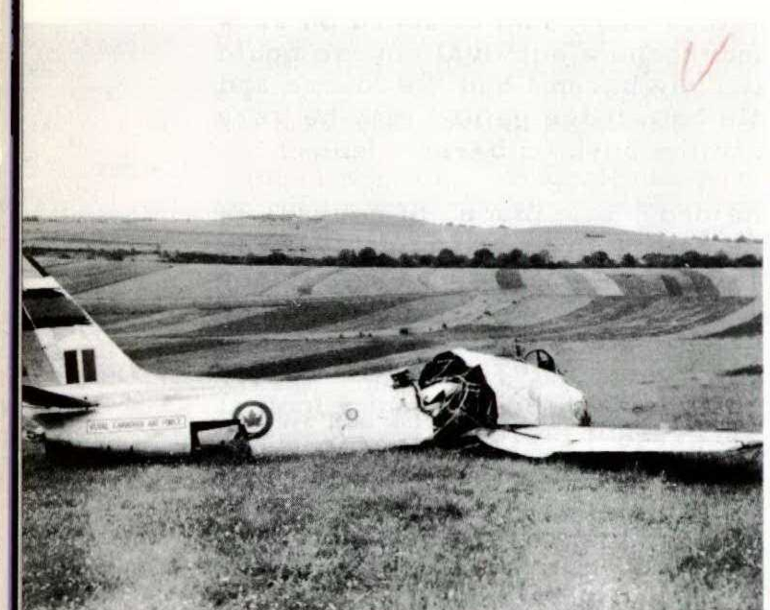


Accident Resumé

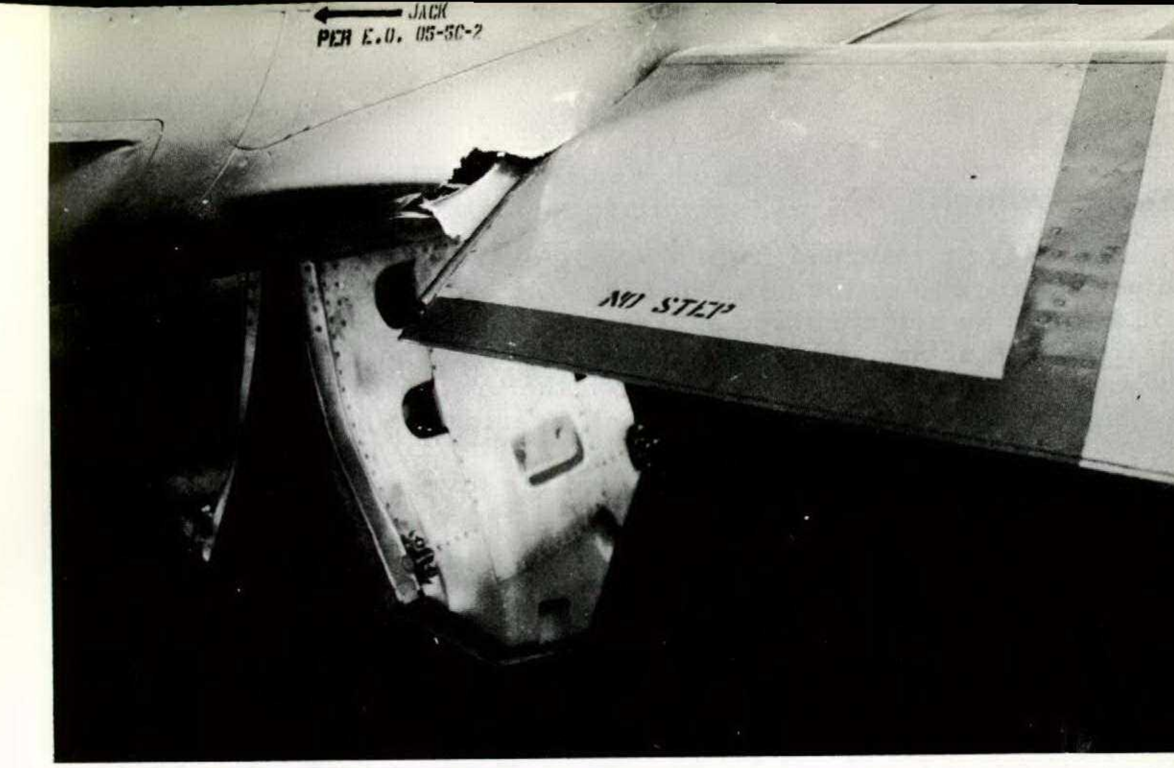
SABRE

Reel Gen

At 1000 feet and about seven miles from the runway on GCA final the pilot experienced a flameout. He had little chance to do anything but prepare for a forced landing. The Sabre struck heavily on a hill side, bounced, hit again and slid up the slope for approximately 200 yards. The pilot was injured in the crash when he was thrown forward against the instrument panel. He had not locked his harness but had depended entirely on the inertia reel for protection.



