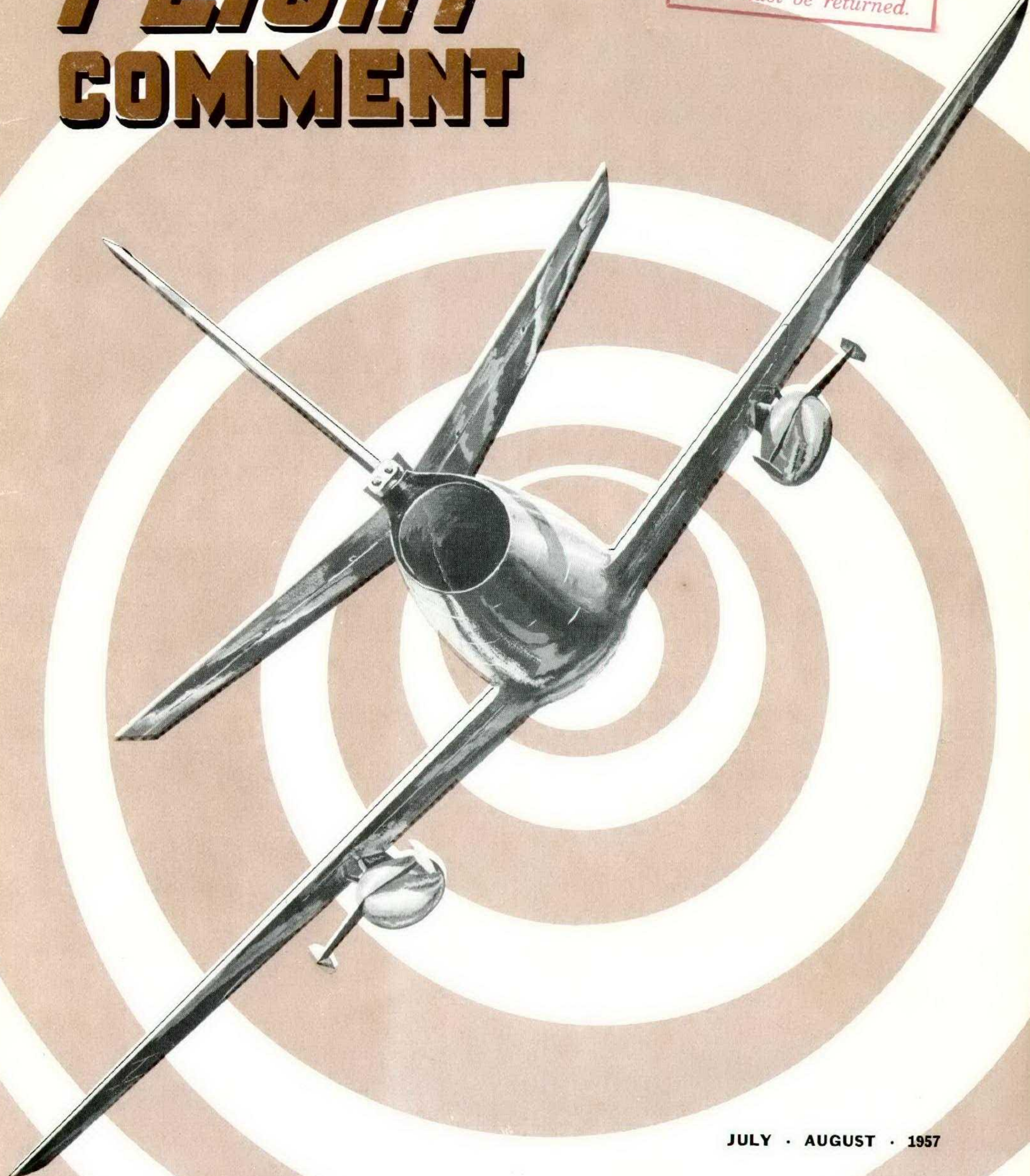
FLIGHT COMMENT



JULY · AUGUST · 1957

FLIGHT COMMENT

ISSUED BY
DIRECTORATE OF FLIGHT SAFETY
R.C.A.F. HEADQUARTERS • OTTAWA, ONT.

JULY · AUGUST 1957

CONTENTS

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OFFICIAL INFORMATION

EDMOND CLOUTIER, C.M.G., O.A., D.S.P
QUEENS PRINTER AND CONTROLLER OF STATIONERY
OTTAWA

F/O L. T. ROSS

Piloting a MkIVB Canuck, F/O Ross took off from North Bay on an IFR exercise. (The Met report at the time of the flight read: 2205Z S11 A3⊕1/2 TRWF ↑↖4 CB10.) He entered cloud at 2200' and climbed on up. Just as he reached 20,000, he heard a rumbling in the aircraft. Shortly after, an explosion occurred and fire erupted through the top of the port engine cowling. The pilot closed the high pressure cock and activated the fire extinguisher. Apparently the fire was reduced but not extinguished because the fire warning light came on. However, when the pilot closed the low pressure cock, all indications were that the fire was out.

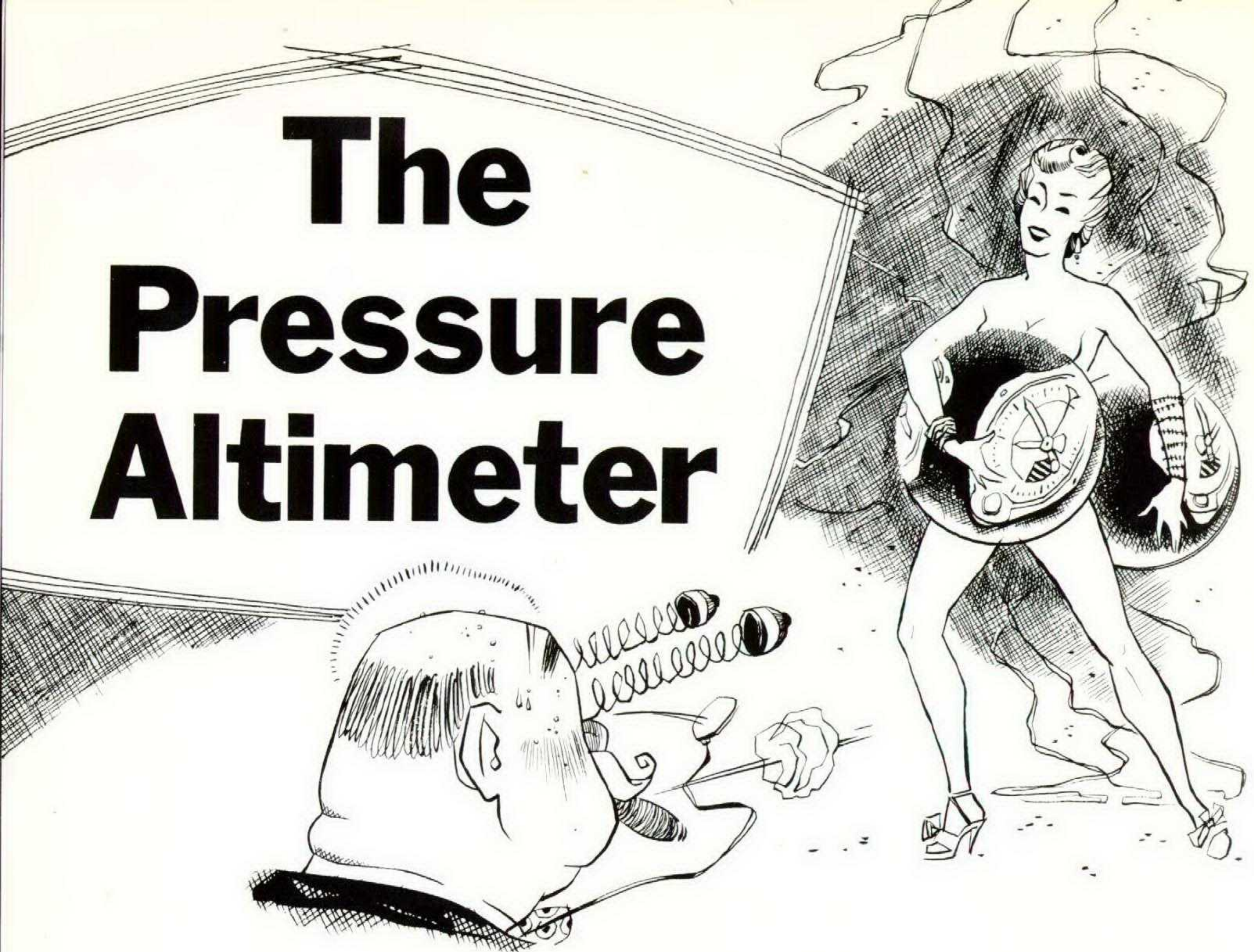
F/O Ross decided finally to return to base rather than eject over Lake Nipissing. He made an emergency call to GCI and received a reply. GCI was unable to fix the aircraft, so the pilot requested that they obtain for him an unrestricted approach to North Bay. Contact was made with North Bay, clearance for a GCA approach obtained, and a VHF/DF steer given. Holding briefly at 10,000' F/O Ross saw the airfield and passed his position to GCA. At 5000' GCA established contact.

The fire warning light was flickering occasionally, but because of his altitude, the condition of the aircraft, and the apparent absence of fire, the pilot decided to attempt a landing. Two overshoots on approach were made by GCA, and a third was necessary because of intermittent GCA contact. Finally a semi-visual circuit and approach were made and a successful landing accomplished.

F/O Ross is to be complimented on the skill with which he handled the Canuck under extremely adverse weather conditions and in the face of complete engine disintegration and fire in the air. Other factors making his problem more severe were abnormal GCA conditions, and a fuel load which was both excessive for landing and impossible to balance properly. Such coolness and ability in emergencies warrant praise and recognition.

[Shortly before going to press we learned that F/O Ross has been awarded the Air Force Cross.— ED]

The Pressure Altimeter



MAURICE HARDMAN Staff Officer, Meteorology
Maritime Air Command

SINCE THE EARLIER days of aviation, one of the most used flight instruments has been the pressure altimeter. There has always been a requirement for a height indicator, and today's dense traffic and rigid traffic control have accentuated the need. The present article will attempt to assess the performance of the pressure altimeter under present day conditions. Will it, for example, give a reading which, uncorrected, provides a reasonable approximation of the true height? If not, is it possible to obtain this by applying a correction? Is there any advantage to be obtained from the fact that the altimeter is essentially a pressure instrument? These and closely related questions will form the substance of this article.

Response Errors

The first point in understanding the altimeter is recognition of the fact that it is a pressure instrument. It responds to changes in air pressure, and these responses are translated by its calibration into readings of height. Hence our assessment of the instrument will begin with the errors in its responses to air pressure changes, which are as follows:

• Instrument Error

The large amount of magnification which is necessary in the linkage from the capsule to the hands on the scale may lead to erroneous readings at certain heights. Since this error is constant for any one height, a correction card can be calculated for it.

• Position Error

When designing the aircraft, care has to be taken to ensure that the static pressure lead to the altimeter produces pressures as nearly equal as possible to the actual air pressure at flight level, since any difference in the two pressures will result in an error in the altimeter reading. This difference varies with airspeed as well as with the design of the aircraft, and may be quite important at high speeds. A formula that may be used to calculate this error is as follows:

$$\text{Error (feet)} = .045k\ (\text{speed in knots})^2.$$

The value of k depends upon the design of the aircraft, so that no universally applicable value can be assigned to it; but it is a positive or negative number, very small compared to one.

• Lag Error

Owing to the imperfect elasticity of the capsule and spring, there is a lag in the response of the altimeter to rapid changes in pressure. Although this type of error has been greatly reduced in the modern sensitive altimeter, it will still be present when climbing or descending rapidly and will cause the instrument to read too low when climbing and too high when descending.

So much, then, for errors inherent in the instrument itself. Consideration will now be given to errors arising from the fact that an instrument which responds to changes in pressure is actually used to measure changes in height.

Height and Pressure

What is the precise relationship between height and pressure in the atmosphere? That there must be some relationship is apparent, if only because the higher your altitude the less the amount of air above you, and hence the less the pressure at that altitude. However, the problem is not quite so simple as this might indicate, primarily because air is a gas; its pressure may be altered by changes in temperature, as well as changes in height.

Temperature and Pressure

The relationship between temperature and pressure is quite straightforward: when air is heated it expands and becomes less dense; when it is cooled it contracts and becomes more dense. To take a specific example, consider figure 1. You will note that the pressure is the same (1015 mb) under the warm column of air as under the cold column of air, but that to reach a pressure of 700 mb you have to climb only 9800 feet in the cold air as compared to 10,000 feet in the warm air because of the difference in densities. In other words a pressure decrease of 315 mb requires only 9800 feet of the cold air as compared to 10,000 feet of the warm air. However, an altimeter would not take into account the fact that the air columns were of different temperatures and would indicate the same altitude at the 700 mb level in both cases.

A definite temperature structure is assumed in calibrating the altimeter. The structure used is the ICAO Standard Atmosphere in which the sea level temperature is 15°C, the sea level pressure 1013.25 mb, and the temperature lapse rate 1.98°C per thousand feet up to a tropopause at 36,089 feet, with isothermal conditions beyond. This means that, providing the correct altimeter setting is used on the sub-scale, the altimeter reading will be accurate if the temperature conditions are the same as those outlined above. If the air is warmer than that of the standard atmosphere, the true altitude will be greater than the indicated altitude; if the air is colder, the true altitude will be less than the indicated altitude. (See figure 1 again, remembering that the indicated altitude is the same at 700 mb over A as at 700 mb over B.)

