FLIGHT COMMENT

ISSUED BY

DIRECTORATE OF FLIGHT SAFETY

R.C.A.F. HEADQUARTERS • OTTAWA, ONT.

MAY · JUNE · 1955

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C O N T E N T S

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OTTAWA

HI • LEVEL FLIGHT

Prepared for FLIGHT COMMENT by members of the staff of the RCAF's Central Experimental and Proving Establishment, the following feature deals with some aspects of high speed, high altitude flight in modern jet aircraft.

This article has been written to highlight a few of the problems that face pilots who are converting to high performance aircraft and to explain why it is essential for these pilots to have a thorough knowledge of the aircraft and its characteristics and an understanding of the Operating Handbook. No attempt has been made to cover the subject in complete detail as this would entail the writing of a book. However, the topics covered may help both experienced and inexperienced pilots to avert trouble when first converting to jets. Wherever possible reference will be made only to types used currently by the RCAF.

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In days recently gone by, pilots converting from one aircraft to another usually encountered the same basic flight characteristics so that the conversion of experienced pilots to new types was in most cases an informal affair. Generally the major change was in the amount of power available. For example, pilots converting from Harvards to Mustangs are probably surprised initially at the basic similarity between the flight characteristics of the two. The stall and spin characteristics, the swing on landing and takeoff, the approach, roundout and landing attitude, are similar for both.

While approaching for a landing in a conventional machine at an angle of attack of six or seven degrees, for example, the pilot may reduce power to obtain a controlled rate of descent. Increasing this angle of attack to approximately 11° results in a large increase of lift with only a correspondingly small increase in drag, and the transition is made for a normal landing.

High speed flight did not present any abnormal problems because the maximum speed obtainable was not normally sufficient to give rise to either control or drag rise problems. Present-day requirements call for fighters to reach higher altitudes and greater speeds than was previously possible with the conventional, piston engine aircraft. The power necessary to achieve these performance requirements became available with the development of gas-turbine engines. Thus, through the evolution of aircraft design, jets were introduced for military use.

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In order to attain the high subsonic speeds presently required, a modern aircraft should have fine fuselage lines, swept wings, and thin wings to delay as long as possible the effects of compressibility. On aircraft with conventional wings—the T-33 for example—drag rise occurs rapidly as the transonic region is approached. (See figure 1.) This drag rise begins at the Critical Mach Number, which is usually defined as the Mach number at which the local air flow first reaches the speed of sound at some point on the wing surface. The critical Mach number, which will vary from one airfoil section to another, depends upon the thickness chord ratio, the position of maximum thickness, and the camber. It will be higher for thin wings and for those with their maximum thickness placed fairly well back. The critical Mach number of an aircraft can also be increased by the incorporation of sweep-back or very low aspect ratio wings. Figure 1 illustrates the effect of sweep-back on the variation of drag coefficient with Mach number. These methods of increasing the critical Mach number—or delaying the occurrence of drag rise, are necessary to attain high speed flight but give rise to undesirable low speed flight characteristics.

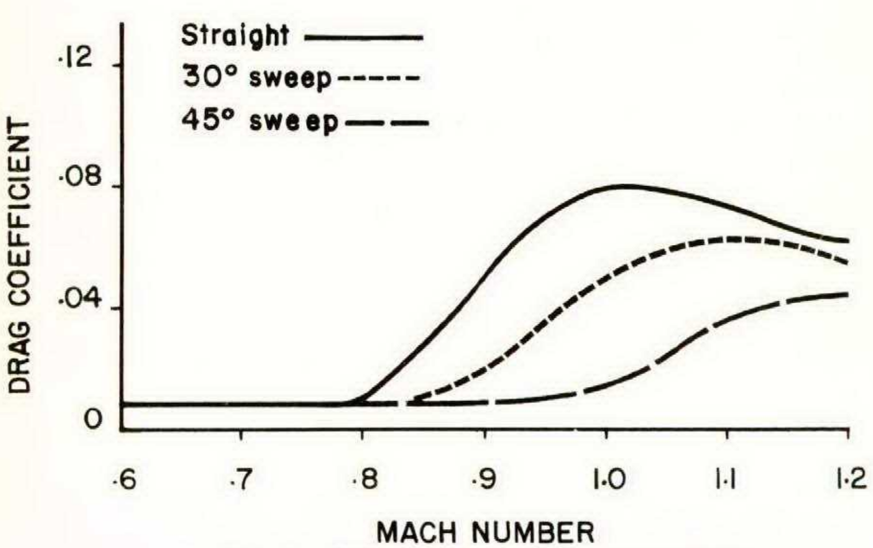

Fig. 1 - Effect of sweep-back on variation of drag coefficient with Mach number.