During the investigation it was learned that many pilots are of the opinion that the inertia lock is activated by forward movement of the pilot's body. It must be emphasized that this is not the case. The inertia reel, on the contrary, is activated by deceleration of the aircraft in the horizontal plane—and that deceleration must be of the order of 2-3G. If, for example, the aircraft bounces on a forced landing, the forward deceleration may be less than the 2-3G required to actuate the reel lock, and injury to the pilot may occur. To reduce the danger of injury in a forced landing, use of the positive harness lock can not be too strongly urged.



Hamfisted

After doing some steep turns at 100% rpm and 400 knots IAS, the pilot decided to return to base to land. To quote the pilot: "With my left palm outboard I throttled off to idle and selected dive brakes out ...." He felt two sharp shocks and discovered that he had inadvertently selected flaps down when retarding the throttle. The pilot was well experienced on type and appears to have permitted familiarity to make him contemptuous of normal, good practice.

Beware the Jet Wash

The pilot was landing as number 3 in the second section of four aircraft in a normal stream-landing approach. At the moment of rounding out he encountered a strong jet wake which caused the starboard wing to drop. Before he could recover, using opposite controls, the wing tip scraped the runway. The aircraft was stopped off the runway without further incident.

Insufficient separation between his own aircraft and the one ahead got this pilot into difficulties with the jet wash. He either levelled off too high or allowed the airspeed to drop too low for a formation landing, thus compounding the error.

Remember that with the wind calm, jet wakes tend to linger and be more concentrated than in stronger wind conditions.

Wot! No Wheels?

The pilot returned from a towing exercise, dropped the flag and joined the circuit on the downwind leg. At 1500 feet and approximately 180 knots he selected dive brakes and throttled off to 75%. He also claims he selected "wheels down". On the base leg he acknowledged the "wheels down and locked" check from the tower; but he did not check the light indicator and does not recall hearing the horn.

At the point of roundout he heard the tower operator transmit "Overshoot! Overshoot!" Since no call sign was given, he assumed that the operator was still talking to another aircraft in the area. In the subsequent belly landing his aircraft suffered considerable damage.

Technical investigation revealed that the hydraulic system was fully serviceable. The pilot either failed to select "wheels down" and check them "down" on final or he lowered the wheels on the downwind and raised them before landing. Stay alert and keep out of trouble. Remember that the tower operator does not say "check wheels down and locked" just to add to the patter.

T-33

No Sweat?

The pilot was flying right wing on his leader during a two-plane, close formation exercise. Weather conditions were good and turbulence was negligible.

After some time (to quote the pilot), "perspiration threatened to impair my vision". In order to wipe the perspiration from his eyes he took his right hand from the control column, replacing it with his left. At that instant the aircraft lurched, its port tiptank striking the leader's horizontal stabilizer. Luckily the damage was slight and both aircraft landed safely. The pilot involved was experienced in all phases of formation flying, but he committed three obvious errors:

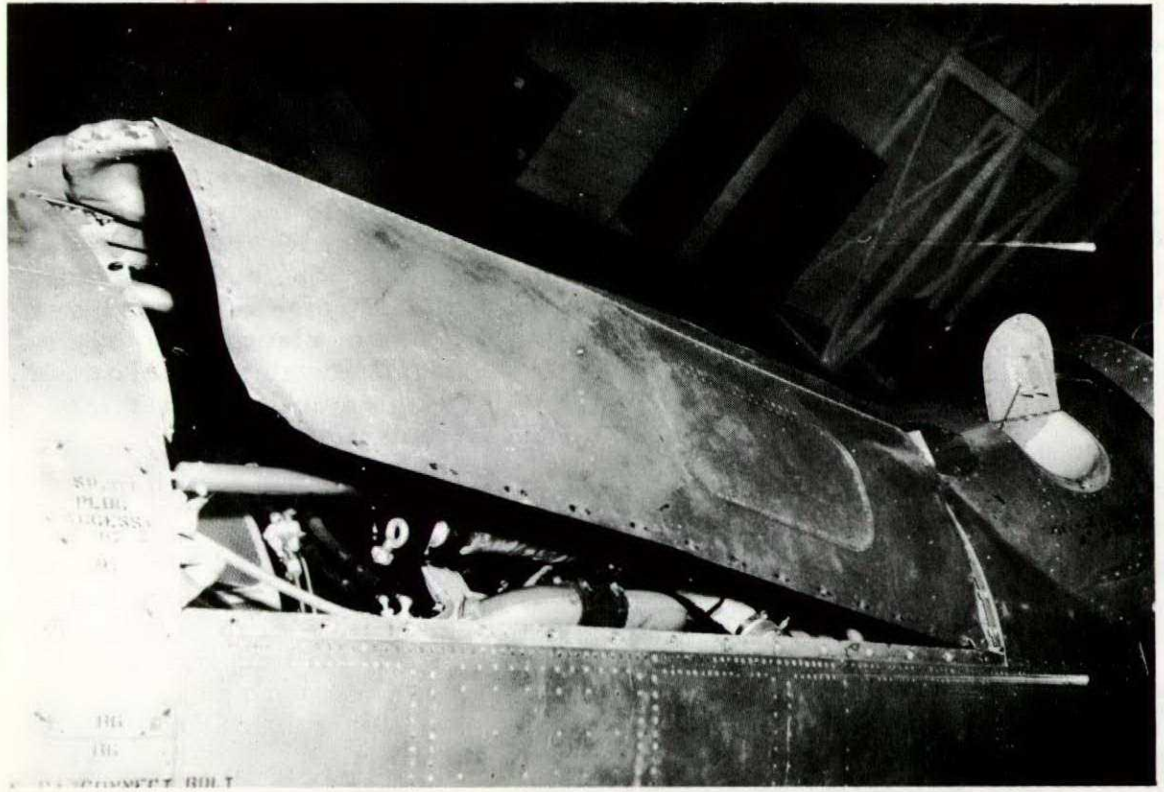
- ▲ Allowed his attention to be diverted while flying close formation;
- ▲ Flew close formation too closely;
- ▲ Failed to compensate for both faults by easing out of position to wipe his eyes.

[Incidentally, we are still puzzled as to why the right hand had to be used! —ED]

Button 'Em Up!

While cruising in a T-33 at 20,000 feet at 270 knots the pilot suddenly noticed considerable vibration and noise accompanied by a drop in airspeed. He checked the aircraft as far as he could and, after a stall test, returned to the field and landed.

As shown by the accompanying photograph the upper plenum doors had nearly parted company with the aircraft. It was discovered that one male and nine female "Airloc" fasteners had been torn out and the doors damaged beyond repair. They had been removed by repair personnel for maintenance purposes on the day before the flight and were



obviously not secured when replaced. Also, it would appear that the airman responsible for checking the security of the fasteners prior to the flight had scamped his inspection.

Damage was comparatively slight in this case but the accident could have been serious had the doors torn off and struck the tail. Don't be responsible for an accident. Make sure that your work is complete and that all parts and panels are secure. If your job is to inspect, then be sure that your inspection is thorough.

Remember the Shake Test

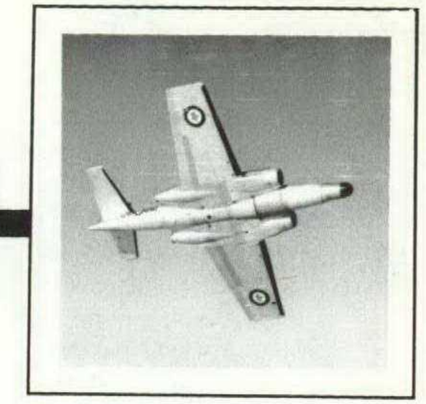
The captain of a T-33 was giving the second pilot instruction on instrument flying. After the exercise the captain made a normal circuit and landing. As he slowed the aircraft for a turn onto another runway in order to return to the ramp, the tower requested he continue straight ahead because a commercial aircraft was ready to take off on the intersecting runway.

The captain applied power and passed the runway intersection at a speed not exceeding 15 knots. Suddenly the T-33 pitched forward on its nose. It seems that the pilot in the rear seat meant to be helpful. With no authorization from the captain he attempted to raise the flaps but selected the undercarriage lever instead. He had moved the undercarriage lever no more than half an inch from the "down" position when he realized his mistake and moved it back into the "down" position—but not before the nose wheel collapsed.

This inadvertent retraction was only possible because the captain in the front seat, on his "down" selection, failed to move the undercarriage selection lever through its full travel to the locked-down position. The T-33 contains a device which was incorporated specifically to prevent this type of accident. Once the undercarriage selection lever has been placed properly in the "full down" position, a locking device prevents inadvertent retraction.

It is considered, therefore, that the pilot in the rear cockpit merely precipitated the collapse of the undercarriage. The error made by each pilot was inexcusable and again emphasizes the need for precise cockpit checks.