Hence, when a knowledge of the true altitude is required — in flight over mountainous terrain or in aerial survey work, for example — it is necessary to apply a correction for the difference between the thermal structure of the air beneath the aircraft and that of the standard atmosphere. However, before this correction can be discussed further, another type of altimeter error must be considered.

Variations in MSL Pressure

Errors due to variations in mean sea level pressure are well known to aircrew and therefore will be only briefly discussed here. These errors arise when the flight path crosses isobars at the surface, and they may be serious if a correction is not applied. This will be readily appreciated when it is remembered that a constant indicated height on the altimeter only means that the flight is at a constant pressure level. For a given temperature structure in the vertical, this level will be higher over a locality where the M.S.L. pressure is high than over a locality where the M.S.L. pressure is low. (See Figure 2).

It is worth noticing that this error will not vary with altitude; provided that all aircraft over a given area are using the same altimeter sub-scale setting, no problem of vertical separation is posed. The sub-scale setting used in altimeter-setting regions is the station pressure reduced to mean sea level, assuming the standard atmosphere temperature structure. In other words, it is the "altimeter

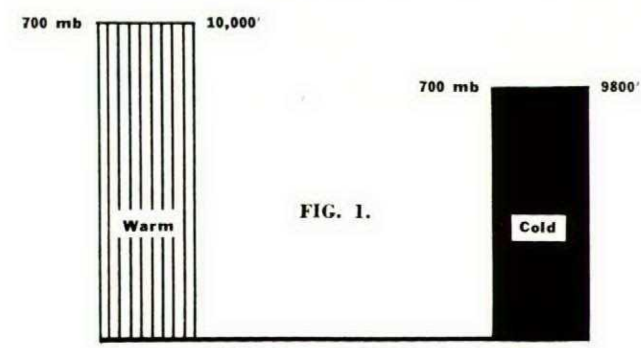


FIG. 1.

MSL Pressure 1015 mb.

setting" of the weather reports. Since the standard atmosphere temperature structure has also been assumed in calibrating the altimeter itself, the altimeter must give the correct field height on landing. It should be noted that since "standard" conditions are not used in calculating the M.S.L. pressure of the weather reports, the use of this M.S.L. pressure on the sub-scale is not likely to give the correct height on landing.

Determination of True Altitude

We are now in a position to see how a true altitude may be obtained from the altimeter reading. The method discussed is based upon the E6B Dalton Computer. Correct use of this computer depends upon a knowledge of the various types of altitude. They are as follows:

▲Indicated Altitude

This is the altitude indicated on the face of the instrument, corrected for any instrument error, when the appropriate altimeter setting is placed on the sub-scale. It is then an altitude above sea level, uncorrected for thermal deviations from the ICAO standard atmosphere between the ground and flight levels.

▲True Altitude

The true altitude is obtained when the indicated altitude has been corrected for thermal deviations from the standard atmosphere.

▲Pressure Altitude

When the ICAO standard mean sea level pressure is set on the altimeter sub-scale (1013.2 mb or 29.92 inches), the altitude reading is called the pressure altitude. Since the altimeter is calibrated according to the standard atmosphere, it follows that the pressure altitude is the standard atmosphere altitude which corresponds to a given pressure level in that atmosphere. A reading of it is needed when converting indicated altitude to true altitude. To obtain the true altitude, the procedure is as follows:

• When only the air temperature at flight height is known, place 1013.2 mb (or 29.92 inches) on the altimeter sub-scale and read off the pressure altitude. Set it opposite the temperature at flight height in the height computations window of the computer. Opposite the indicated altitude on the inner (minutes) scale read the true altitude on the outer (miles) scale;

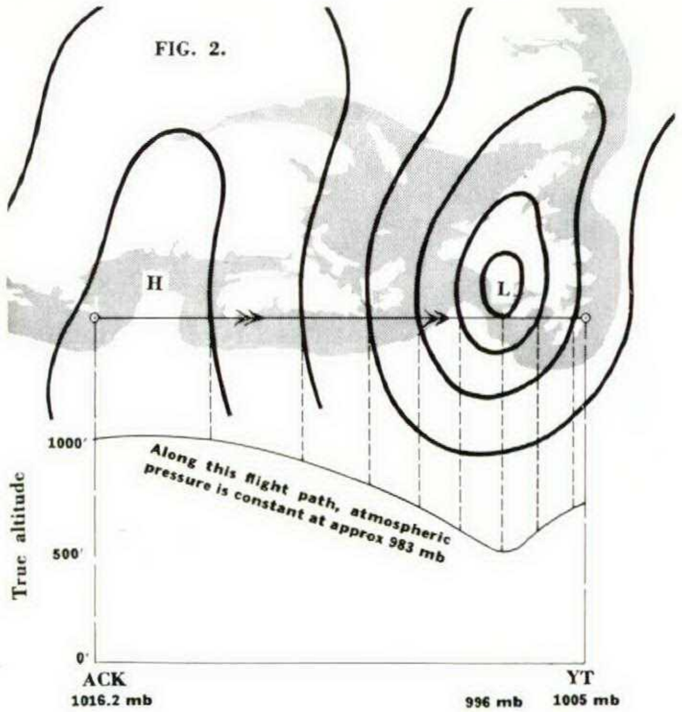
• When the mean temperature of the air column beneath the aircraft is known, again find the pressure altitude, but set the known mean temperature opposite one half of the pressure altitude in the height computation cutout. Opposite the indicated altitude on the inner (minute) scale, read the true altitude on the outer (miles) scale. (See figure 3.)

Of these two methods, the second is much more accurate but the information required for it is not often available in flight. In the first method, the assumption is made that the lapse rate of the column of air beneath the aircraft is that of the standard atmosphere. This very often will not be the case and considerable errors are possible. No such assumption is made in the second method, but even with it no greater accuracy than plus or minus 100 feet should be expected.

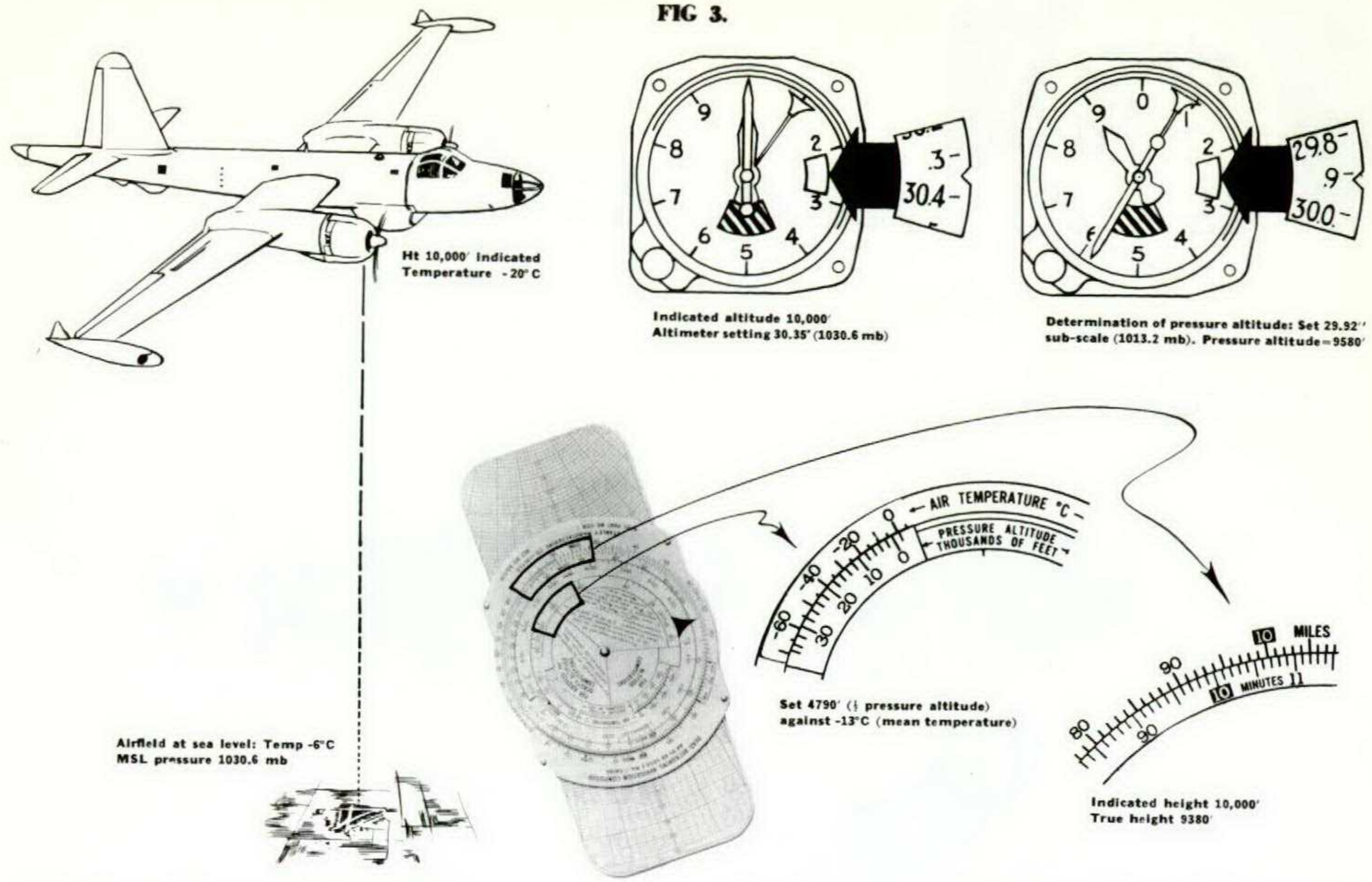
Altimeter Error Over Mountains

Even in an article as brief as this, mention should be made of a type of altimeter error that may occur in flight over mountains. In such a flight the temperature errors discussed above may be present, but besides these there is another error that might arise. It is due to the pressure effects produced by strong winds blowing over mountains. Although precise figures are difficult to obtain, it has been estimated that errors of as much as 2000 feet may occur in extreme cases. Observations of the rapid fluctuations of barometer readings, sometimes noted in mountain locations, give considerable support to this view.

Large altimeter errors of this type would be expected in the same weather situations as produce the greatest hazards from turbulence, down-drafts and horizontal gusts, namely in situations where there is a wind flow across the mountain barrier with the wind speed increasing rapidly with height.



Path of an aircraft flying from Nantucket to Torbay at time of above composite surface weather map, if the aircraft maintains 1000' indicated and uses, for the whole flight, the altimeter setting valid for Nantucket at time of departure.



Altimeter and Pressure Pattern Flights

Thus far our discussion has been concerned with errors which arise because the altimeter is a pressure instrument. However there is one particular use of the altimeter in which the fact that it is a pressure instrument becomes an asset instead of a liability. This is in its application to pressure pattern flying techniques. In these techniques flight is deliberately planned for a constant pressure level rather than for a constant height, and all that is needed to maintain this pressure level is to hold the same altitude and the same setting on the altimeter. In effect the altimeter is then being used for what it really is—a barometer. Pressure pattern techniques have become popular in recent years because of certain navigational advantages accruing from them. The appropriateness of the pressure altimeter for these techniques must be reckoned in its favour.

*

It is evident that on occasions the pressure altimeter must be used with caution. Nevertheless it does have its advantages, and in many flights all that is needed is to ensure that the correct altimeter setting is used on the sub-scale. If a true altitude is required, corrections for the temperature structure of the air are necessary; and when flying over mountainous terrain, or at high speeds, the possibility of errors must be kept in mind. It is still true, as it has been from the beginning, that the pressure altimeter is an indispensable instrument.

TAKE THE "IF" OUT OF IFR

Instances of aircraft clearing VFR into known IFR weather conditions are a continuing subject of reports received by safety agencies. Generally the pilot will state that if he can't make it VFR, he will change his flight plan. Obviously this can lead to the pilot's attempting to maintain VFR down to the point where he is below minimum flight altitudes as specified in 3710.7 and CAR 60. This sort of thing can be particularly hazardous in mountainous terrain. In short—don't fight it! File it!

USN: Approach

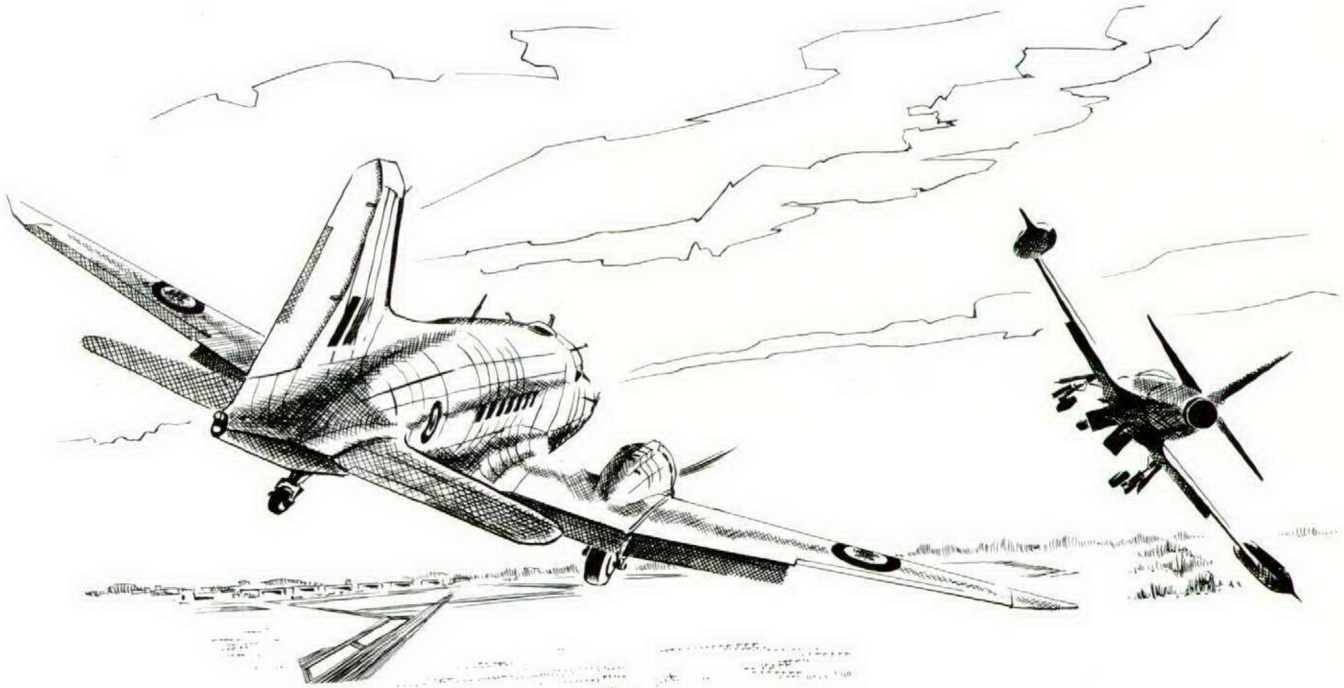
near miss

CROWDED CIRCUIT

During the final run for a precision approach on runway 24, the safety pilot aboard our Dakota spotted a T-33 closing in a shallow turn to starboard at about 4 o'clock. The T-33 continued to close in on this arc and GCA was advised when he had approached to within approximately 1000 yards of us. The traffic controller then tried to convince us the T-33 was on our port side and that we were to take any evasive action necessary. The T-33 continued to close in, apparently trying to line up for a landing on runway 24.

At about 300 feet above ground we assumed the jet to be now above us, since neither pilot nor co-pilot could spot him, and we accordingly broke right to clear the landing path. When we were established on a heading clear of the runway, the T-33 shot past our starboard wing tip at very close range. The cause of our near miss seemed to be poor liaison between the GCA traffic controller and the tower. Either the tower requested too late that the T-33 break off, or else, the pilot waited too long to do so. On these practice runs the first controller should always relay what information he has on other traffic in the area.

The location of the jet beacon is almost in line with runway 24. It is inevitable that transport aircraft on GCAs—when making a larger circuit pattern than normal—will become involved with the jet traffic when the beacon and runway 24 letdowns are being used simultaneously. When such a situation exists, it calls for extreme care in lookout. (This subject, incidentally, was covered in the article titled "Mixed Circuit" which appeared in Flight Comment for Nov-Dec 1956. —ED)



The T-33 shot past our starboard wing tip.

RUSSIAN ROULETTE

When I checked my oxygen mask prior to flight, it appeared serviceable. However, when I was taxiing out in the Canuck, I noticed a slight restriction in inhalation. At the button I stopped, ran through my oxygen check, and concluded that the aircraft's oxygen system was serviceable. But when I inhaled with the connector flutter valve depressed, the restriction proved to be in my mask. Since the restriction appeared slight, I decided to continue with the exercise.

Takeoff and climb-out appeared normal. During a normal crew check the navigator mentioned that we were going through 27,000 feet—and with a start I realized that I had been staring at the instruments in a daze. I then made a check of the altimeter, but its figures appeared large and fuzzy.

At this point I made a strong effort to complete a thorough cockpit check and found that the yaw damper switch was off. Getting my hand to it was more than my co-ordination could manage, for all I did was stab at the air around the switch. My fumbling attempt to turn it on succeeded at last in alerting me to the condition I was in, so I immediately initiated a descent.

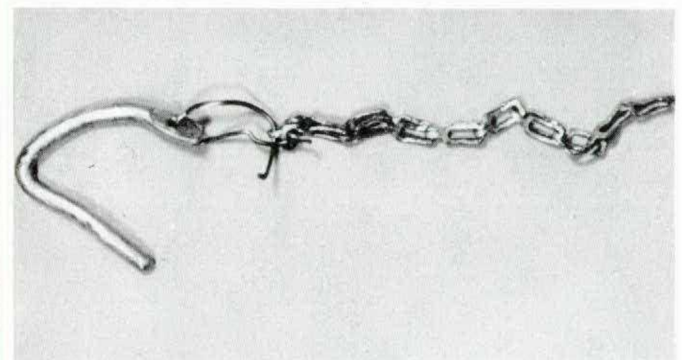
Ensuring an oxygen supply with the press-to-test button did not seem to help, so I turned the oxygen to normal and concentrated all my effort on flying. I soon felt better, but at the time did not attribute this to lower altitude or less oxygen after selecting normal.

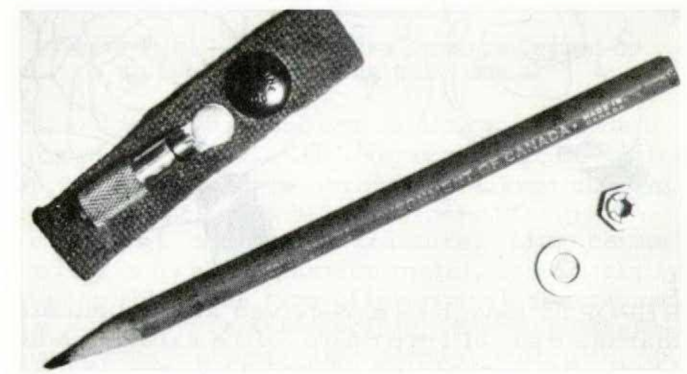
Analyzing the incident after landing, I concluded that it was a case of hyperventilation. The symptoms I experienced were most likely brought on by my unconsciously trying to overcome the slight restriction to inhalation.

This Near Miss could easily have developed into an "obscure" fatal accident. "Pressing on" with faulty oxygen equipment, regardless of how minor the malfunction appears, is like playing Russian Roulette.

FOREIGN BODIES

A Canuck was making a normal start in preparation for an air interception exercise. There was a sharp explosion from the starboard engine approximately five seconds after it was started. The engine was shut down immediately and a visual inspection showed considerable damage to the second and third stage compressor blades. Overhaul revealed a bent undercarriage lock pin, 3-1/2" long, and a nine-link piece of chain resting on the second stage rotor blades.





Another Canuck was being taxied out for takeoff when its ailerons seized. During a thorough examination of the aircraft's control system, the items shown in the accompanying photograph were found in the right and left consoles of the rear cockpit—areas considered "sensitive" to jamming. It is obvious that both maintenance and aircrew personnel were using less than reasonable care for items such as these to be found where controls could be jammed.

Ancient Aviation Safety Proverb

TRANSLATION: ***Feed not into engine items which are difficult to convert into forward thrust.***

OVERHEATED BRAKES

REPORTS have been received which indicate that the use of improper fire extinguishing agents on overheated brakes and wheels can create an extremely hazardous condition. Accidents have occurred, both on military and civilian airplanes, causing damage to aircraft and injury to personnel. The danger arises primarily from the use, on wheels and brakes, of fire extinguishing agents which effect a severe cooling or chilling action. The primary offenders of this sort are CO_2, water, and foam. (Foam has a water base.)

Accidents That Have Occurred

In one instance of commercial operation, a ground service man applied CO_2 to a hot magnesium wheel and tire assembly when the left outboard (number one) brake was emitting smoke. The resulting explosion blew the axle nut off, hurling the wheel through two ramp railings made of 2 x 6 wood and across 500 feet of airplane parking area. The wheel finally came to rest in a garage lean-to after damaging five automobiles. The explosion also caused the number two tire to blow and ruptured a shuttle valve, causing hydraulic fluid to leak on the hot brake and start a fire. (See figures 1, 2 and 3.)

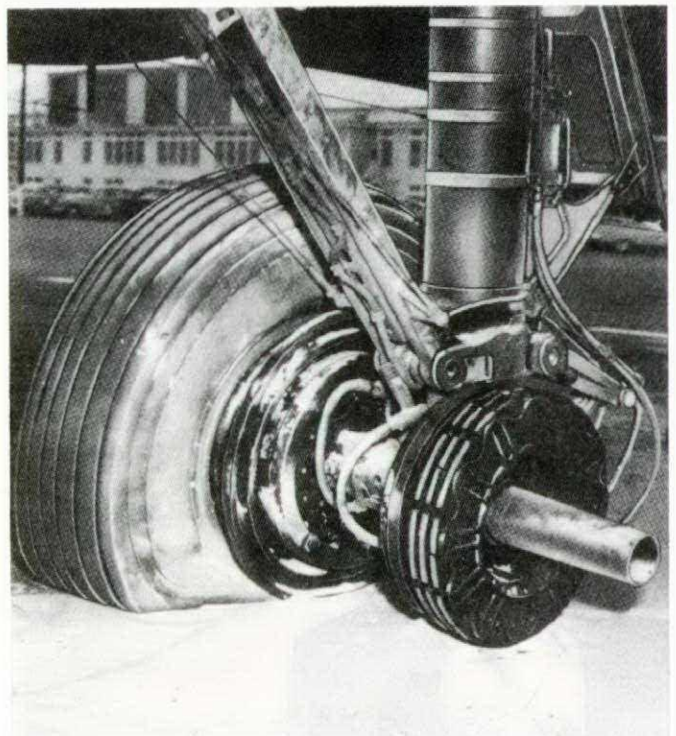


Figure 1 (a) — Left Landing Gear After Outboard Wheel Explosion

A military airplane was being given takeoff and landing tests at high elevation, and after the airplane had been parked it was noticed that the right brake was smoking excessively. CO_2 was applied, after which a fine spray of water was used on a flame deep inside the wheel. Approximately six minutes after application of the water, an explosion occurred which blew the wheel off with such force as to cause a fatal injury by hurling a man against the side of an automobile (see figure 4).

A jet-type airplane, after takeoff and landing tests, was taxied to the parking area with brakes overheated. A fire broke out in both main landing gear wheels. CO_2 was applied to the wheels, smothering the fire in the left wheel; but a subsequent fire started in the right wheel. This necessitated the use of additional CO_2, causing the "snow" (dry ice) to build up on both the wheel hub and the landing gear. Approximately 15 minutes after the fire had been smothered, the tire blew out. A crew member was seriously injured, and flying fragments caused extensive damage to the airplane.

Causes of Wheel Explosions

Studies indicate that fire in a wheel will not necessarily cause it to fracture, as the wheel will normally withstand considerably more pressure than the tire. However, the sudden cooling of a hot wheel by application of an improper extinguishing agent, such as CO_2, water, or foam, can cause it to fracture, thus permitting the tire to blow. This fracturing is

Figure 1 (b) — Left Landing Gear After Outboard Wheel Explosion

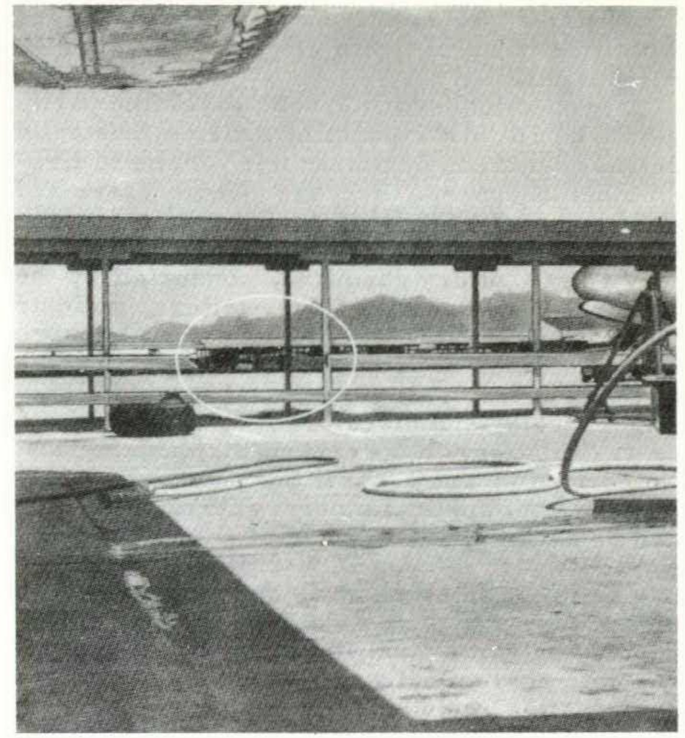


Figure 2 (a) — Ramp Railing Damage Caused by Exploding Landing Gear Wheel

caused by rapid, uneven cooling and contraction of the wheel. CO_2, for example, chills on contact and gives uncontrolled spot cooling, and when applied to hot metal, it sets up stresses which can cause fracture. Magnesium, being a high expansion metal, is especially susceptible to the type of internal stress caused by such severe spot cooling. Burning magnesium, when brought into contact with a liquid, is apt to explode.