CANUCK

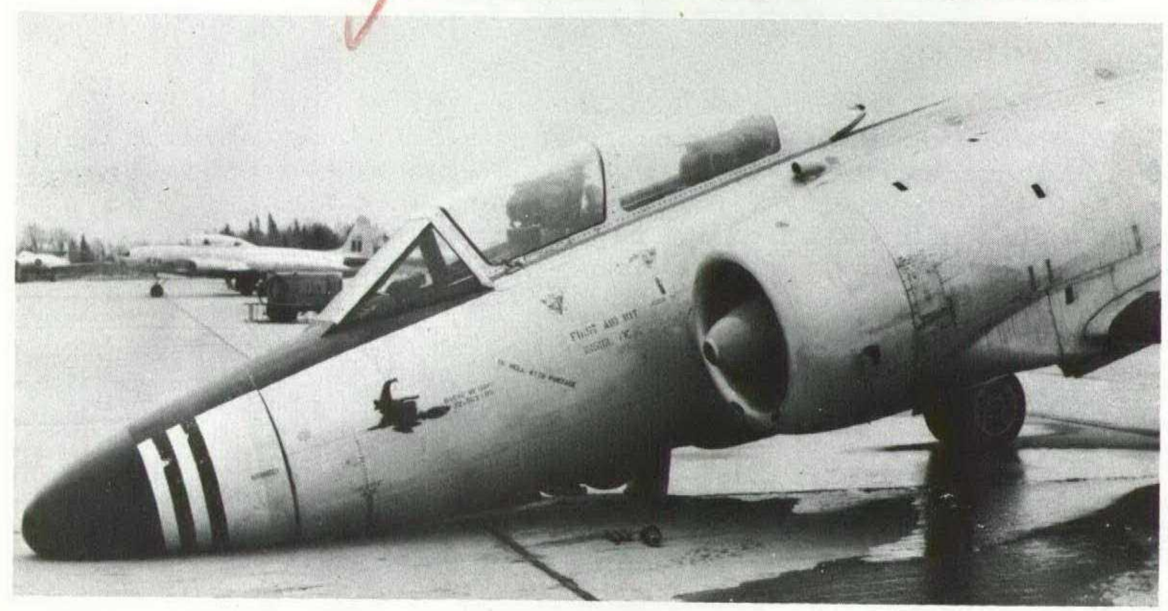


Short Scramble

Authorized to do a "scramble", the pilot ran out to the Canuck, did a quick external check, climbed aboard, and signalled groundcrew for the engine starter. As the engine started the nose wheel collapsed causing "B" category damage to the aircraft.

Switching off the engine the pilot did a cockpit check and noticed that the undercarriage selector button was in the "up" position. The aircraft had just come out of maintenance having undergone retraction tests.

Primary cause of the accident was assessed against Maintenance because some person had failed to put the undercarriage selector button in the "down" position after completion of the retraction tests. The pilot erred when he made his pre-flight inspection by not ascertaining that the undercarriage selector button was in the "down" position. A mitigating factor in the pilot's favor was the fact that he was on a scramble and therefore forced to make a fast, brief cockpit check.



HARVARD

G Tolerances

An instructor and a student were on a properly authorized instrument flying exercise. Approximately one hour after commencement of the exercise an eye-witness saw the aircraft performing what appeared to be aerobatic manoeuvres. Almost coincidental with a pull-up from a long, shallow dive, something was seen to leave the aircraft. The Harvard then went into a spiral dive and crashed, killing both occupants.

Examination of the wreckage and the scene of the crash revealed that the port wing had failed in flight and separated from the aircraft. Testing of the failed wing disclosed no evidence of faulty material or of fatigue failure but did show evidence of critical stressing. It was concluded that the wing failure was a result of inadvertent overstressing during flight. From the evidence it appears that the instructor, after completion of the instrument exercise, was performing aerobatics during which the aircraft was overstressed.

The instructor had recently completed à tour on Sabres, so it has been suggested that his "G" threshold may have been quite high. Under such conditions it would have been possible for him to unknowingly subject the Harvard to "G" loadings sufficient to cause failure.

Know the "G" limitations of yourself and your aircraft—and remember that safe "G" habits on one aircraft type may be dangerous on another.

SIKORSKY S-55

Combined Error

An S-55 had been in the hangar overnight with its rotor blades folded. In the morning it was pushed out of the hangar and the blades were spread prior to an engine test being made. The pilot stated afterward that he made an external check before starting the engine. However, when the rotor was engaged, and before a full revolution had been completed, there was a sharp jolt as one of the blades flew into the tail section of the aircraft, demolishing the cone, shaft and cover. It was found that one blade horn had not been locked and as a result the blade had no pitch control.

The unit has since issued a maintenance order requiring the unlocking or folding of the rotor blades to be entered as a major unserviceability in the L14. Here is an example of positive safety action being employed to correct an unsafe condition.