Where a wheel explosion has occurred some time after the fire is out, the tire pressure may have built up because of continued heat transfer from the wheel to the tire. The increased tire pressure, plus the presence of a wheel fracture, can form a combination sufficiently critical to explode. It is interesting to note, however, that mere heat is not likely to be sufficient to blow a tire by increased air pressure alone. A tire normally carrying a pressure of 110 to 120 psi, when tested by its manufacturer in runs up to 500°F, showed a pressure increase of only 15 to 20 psi. A tire will begin to deteriorate at 375°F if held at this temperature for any length of time.

Characteristics of Extinguishing Agents

In tests of hot metal in contact with dry chemical, CO_2, and foam, dry chemical was found to be far superior, and it also extinguished the fire with a minimum of corrosion and without causing the metal to crack. For example, one pound of a well-known brand of dry chemical, in decomposing, will absorb over three times the heat from a fire as compared with one pound of liquid CO_2, and will do so without chilling.

Dry chemical extinguishers expel fine particles which, on contacting a flame, instantly release hundreds of times their volume in fire-smothering gases. Because these gases are released at the heart of the fire, their extinguishing action is especially effective. Laboratory tests of dry chemical, conducted by the National Board of Fire Underwriters, indicate that it has no abrasive qualities, will absorb heat, and does not chill on contact. According to Douglas tests, dry chemical produces only slight etching and discoloration, and moderate or no oxidation, on the various airplane metals. No corrosion will occur if the area is properly cleaned after application of dry chemical, which can be accomplished by use of an air hose. As an additional safeguard, use of the air hose can be followed by washing down the area with clean water applied as a high velocity spray, concluding with a final fine spray solution of 5% chromic acid mixed with water to neutralize any possible residue.

The following characteristics of dry chemical are listed by a well-known manufacturer:

- Water repellent
- Non-abrasive
- Non-toxic
- Non-conducting
- Non-corrosive
- Will not freeze
- Will not cake, deteriorate or evaporate
- Immune to normal temperature extremes.

It is strongly recommended that dry chemical be used on all wheel and brake fires, as its heat absorbing qualities will prevent excessive stress build-up such as that caused by CO_2,

Figure 2 (b) — End of Projective Flight of Exploding Landing Gear Wheel

Figure 3 (a) — Landing Gear Axle Assembly Stripped by Exploding Wheel

Figure 3 (b) — Landing Gear Wheel and Tire Damaged by Explosion

water, or foam. (Ref. EO-00-80-4/32.)

Although brakes are designed to withstand a great amount of heat, they normally give off little odor or smoke. Obviously, however, if a fire definitely exists, the important thing is to extinguish it by whatever means are available, as soon as possible. (Even if smoke is being emitted, an actual fire may not exist because smoke can be caused by excessive grease or foreign matter.) Then the brake should be allowed to cool by itself, but with fire fighting equipment held in readiness. A safe distance should be maintained by personnel during the cooling period, since an overheated brake condition must always be regarded as extremely dangerous.

If a fire definitely exists, the tire should be approached from the front or rear. Then, if an explosion occurs, concussion will be less injurious than flying fragments of the wheel. Following the extinguishing of a wheel or brake fire, the immediate area should be evacuated for a reasonable length of time.

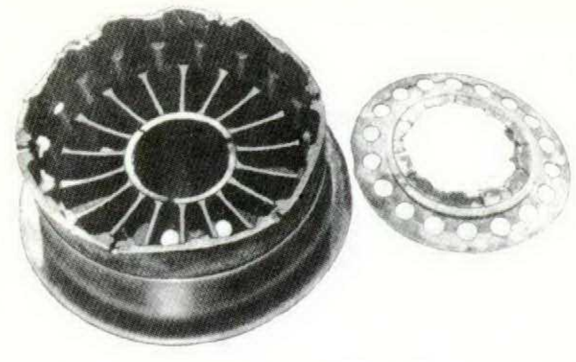


Figure 4 — Effects of Wheel Explosion Caused by Use of Improper Fire Extinguishing Agents

One operator recommends that, if dry chemical is not available and CO_2 must be used, the service man stand in front of or behind the wheel, and blanket the area by holding the end of the discharge nozzle 4 to 5 feet away from the brake. This will cause less temperature drop, and decrease the possibility of wheel failure. This operator further recommends that, unless a flame actually develops, cooling agents such as CO_2 should not be used, since quenching or accelerated cooling can be far more damaging than the extreme temperature. Finally, when an airplane with hot brakes has been parked, brake pressure should be released to minimize the possibility of a hydraulic leak.

*

Note: Pilots are urged to use propeller reverse pitch to as great an extent as possible, during initial slowing of the airplane, thereby minimizing the over-all brake usage for the deceleration. Also, an effort should be made to avoid unnecessary riding of the brakes during taxiing operations. It is possible that the increasing size of present-day transports, plus the height of the flight compartment, create an illusion of a slower taxiing speed than is actually being used.

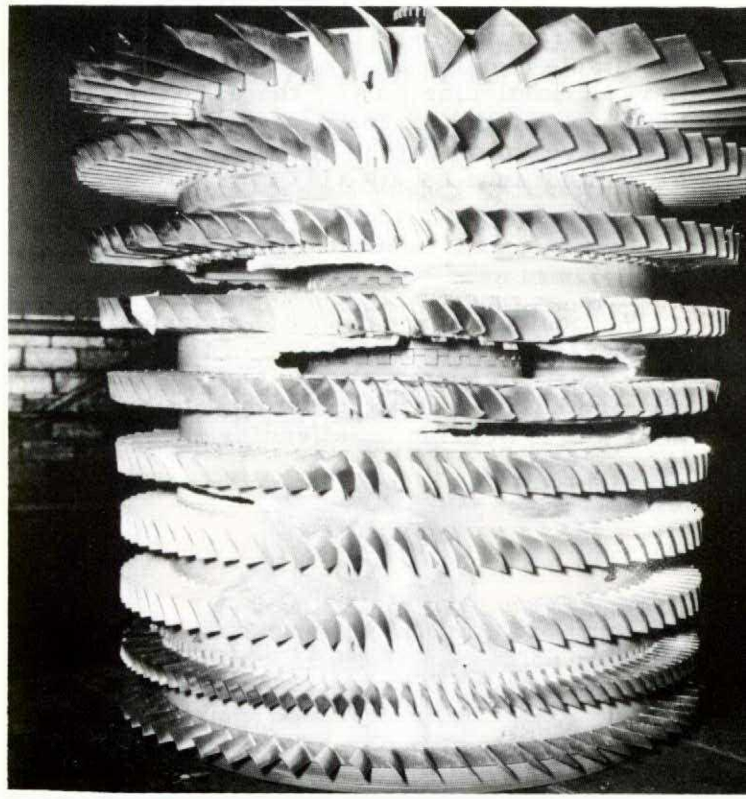
Douglas Service
Douglas Aircraft Company

HARD HARD WATER

During the 1956 thunderstorm season there were several instances of Series 11 and 14 Orenda engines in Canucks and Sabres being damaged when the aircraft were climbed through regions of heavy precipitation at altitude. It was concluded that the damage originated when the stator blades began rubbing on the rotor spacer rings. This rub resulted from a distortion of the compressor casing caused by the cooling effects of the large amounts of water ingested.

Apparently the damage is most likely to occur when the ratio of water to air is high—i.e., in the medium and upper levels of CBs where much water is carried aloft, and held there, by thermals. The possibility of damage occurring is further enhanced by a high power setting.

Blade tip clearances have been increased during the past year and this has raised the water tolerance of the engines. However, since the precise effect of this increased tolerance cannot be easily determined, pilots of aircraft with the Orenda 11 and 14 installed should avoid CBs whenever possible.



LETTERS TO THE EDITOR

Boots

On page 19 of the Mar-Apr 57 issue of Flight Comment is an article entitled "Basic Safety". It contains a photograph of a pilot doing an external check on a Sabre aircraft. Presumably he is about to fly it, since he appears to be dressed for flying. However, instead of wearing an RCAF flying boot, the man is wearing a pair of Oxford-type shoes! Would not the wearing of proper clothing and equipment be considered "basic safety", too?

The ramifications of wearing improper or unsuitable clothing and equipment are many. In this particular case, the pilot would be lucky to retain his footwear if he bailed out. Even if he did manage to keep them, they would be a hindrance in his attempts to survive.

F. D. Broadbent, F/L
AFHQ, Ottawa

We couldn't agree more! Incidentally the photographic editor's penance is to consist of wearing flight boots—even to bed—for the next six months. We'd also like a quiet talk with the pilot who is wearing the offending shoes. — **ED**

And Feet

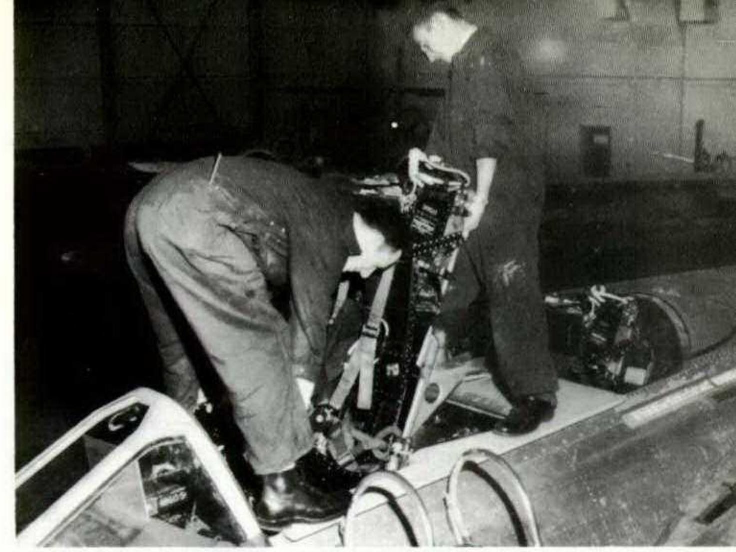
For two years I was employed as a navigator on a Canuck squadron. There I had the "opportunity" of experiencing cabin pressure failure. Cabin pressure failure has several causes—one of them being bent canopy rails. The easiest method of bending the rails is to walk or stand on them. To stand or walk on them while lifting an ejection seat out of the cockpit is a sure way of guaranteeing that some crew on a future trip will major the aircraft for cabin pressure failure. It can also make things very uncomfortable for the crew.

The back cover photo on your Jan-Feb 57 issue shows a clued-up pilot leaving his cockpit in the accepted fashion. But your front cover shows two men doing exactly what is needed to bend a couple of canopy rails. Shame on Flight Comment!

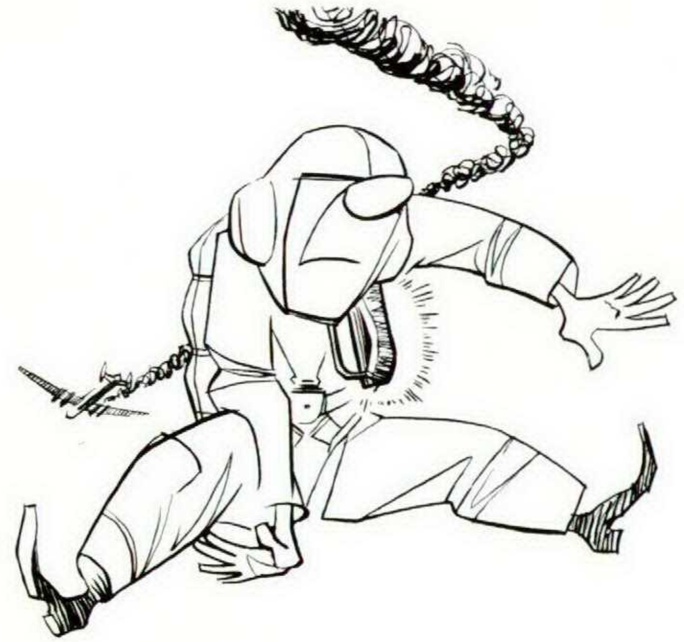
M. E. Pett, F/L
OBS/NAV 405 (MP) Sqn
RCAF Station Greenwood, N.S.

RCAF Station Uplands and AMCHQ have confirmed that ejection seats have been removed from these aircraft in the manner depicted ever since the introduction of Canucks into the RCAF. Furthermore, no official reports (e.g., UCRs) have been received from operating units citing cabin pressure failure as a result of bent canopy rails.

Nevertheless the observation is well taken, because continued ejection seat removal in this fashion could lead to eventual cabin pressure difficulties. To prevent damage to or accumulation of dirt in the rails, and to protect personnel from any injury they might sustain because of the precarious footing, RCAF Station Uplands has devised a platform on which ground crew technicians can stand when installing or removing ejection seats. The platform is in use at RCAF Station Uplands and details of its construction have been forwarded by ADC to all user units authorizing its use and its fabrication by local resources. — **ED**



Herewith the Uplands anti-bent canopy rail device. The platform protects both aircraft and personnel.

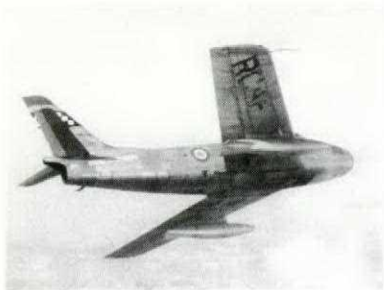


ALBERT and the RIPCORD

'Ast 'eard tale of Albert Ramsbotham
An' 'is tussle wi' Peter at gate
When 'e found 'imself stranded in 'Eaven
'Cos 'e'd thought of 'is ripcord too late?
"Look 'ere, Sir," says Albert, determined,
As position got 'orribly clear,
"I've a missus an' kids down in Yorkshire—
'Ow'll they get on there if I'm 'ere?"
Saint Peter scratched whiskers, then answered:
"Ye're lucky to be 'ere—don't carp!
'Twere better to stay while ye're welcome,
An' be issued wi' white robe an' 'arp."
Then Albert got 'ot under collar—
'E were thinkin' o' Mabel in plight,
An' green peas comin' on in allottment,
An' the Bull of a Saturday night.
"We was up," 'e explained, "over Prangmere,
I were peaceful-like, thinkin' o' nowt,
When all at once flames shot from rudder,
An' pilot gave word to bale out.
The suddenness gave me a shock like—
It weren't quite like jumpin' off 'bus—
Ye see, what 'ad 'appened to others,
I thought, couldn't 'appen to us.
I were dazed still when 'atch were shoved open,
A voice said, "Unconscious don't wait!"
An' it wasn't till ground rushed to meet me
That I thought of my ripcord—too late."
"After all yer instructions—" bawls Peter,
"The 'undreds o' times ye've been told.
No more Yorkshire puddin' for you, son—
Ye've 'ad it—get into t' Fold!"
Take warning from Albert Ramsbotham,
And take always a very poor view
Of the saying "It may never 'appen"—
It may 'appen, presto! to you.

Flying Safety Review
RAF Bomber Command

Pilots of RCAF jet aircraft are provided with an Auto Rip connection which relieves them of the responsibility for pulling the rip cord in the event of an ejection. Need we add the reminder that the auto rip connection must be hooked up before flight or "Albert" is right back in the picture again? — **ED** .



Sabre Spins

F/L J. C. HENRY

WHY DID THE RCAF call for spinning tests on the Sabre? After all, the aircraft was operational in the USAF for several years prior to its procurement for the Canadian Air Force. The question is a logical one and deserves an explanation.

For one thing, the RCAF Sabre has an Orenda engine installed in place of the J-47 used in the USAF Sabres. Besides, it is essential that everything possible be known about the handling characteristics of both an aircraft and its engine before they go into operational service: Will the engine flame out during a spin at high altitude? Can you get a compressor stall? Has the aircraft any unusual characteristics in a spin? What is the best method of recovery? These are a few of the questions our spin tests are expected to answer.

From experience we have learned that it is necessary to find the answers through actual tests rather than by accepting the results of previous tests and assuming that a given modification will make no difference to the aircraft's behaviour. The task of carrying out these assignments is in the hands of the RCAF's Central Experimental and Proving Establishment.

Now let us examine the case of the Sabre. In all, four different models of the aircraft have been tested by CEPE: the Sabre 2, the Sabre 5, and the Sabre 6 with both the solid leading edge and the slatted leading edge. (The Sabre 2 will not be discussed here since it is no longer in use in the RCAF; but its characteristics in a spin were only a little different from those of the Sabre 5 and 6.)

In 1954 I was allotted the task of carrying out handling trials on the Sabre 5 aircraft. This included spinning tests, and meant that once again I must dig out the spinning requirements for fighter aircraft. These are rather frightening in the number and configurations required. First of all, the spins must be done for the worst center of gravity case—the most aft c of g—which for the Sabre normally means with the ammunition fired off. The spins then fall into four major classifications:

- Erect spins from straight stalls, power at the idle
- Erect spins from 2G turning stalls with power on
- Inverted spins from inverted straight stalls, power at idle
- Erect spins from straight stalls in the landing configuration.

In both erect and inverted spins the effect of operating dive brakes, and of using aileron in the direction of the spin and against the spin, must be investigated. Double all these to get the results of spins to the right and left, and double again to check the results of each spin, and it can be seen that the program becomes healthy (or unhealthy, depending on your viewpoint!). Add to these the necessity for repeating the lot with drop tanks installed, and again for each mark of the aircraft, and the whole thing becomes staggering! However, in spite of this impressive list of spins, the Sabre presented no real problem at any time.

Normal Erect Spins, Clean Configuration

Let's look first at the five-turn spins to the right and left from the power-off straight stalls, starting at 30,000 feet. They are both moderately oscillatory spins. The nose rises and falls during each turn, as can be seen in the accompanying diagrams, but they are really quite gentle as spins go. It should be noted that as the spins become fully developed, the one to the left is normally faster than the one to the right. This faster rotation gives the aircraft a rate of descent of about 1000 to 1500 feet per turn in the spin to the left as compared with 1500 to 2000 feet per turn in the spin to the right. It also means that the aircraft has a higher inertia in the spin to the left, which results in an extra one-half to three-quarters of a turn before the recovery action takes effect.

Effect of Dive Brakes

Several spins were done with the dive brakes out. Their main effect seemed to be to increase the rotational speeds slightly in the spin, which in turn meant that it took slightly

FIG 1. Spin to Right

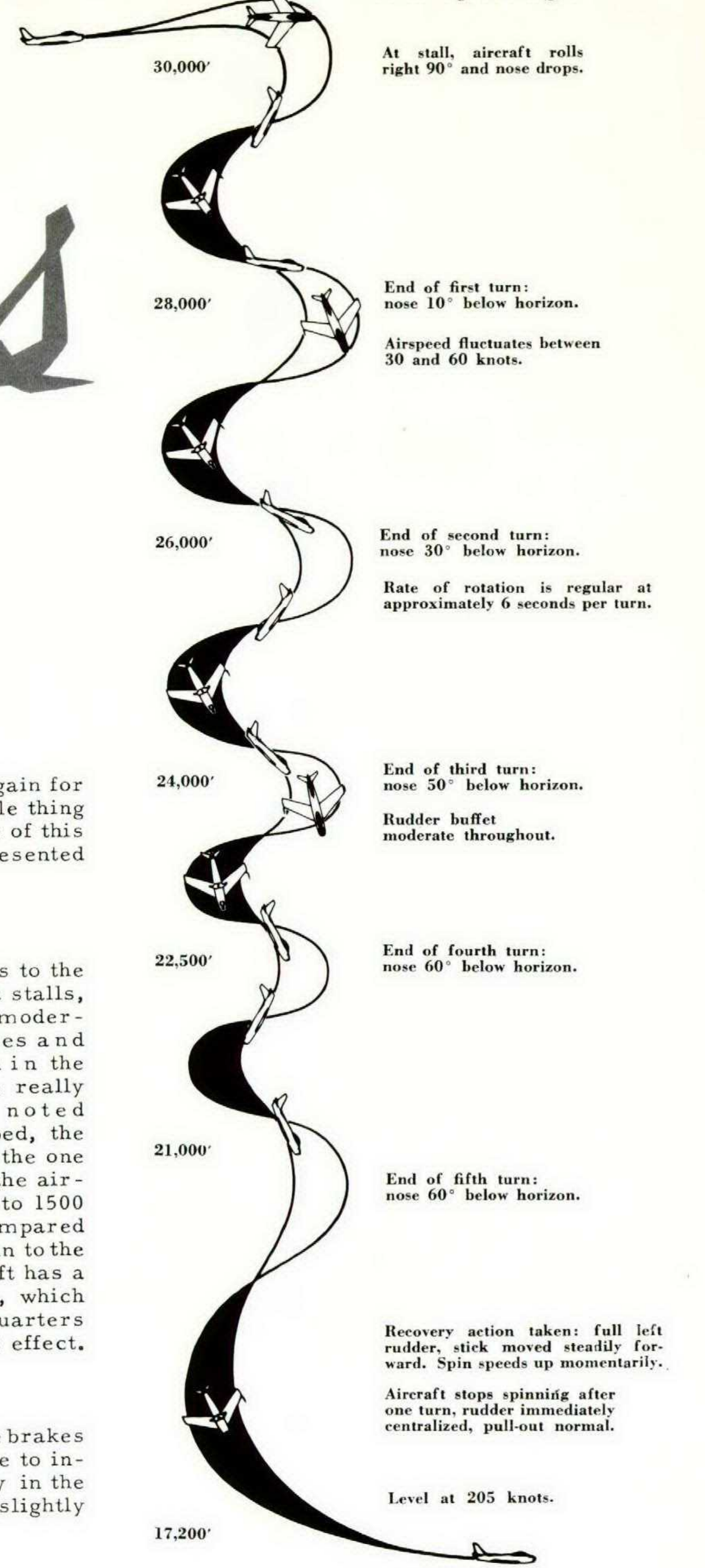
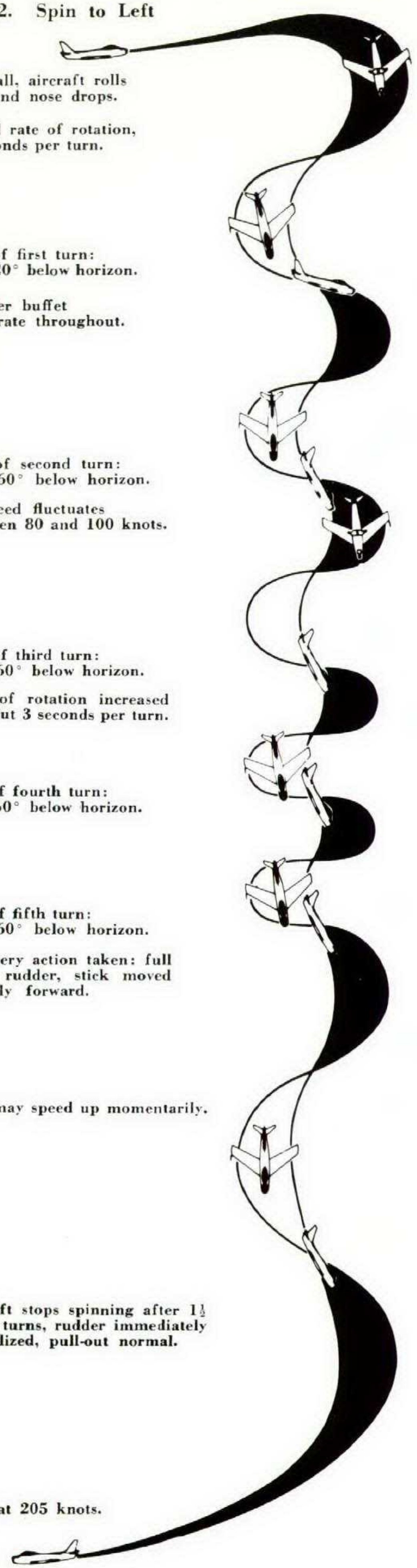


FIG 2. Spin to Left



longer for the recovery action to take effect. However, in no case did the recovery take more than two turns.

Spins Out of Turns

These spins were investigated by pulling into turns from level cruising flight at 30,000 feet. When the aircraft (at about 85% power) was pulled into the stall and full bottom rudder applied, it buffeted itself around a slow roll. After this one roll, power was reduced to idle and the aircraft went into a "normal" spin (if a spin can be called a "normal" manoeuvre!).

Spins in the Landing Configuration

With the wheels and flaps down and dive brakes out, only one turn of the spin was made before recovery action was taken. It is assumed that most pilots would immediately recognize an inadvertent spin in this configuration and initiate recovery action before even half a turn had taken place. However, for these trials one full turn was made, and then the wheels and flaps were selected "up" and recovery action was taken. The spin stopped within one turn and the aircraft was pulled up easily to level flight. Use of the dive brakes in the recovery in this case helped prevent excessive speeds in the dive while the wheels and flaps were still retracting. Normally the dive brakes should be in for recovery.

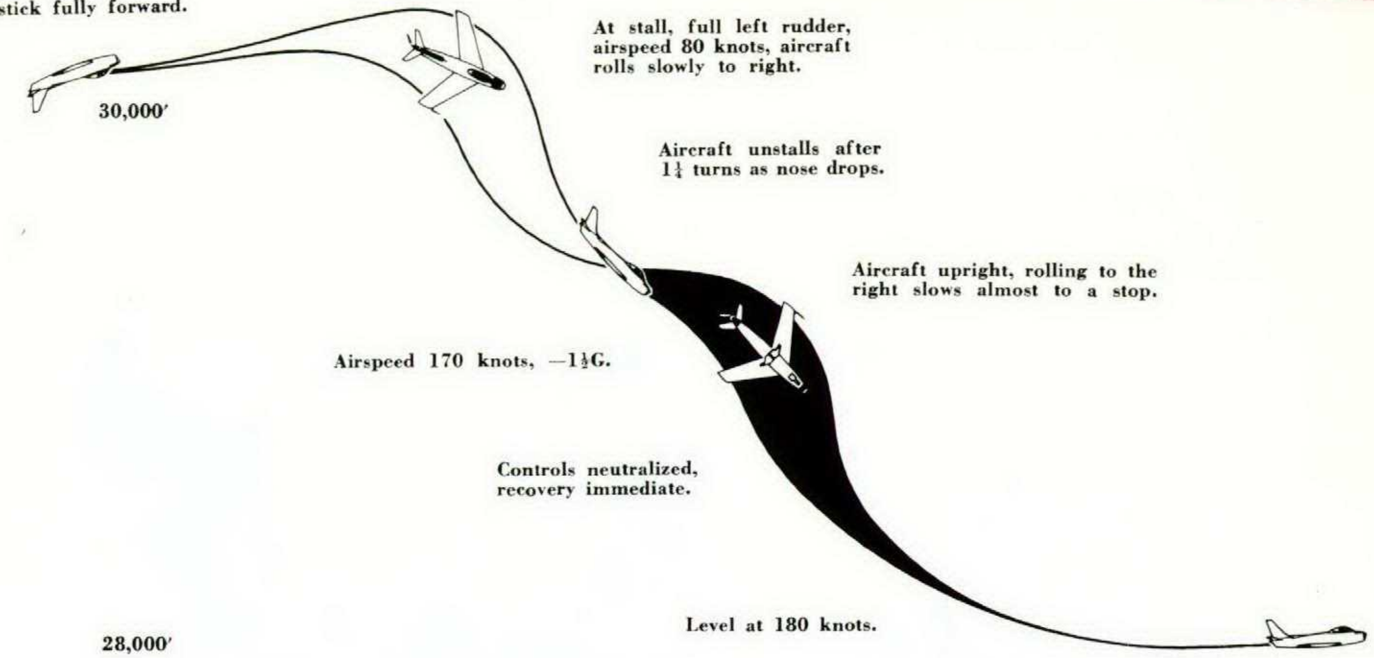
Inverted Spins

Someone always asks about inverted spins and how to recover from them. It doesn't seem to help to point out that CAP 100 says inverted spins are prohibited manoeuvres. All the test pilot gets is a fishy stare and the comment that if it can be done, some idiot will do it, so go ahead!

The preliminaries over with, the Sabre was taken up to 30,000 feet. At 150 knots, with the power at idle, the aircraft was rolled inverted and the stick pushed forward to stall it. Wonder of wonders, the aircraft was "idiot-proof"—it could not be fully stalled at normal loadings. There just wasn't enough elevator travel. However, the joy was short lived because somewhere along the line someone wondered what would happen if the center of gravity were moved back beyond the aft limit. Off we went again.

This time, although the "normal" spins were not affected, it was possible to stall the aircraft inverted at the most aft loading tested. Consequently a number of inverted spins were done, the results of which were quite surprising. At the inverted stall, when full left rudder was applied the aircraft rolled slowly to the right! (The reason for this becomes evident if a model is used.) As it rolled to the upright position, the Sabre unstalled and the rolling slowed down.

FIG 3. Inverted Spin to Left



The aircraft probably would have started a roll to the left except that by that time the airspeed was up to 170 knots, and the minus 1-1/2G made it difficult to hold the stick fully forward. When the controls were centralized, recovery was immediate. Figure 3 illustrates the inverted spin to the left. The spin to the right is similar.

Effect of Ailerons

Next we come to the effect of ailerons on the spin and during recovery. This subject has not been mentioned in RCAF publications because all our aircraft which can be spun have a common recovery procedure: full opposite rudder, then stick forward steadily, with ailerons neutral, until the spin stops. Nevertheless, with swept and delta wing aircraft, ailerons can—and in some cases must, be used to ensure recovery. The Sabre is one of those aircraft on which ailerons can be used to advantage if handled correctly.

The spin tests carried out on the Sabre showed that when aileron was applied against the spin—left aileron applied in a spin to the right—the rate of rotation was greatly increased; and that if the aileron was held against the spin while recovery action of opposite rudder and stick forward was taken, the aircraft would not recover at all! However, as soon as the aileron was returned to the neutral position, the spin returned to "normal" and recovery was normal.

Aileron into the spin (right aileron in a spin to the right) produced an entirely different result. When aileron was applied in the direction of the spin, the fairly steady rate of rotation of the "normal" spin was immediately upset, alternately speeding up and slowing down, and becoming more oscillatory. When recovery action was taken with the aileron held into the spin instead of neutral, the spin stopped abruptly in less than one half turn! It seems that aileron into the spin is far more effective than elevator alone in unstalling wings.

Other Configurations

All of the above spins were for the Sabre 5, clean. However, the other tests showed that, regardless of whether the aircraft was a Sabre 5 or 6, with slats or without, and with or without the empty 100-gallon drop tanks, the spin characteristics were all basically the same. Spins with fuel in the drop tanks, or with the 167-gallon models installed were not done and are not recommended.

*

Only one conclusion can be reached from these tests: When it comes to spinning, the Sabre is quite an ordinary aircraft with no outstanding vices. Consequently there is just one standard procedure for spin recovery:

• Clean up the aircraft—wheels and flaps up, dive brakes in, and power to idle

• Having established the direction of rotation, apply full opposite rudder to stop the rotation

• Pause; then move the stick steadily forward until the spin stops, which it should do in less than two turns if the altitude is below 30,000 feet. Above this altitude the recovery may take longer because of the thinner air.

There you have the normal recovery procedure for spins in the Sabre. If for some obscure reason the aircraft does not appear to be recovering by this means, then a fourth step may be added:

• Apply full aileron in the direction of the spin while keeping on full opposite rudder and stick forward. If that doesn't snap it out of the spin, nothing will!

("Aileron into the spin" is being evaluated as a possible authorized secondary procedure for spin recovery.— **ED**)

Of course it is understood that the controls must be centralized immediately the spin stops in order to regain level flight as quickly as possible and prevent a further spin from developing. The Sabre requires about 5000 feet, after recovery action is taken, to stop a spin and regain level flight. Adding a good margin of safety to take care of altimeter lag and other factors, it is recommended that if a spin persists below 10,000 feet, the aircraft should be abandoned.

So much for all the spins, recovery techniques, and when to part company with the aircraft should it ever prove necessary. All that is left is a final thought:

IT'S WHAT YOU DON'T KNOW THAT WILL HURT YOU

THE AUTHOR

F/L J. C. Henry graduated from the University of Toronto as an aeronautical engineer in 1949. He was also a member of UATP 1, the first post-war course of University Flight Cadets. After completion of his training with this group he went to 426 Squadron for a period of three years during which he participated in the airlift to Japan. A tour of duty at Central Experimental and Proving Establishment followed next, after which, in 1953, F/L Henry went to Britain for the Empire Test Pilot's Course. Since that time he has been stationed at CEPE Rockcliffe as a test pilot.

This is the author's second appearance in our pages. His article "Spinning the T-33" was printed in the Jan Feb 1956 issue of Flight Comment.

PILOT ERROR

WHENEVER THE SUBJECT of aircraft accidents is being batted about in the crew room, the mess, the OC's lair, and the various other offices on a unit, it doesn't take long for the argument to get around to the term "pilot error". Among members of the flying fraternity this topic is likely to provoke a somewhat heated discussion—and undoubtedly some very pointed and scathing charges are made against those whose duty it is to determine and assess the cause of accidents.

At the risk of stirring up the pot to boiling pitch, we think that an informative examination of the subject might be helpful, particularly when it is a matter of statistical record that a large proportion of accident causes are attributed to pilot error.

We assume that the procedure followed in the service for the selection and preliminary training of pilots will have eliminated the physically and mentally unfit. In addition we do not propose to examine pilot error as the cause of accidents which involved wilful disregard of well publicized regulations such as unauthorized low flying. Yet, despite these deletions, we are still left with a large variety and number of pilot error accidents to examine. But first an explanation of the reasoning and procedure followed for establishing pilot error as a cause.

An aircraft accident may have one or many causes, the assessment of which depends upon two factors:

• How far back the events leading up to an accident can be established and evaluated

• The relative magnitude or degree of responsibility of the various cause factors.

In the Air Force, where the immediate cause of an accident is attributed to poor airmanship, incorrect technique, an error in judgment, or a default in captain's responsibility, then at least one assessment of cause is established as pilot error. And this is where the argument begins: Why did the pilot err ?

The Reasons Behind

Take an example in this category. Two aircraft in a formation of three collided during an unorthodox manoeuvre. One of the pilots had misunderstood an executive order given over

A lost weekend—and a long flight back.

the R/T. Pilot error was the immediate cause of the accident. But inadequate preflight briefing was the predominant cause, attributable to the failure of an organization to institute formal briefings as standard procedure prior to each flight.

The foregoing example is representative of a category of pilot error accidents in which the failure of our organization to develop and enforce standard operating procedures is the explanation for the errors committed.

Another category includes those cases where, although adequate standards have been set, the pilots involved did not receive the required training. Many accidents attributed to inexperience fall within this category. While it can be established that a pilot received particular training and passed the appropriate standards checks, nevertheless he becomes involved in an accident in which his technique or judgment has been found lacking. The accident is proof, insofar as the particular individual is concerned, that the quantity and quality of instruction he received was inadequate.

The accidents caused by anoxia provide another example. A general investigation of the problem revealed that aircrew personnel, including many of senior rank, had insufficient knowledge of their aircraft oxygen systems and associated personal equipment. More significant was the lack of concern about this equipment. Although correct and adequate procedures were known in some quarters, aircrew had not been given the necessary co-ordinated instruction with the appropriate emphasis. Subsequently the pilots who failed to obtain a good fitting for their oxygen mask, or neglected a preflight check of their mask and oxygen system, or failed to have a previous anoxia experience investigated, were all responsible for these "pilot error" accidents. But the reason behind the accidents was inadequate training to meet known standards.

A third category includes accidents in which investigation establishes that, although appropriate standards had been set and pilots adequately trained to meet the standards, the causes can still be attributed to pilot error. For example, there was the pilot with a total of over 8000 hours' flying to his credit and 159 hours on type who, after losing an engine on a twin-engined aircraft, failed to use the correct emergency procedure for lowering the under-carriage. His flight terminated in a wheels-up landing.

Another pilot was making a VFR flight at low level during deteriorating weather. Unwisely he pressed on until he was compelled to make a hasty forced landing on water. The aircraft sank after a poorly executed landing. Then there is the case of a pilot who was very familiar with the route and local area but made the bad decision to descend below the minimum safe altitude during an IFR approach. His aircraft collided with trees on some high ground in zero conditions. In all of these accidents the pilots were experienced, had received adequate training, and at one stage in their careers had met the required performance standards.

Bad Habits

The immediate cause of these accidents was undoubtedly pilot error. However, in flying as in other fields, one can unconsciously develop bad habits. Familiarity with an operation can breed carelessness. Those do-it-yourself fans who have unfortunately lost fingers in their hobby shop buzz saws will verify. One's ability to execute emergency procedures to the letter becomes doubtful without regular practice. It remains commonsense and good management, then, to apply a system of frequent and regular checks of pilot ability by both responsible and independent authorities. Such was not the case in the examples cited, and the failure to do so can be given as the reason for the pilot's error.

Physiological Causes

There are physiological reasons to explain some of the errors committed by pilots. Fatigue will, for example, slow one's reaction and cloud judgment. There is evidence to suggest that fatigue also promotes vertigo. Inadequate rest, irregular or insufficient meals, long hours of duty, and an excess of flying are some of the causes of fatigue. A number of these factors are within the pilot's control. That "lost weekend" followed by a long flight back to base is an example. The medical officer and the supervisor, however, have a large share of responsibility to ensure that the stage is not set for a pilot error accident arising out of fatigue.

The difficulty of seeing other aircraft in time to avoid a collision is another physiological matter. As traffic becomes more dense, and as the speed and altitude performance of our aircraft increases, the risk becomes more acute. Experts suggest that at high altitude the eyes, accustomed to focusing on objects and finding nothing in the upper atmosphere to concentrate on, will automatically revert to a short range focus. If this proves to be true, an aircraft on a collision course would not be seen in time, and therein may be the cause of some future collision accident.

Psychological Causes

Habit interference is the explanation for a number of errors. It is the sort of thing you experience when, after driving a car with an automatic transmission you revert to a gear shift model and promptly neglect the old SOP which you used for many years. The same phenomenon applies to aircraft, except that the results are sometimes more dramatic. Other psychological reasons include worry, frustration and personal problems.

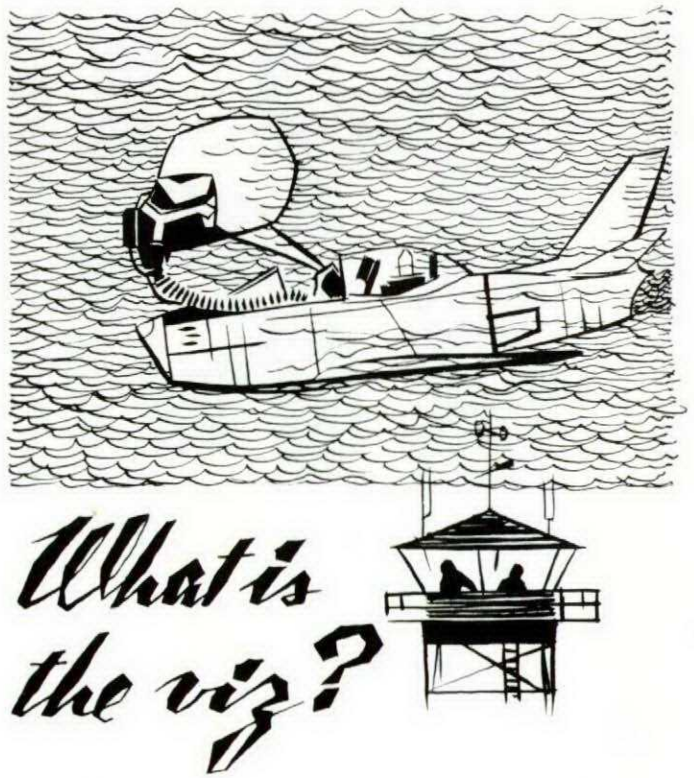
Unsafe Design

Finally we come to unsafe design, which places unnecessary demands on human pilot ability. Best known to the majority of pilots is the ground-looping tendency of the Mk II Harvard. The introduction of the Mk IV with the steerable tail wheel has greatly reduced ground-loop accidents, thanks to a safe tail wheel design. Another less known example concerns one of our modern high performance aircraft. Should its throttles be closed during a manoeuvre creating G forces, the increased weight of the hand is sufficient to inadvertently stop-cock the engines when the throttles reach the closed position. This is believed to have occurred in at least one "A" category accident when altitude was insufficient to permit a relight. Human error was present but unsafe design was the predominant factor.

The reasons for pilot error accidents can be summarized as follows:

- Lack of safe standard operating procedures
- Failure to train pilots to current standards
- Lack of frequent and regular checks of trained pilots
- Physiological causes
- Psychological causes
- Unsafe design.

From a flight safety aspect, the large proportion of accidents attributable to pilot error emphasize the importance of adequate training to meet standards, and continual and frequent checking of the ability and knowledge of trained pilots. Much can be done to overcome physiological problems arising out of fatigue. Personnel monitoring the development of new aircraft are responsible for the incorporation of safety in design, while units operating aircraft may UCR unsafe features not involving major redesign. Finally, authorities investigating pilot error accidents have not completed their assignment until the reasons for the pilot's error have been established and reported. Such information enables the responsible authorities to develop and apply the all-inclusive corrective action required for the effective reduction of our pilot error accident experience.



Why not see "Interpreting Weather for Landing Aircraft" (TF-1-4996)? Reviewed by the Directorate of Flight Safety, this USAF film is an excellent cartoon presentation of the Met problems which can arise on circuit and approach. Highly recommended.

FLIGHT SAFETY and the UCR

F/L H. E. BRYANT

EVERY MEMBER of aircrew can remember the many occasions when he has met with an annoying situation, struggled with it, sworn at it, swallowed hard—and often forgotten it. The times when such situations are remembered and reported correctly occur so infrequently that the same unsatisfactory circumstances arise again and again, and eventually become established as something which just has to be lived with and accepted as normal. This situation is insidious because it is likely to bring about a subtle change in our mental outlook, with the result that the margins bordering on acceptable levels of serviceability gradually broaden until the once hazardous situation becomes the normal.

The Snare

Aircrew in general are particularly clever at adapting themselves to new situations. They have to be. They learn cockpit drills and procedures to be followed with precision so that safety will be promoted and emergencies met with prompt and proper action. This is all to the good, and we question neither the principle nor the practice; but we do suggest that because of this regimentation there is a tendency to accept unsatisfactory conditions. If the tendency is allowed to persist, curiosity declines and passive acceptance becomes dominant.

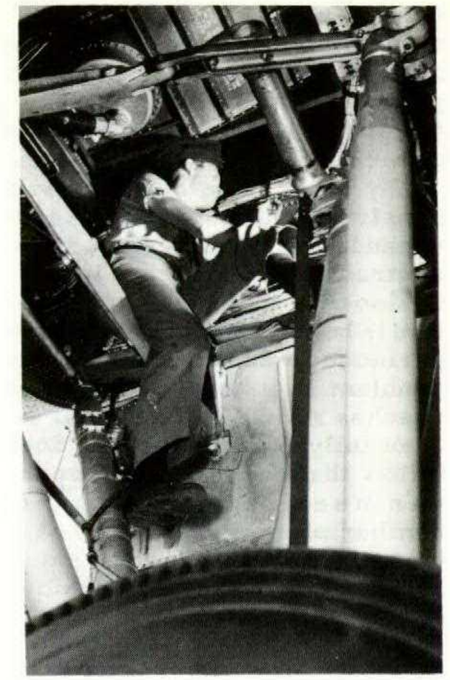
The Catch

It is a fact that, only after fifteen years of operating the Harvard in the RCAF was an unsatisfactory condition reported concerning

the operation of the aircraft's rear cockpit hood. The location of the handle which operates the hood makes it difficult to grasp when the hood is closed; yet pilots lived with this condition for fifteen years before it became the subject of a properly prepared report.

The Medium

A medium does exist whereby personnel, whether service or civilian, may propose changes to technical or operating procedures, or report to the appropriate authorities deficiencies in design, failures, malfunctions, or general shortcoming of materiel. This medium is RCAF Form 318—entitled "Unsatisfactory Condition Report"—commonly dubbed a "UCR". Its purpose is to place on record the fact that an unsatisfactory condition exists somewhere. EO 00-10-1, part 5, gives full details as to the proper submission of the UCR form, and it will be noted that the terms of the definition are so broad that almost any situation is open to the submission of a UCR.



Requirements

To make an accurate analysis of an unsatisfactory condition, it is important to give full information concerning the proper nomenclature of the item: type or model, serial number, and hours or mileage since new. Photographs or sketches which illustrate the item will often help the recipient of your UCR to determine what is causing the trouble. Always provide sufficient detail to ensure a full understanding of the problem at the receiving end—and do what research is necessary to establish whether an item is standard or non-standard.

It is this kind of care that reveals incorrect operating procedures and conflicting orders. If someone somewhere does not take the time to produce a UCR based on sound reasoning and true facts, somebody else somewhere else will be unable to give the UCR the attention it deserves. The net result might well be an unsatisfactory solution to an unsatisfactory condition.

Procedure

It is recommended that EO 00-10-1, part 5, be carefully read before a submission is made, and that full supporting information be given to those responsible for completing paragraphs 17 and 18 of the UCR. This will enable unit specialist officers to make a proper appreciation of the problem against the background of their greater knowledge of the total situation at unit level.

The Channels

After despatch from a unit the UCR is channelled through to Command Headquarters where further investigation is made on the subject of the report. Additional data is available at this level, so if the same item has been previously submitted, the new data will help in judging the gravity of the problem in the light of the total situation at Command level.

By now, some readers will be smiling and construing this to mean that as the total situation expands the relative importance of the problem contracts. This is true, in a limited sense; but it is also true that this same unsatisfactory condition is being handled by people with sufficient experience to allow them to appreciate the unit problem in its own background. When the UCR reaches AMCHQ, the total situation will have been fully expanded; but it does not necessarily follow that the relative importance of the UCR has been correspondingly diminished. The number of previous reports is not the sole factor in assessing requirements for corrective action. Other factors considered at this level determine the degree to which corrective action should be taken; among them are the safety of personnel and equipment, and operational and training requirements. Cost, availability of parts, manpower and time are others.

Whatever the final decision may be, it is annotated in para 20 of the UCR. The latter is then channelled back to CHQ and to the unit concerned—at which point the originator may acquaint himself with the answer.

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The subject of the UCR and the decision given may end up as the basis for an engineering order amendment, or a special inspection, special information or modification leaflet. It may be included in the UCR Digest (EO 00-10-2) or serve as the stimulus for an "original idea". However it ends up, if the UCR has helped to raise efficiency or promote safety in the RCAF or to decrease cost or manpower requirements, it has justified the purpose for which it was designed—and the existence of the man who set it rolling in the first place.

THE AUTHOR

F/L H. E. Bryant joined the RAF in 1939 and from then until 1941 was engaged in maintenance. Posted to Canada in 1942 he qualified for his pilot's wings and became a flying instructor. Leaving Canada in 1944 he spent the next three years in transport and staff pilot flying abroad. Leaving the RAF in 1946 he took to airline work and flew for Scottish Airlines and Airwork Limited until 1952 when he joined the RCAF. Currently he is a member of the SOMaint Branch at TCHQ.

This is not F/L Bryant's first contribution to Flight Comment. His article titled "A Matter of Balance" appeared in the issue for Mar-Apr 1955.

Accident Resumé

All Broken Up

During the airflight following a GCI intercept, number two became separated from his leader but requested permission to press the attack. The leader, orbitting above, agreed. Watching the fighting below him he apparently became disoriented and dove almost headlong into the fight, colliding with the tail of the aircraft his wingman was attacking. He ejected and parachuted to safety while the pilot of the other aircraft managed a safe landing.

By leaving his section split up after number two lost him, the leader forfeited valuable cross-cover. While this may be necessary at times under actual combat conditions, during training exercises it is obviously desirable to re-form in a clear area. Considering the number of aircraft engaged in the airfight and the difficulties involved in keeping track of everyone, here is a case where a broken section resulted in two broken aircraft.

During the investigation it was learned that the pilot who parachuted did not have the auto-ripcord of his parachute hooked to the aircraft harness. Had he been injured in the collision or during ejection, another fatality could have occurred. There have already been too many! Remember that the numerous seat, harness, parachute, oxygen, radio, helmet, emergency pack and G-suit connections you have to make before flight are for your safety. One missed connection can result in no protection.

Wound Up

Pilots have been spinning Sabres for a number of years now, and only occasionally has any problem arisen. The spins have been chiefly of the textbook variety, and standard recovery has proved effective. In fact, almost any Sabre pilot will tell you of releasing the controls and letting the aircraft make its own recovery.

However there's invariably a joker in the deck, and trouble first reared its ugly head in September 1955 when a pilot spun all the way in. In this instance, however, it was established that he had "broken" the spin and then apparently over-corrected and spun off again at low level.

In 1956 three pilots ejected from spinning Sabres when they found themselves unable to recover. The evidence suggests that they attempted a number of unorthodox methods of recovery, but did not give any one method time to take effect before switching to another. At least one of the aircraft was seen to recover from its spin after the pilot ejected, and the same possibly applies to one of the other two. All three ejections came off without apparent difficulty, and safe parachute descents were made.

The year 1957 has seen a sharp increase in the incidence of such accidents; in the first quarter four aircraft and three pilots have been lost. Unfortunately a lack of eyewitnesses has obscured many details of these accidents, but investigation has shown great similarity in many of the circumstances.

First, a relatively inexperienced pilot transmitted that he was in a spin at 20,000 feet, unable to recover. At 10,000 feet he believed he was in a spiral and was ordered to eject. He was seen to eject from the spinning aircraft at low level but had failed to connect his auto-parachute release and was killed.

A month later another pilot with limited Sabre experience was ostensibly on a high level exercise when he encountered trouble. Some 45 minutes after takeoff he was heard to transmit, "In a spin! Bailing out!" Cloud at the time extended from around 7000 feet up to 19,000. He was seen momentarily as the aircraft rolled through an erect position only about 1000 feet above the treetops. The pilot ejected at this point, but failed to clear his seat (which was unmodified), and the aircraft struck the ground almost vertically.

Two days later an experienced pilot was practising spins at 35,000. He carried out a two-turn spin to the right and recovered normally. Climbing back up to 33,000 he initiated another in the same direction but this time found he could not recover. He tried several variations after holding normal recovery action for what seemed a reasonable period but all his efforts failed. Passing through 17,000 feet he jettisoned droptanks, then canopy, and finally ejected.

A fourth case has occurred since, but other more variable factors may be involved which could disqualify the case as a spin accident.

This is the record to date, and a number of conditions were common to almost all of them:

- Droptanks were installed.
- Standard spin recovery technique was not held, as far as is known.
- Most of the aircraft had an over-G record.
- Spins were entered at relatively high levels.

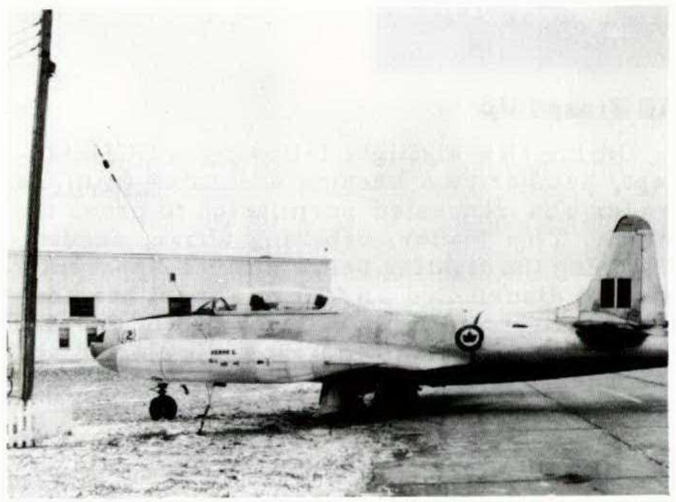
Research is continuing in an effort to determine whether there is a configuration attainable in a Sabre which could preclude a spin recovery. So far most avenues have led back to the possibility of an out-of-trim aileron condition, where the aircraft may be trimmed over in the direction opposite to rotation. As can be seen, the first three conditions listed above could all contribute to this configuration in varying degrees.

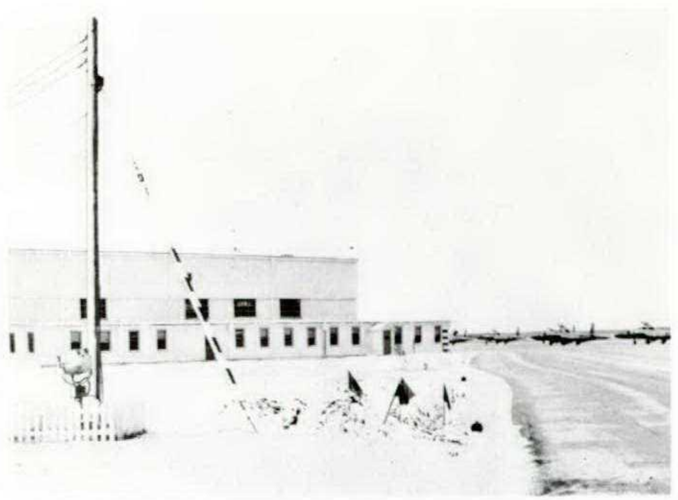
CEPE test pilots have carried out a large number of spins in the Sabre and have never had serious trouble. Readers are earnestly referred to the article by F/L J.C. Henry on page 14 of this issue.

Taxi Accident With A Twist

When aircraft are reported as having struck a cable or wire it can usually be assumed that low flying is involved. Here, however, is a case where a T-33 was being taxied in formation when the port wing tip caught a guy wire.

Supervisory staffs had not considered the wire to be a hazard until the accident, although pilots had been warned not to taxi too close to the edge of the tarmac. The photographs depict "before and after", but if pilots would remember to keep their necks on a swivel and eyeballs uncaged, much damage to equipment—as well as to reputations—could be avoided.





Failed Throttle Control

When the pilot joined the circuit and retarded his throttle, the rpm remained at 92%. Movement of the throttle resulted in no change in rpm. Because of inexperience, he next lowered his wheels and flaps at excessive speed. Then he flew a normal circuit, overshot, and returned to initial point for a long, straight-in approach, closing the high pressure cock about half a mile from the button. The landing was successful.

Technical investigation revealed that the engine throttle control torque shaft arm had slid off the engine throttle control cross-shaft. The clamping bolt, nut and split-pin were still in place. This item is not disconnected during normal inspections but is checked for security every 75 hours. Faulty daily and periodic inspections set the stage for this one. Don't be responsible for an accident. Make your inspection complete and accurate.

Illegal Parking

A recent issue of Flight Comment carried an article on the subject of airfield hazards and depicted the damage caused when aircraft strike such obstacles as ditches, mounds of earth or snow, concrete bases around drainage gills, and exposed runway lips. It now becomes necessary to add automobiles to the list. Within the past five months there have been two instances of aircraft tangling with parked cars. Aircraft, and incidentally the pilots, always come off second best in these little encounters. In this instance a car belonging to a contractor who was working on the field was parked on the edge of a taxi strip.

The student landed, turned off the runway and completed his post-landing check. When he started to taxi towards the ramp he noted a moving truck ahead of him and shortly thereafter saw the parked car. Because he did not know what the truck driver's intentions were, the student slowed his aircraft for a moment and then continued taxiing. He misjudged clearance with the result pictured.

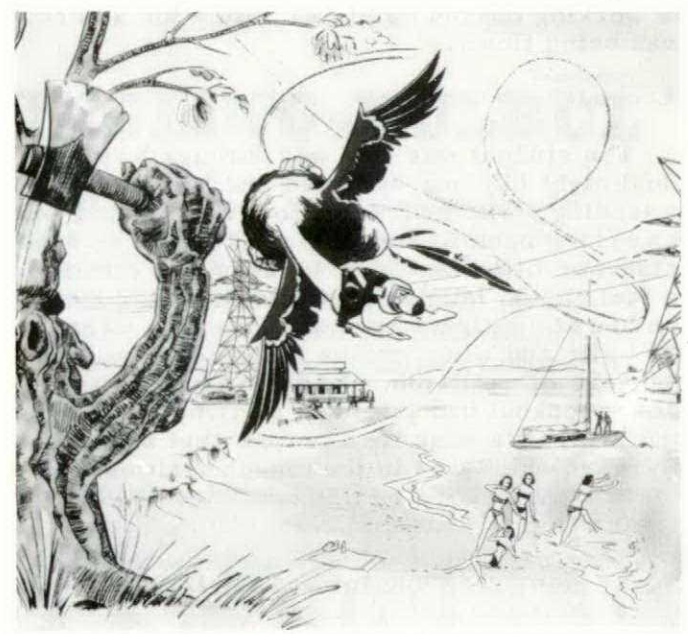
The owner of the car had been warned about illegal parking but had done nothing about it. He may be inclined to remember henceforth that a flying field is not a car park.

Periscope Depth

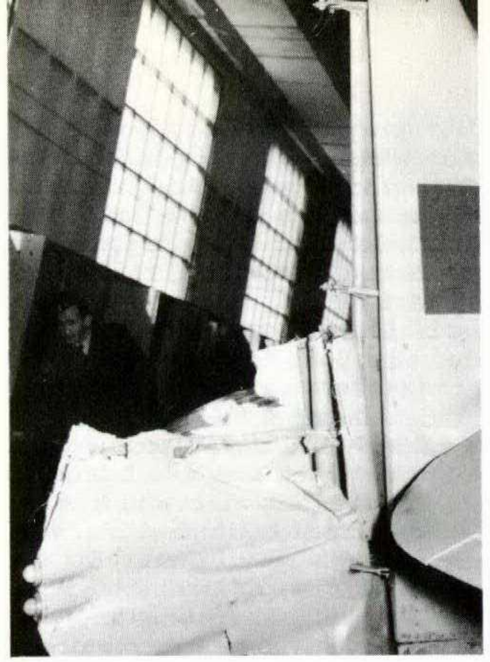
Unauthorized low flying has again taken its toll in damage to an aircraft as well as to a pilot's reputation.

With an airman as passenger the pilot put the Harvard through 30 minutes of aerobatics, after which he decided to so some low flying. What happened next he describes in these words: "Seeing an airport to the south I began diving in that direction. I passed just to the right of it at approximately 800 to 1000 feet and began a gentle turn to the right to line up with the river. The airspeed at this time was approximately 160 to 170 knots.

As I was levelling out and putting power back on, we felt a sudden jolt. At this time our altitude above the river bed immediately below us was 300 to 400 feet. We were above the level of the surrounding terrain, for when I looked off at some abandoned aircraft on the airport,



HEDGE-HOPPING THRILL-SEEKER



"The tail appeared to have a large dent in it."

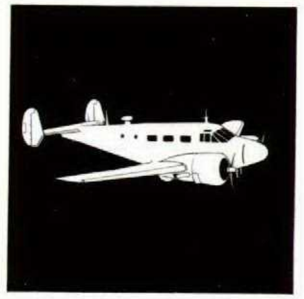
they were still below me. I noticed that my airspeed was reading erroneously and that my pitot head was gone. Looking back at the rudder, it appeared to have a large dent in it."

Let's look at the arithmetic involved, bearing in mind the pilot's claim of a 300 to 400-foot clearance. Evidence found at the scene of the accident confirms that the aircraft struck and parted the lower strand of a two-strand power line spanning the river just north of the airfield. In this locality the river flows through a gully approximately 3000 feet wide and from 200 to 250 feet deep. The power line dips into the gully and spans the river at a height of 75 or 80 feet above the surface of the water. Parts of the Harvard's rudder were found in the vicinity of the severed power line. An expert in mathematics would have no trouble at all in working out the height at which the aircraft was being flown.

Lookout

The student was half way through his third dual night flying exercise and had completed a landing. The instructor took control and was taxiing back to run-up position to give the student a little rest when he asked the latter for a fuel check, intending to have the fuel contents indicator lights turned off as they were too bright and could not be turned down. The dangers of collision, and the need for a very sharp lookout had just been pointed out when the aircraft's wing tip struck that of another Harvard which was in the run-up position. Before the instructor could shut down, the aircraft swung around and again struck the other Harvard—this time head on. Both aircraft were damaged, but fortunately the occupants were uninjured.

The fuel check while on the move at night was a mistake. It occupied the attention of both pilots at the expense of properly observing their taxi path. All lights were functioning properly, and the pilots in the aircraft which was struck saw the other Harvard as it approached but did not realize the collision danger until too late.



Emergency Lowering

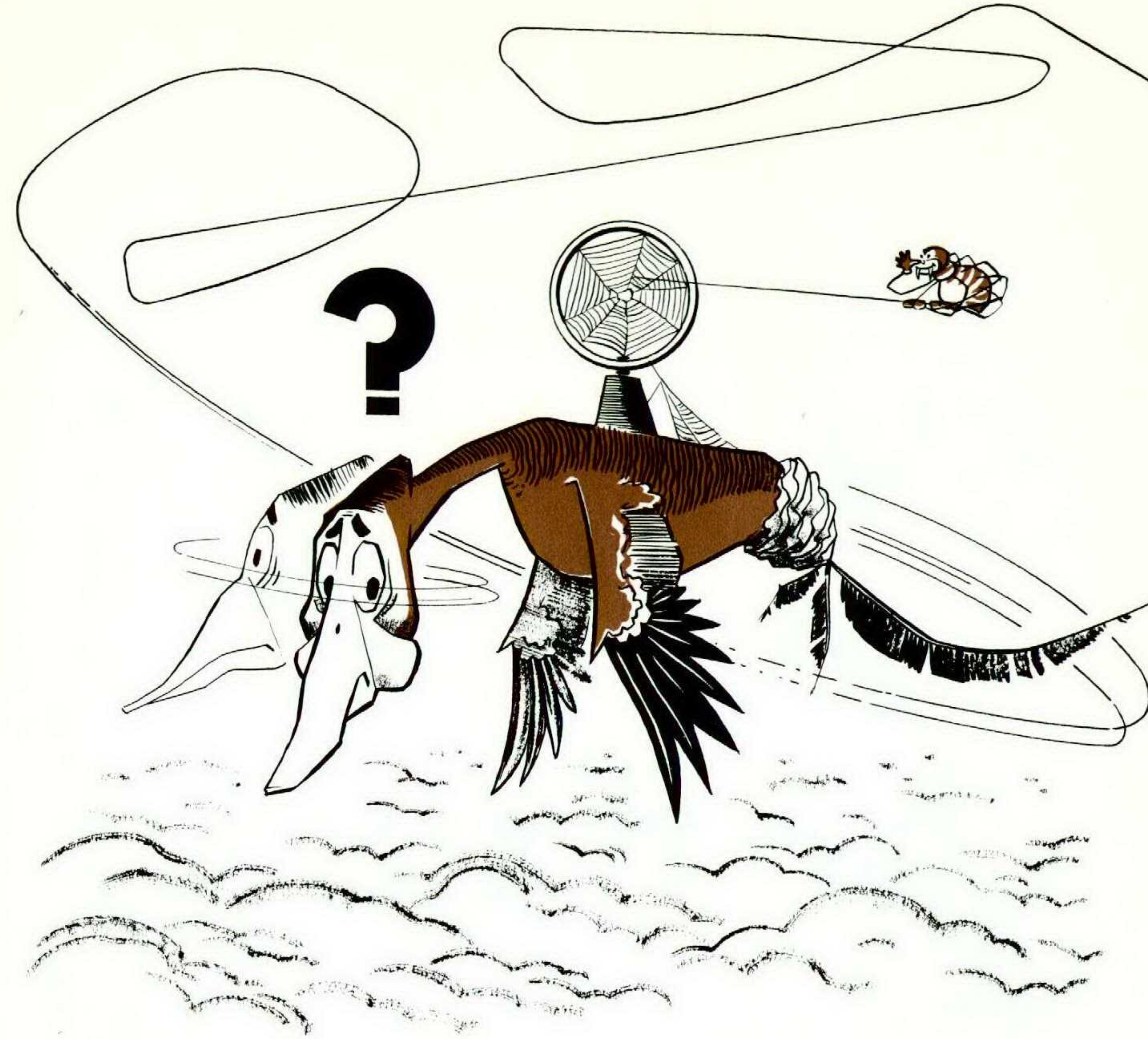
In the event of a main system failure, most aircraft are provided with an alternate means of lowering the undercarriage. Some are more complicated than others but all have one feature in common—the human operator. Unless a pilot goes through the correct motions, the result can be the same as though both systems had failed.

The pilot of the Expeditor stated that as he turned crosswind the undercarriage warning horn sounded when the throttles were retarded, so he went around again. He made several attempts to lower the undercarriage normally but the horn still sounded when the throttles were closed, and no lights—either warning or safe—came on.

An emergency lowering was tried, after which the undercarriage was retracted and the emergency lowering repeated. The horn still sounded and no lights appeared. The inspection panel was opened and the gear mechanism checked. It appeared all right to the pilot but the horn still sounded. He decided to land, and on touchdown the gear collapsed.

Tests conducted after the accident showed the undercarriage to be operating perfectly on both normal and emergency systems although the warning lights did not work until later in the tests. As no faults were found with the undercarriage operating system, the pilot was interviewed as to his emergency procedures.

He had applied an insufficient number of turns to the hand crank, which meant that the undercarriage failed to reach the geometric lock position. The pilot also failed to heed the horn warning and missed a sure way of checking for "undercarriage down and locked"—that of a visual check to see the front edge of the tire through the side windows.



BIRD-BRAINED BUNGLING-BULBUL

Or Pipio Perplexus. Is equipped for keeping track of itself but seems singularly reluctant to use these instincts. Has been lost even over normally familiar territory, flapping about in a desperate hunt for any available perching site. Often stretches endurance to or beyond the limit in preference to calling on *facilities* for help. Poor flying characteristics when "starved". A distant relative of the Clipped-Winged Wombat which, as everyone knows, flies in ever-decreasing circles. Habitat: Various strange airfields or in the "rough". Call: WHERENELLAMIAT?

BIRD WATCHERS' CORNER

DFS