Swept wing aircraft do not generally possess good stalling characteristics. They have a tendency towards tip stall, with an associated decrease in lateral control. (See figure 2.) This phenomenon may be somewhat alleviated by the installation of boundary layer fences as, for example, on the Sabre V. Wing twist, or washout, may be used to give a lower angle of attack at the tips, or the airfoil section may be varied judiciously along the wing,

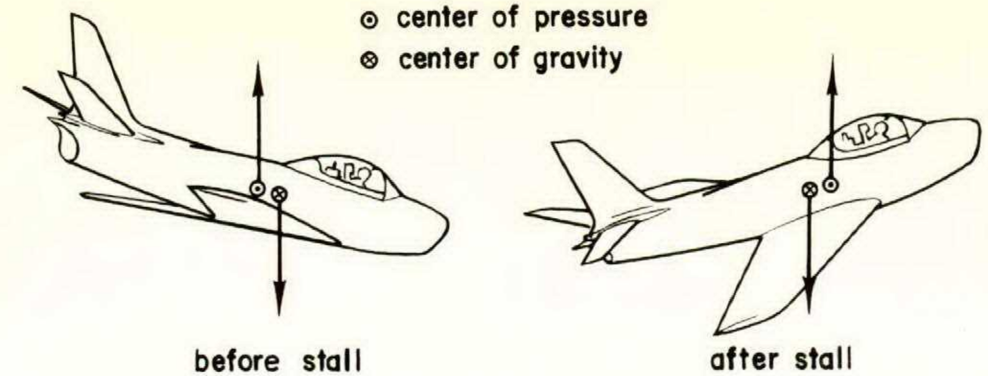

Fig. 2 - Effect of sweep-back on aircraft's stall characteristics.

using a section at the tip where there is a high maximum lift coefficient, a large range of angle of attack between zero and maximum lift, and a gradual stall pattern. Spoilers or stall strips are sometimes installed inboard in order to force the wing roots to stall first. It should be noted that stalling of the tips before the wing roots can produce undesirable effects because the centre of pressure will move forward due to the loss of lift on the after part of the wing. Depending on the position of the centre of pressure relative to the centre of gravity, the aircraft may pitch either up or down at the stall and suddenly go into a flick or inverted flight.

Thin wings, common to all high speed aircraft, are desirable from a drag and critical (or limiting) Mach number point of view. As figure 3 indicates, the Sabre wing root airfoil section has a pronounced dip in its drag coefficient curve over a small range of lift coefficient at low values of lift coefficient—i.e. at high speeds. This dip shows up clearly when compared with the drag coefficient curve of the airfoil section of a Harvard wing. However, although the drag coefficient is considerably less, so is the lift coefficient for a given angle of attack, as shown in figure 4. Thus, in order that the same lift at a given weight and airspeed may be attained, a higher angle of attack must be used.

Another undesirable characteristic of thin wings or airfoils is shown in figure 4. At an angle of attack of approximately 15° the thin airfoil stalls. As its angle of attack is further increased, its lift decreases much more rapidly as compared to the stall characteristics of the Harvard wing section. This results in a more violent stall, because the flow breaks away very quickly from the wing surface and provides less warning as the stall is approached.

Although we have been discussing airfoil

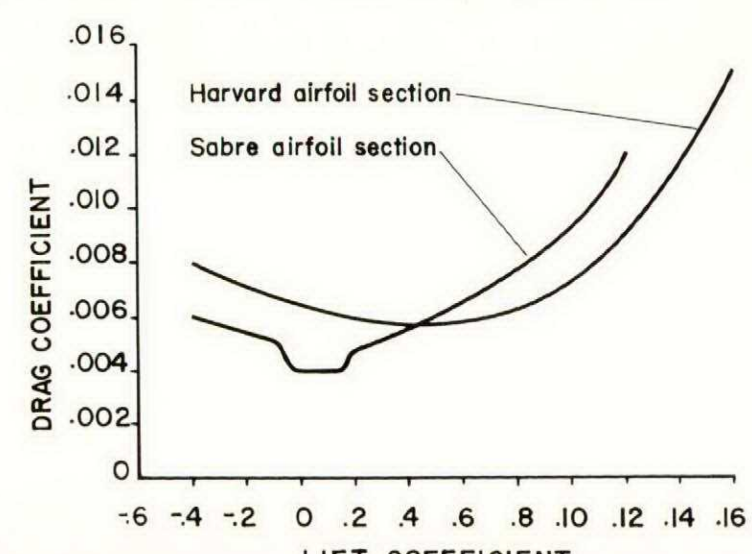

Fig. 3 - Typical airfoil drag polar curves.

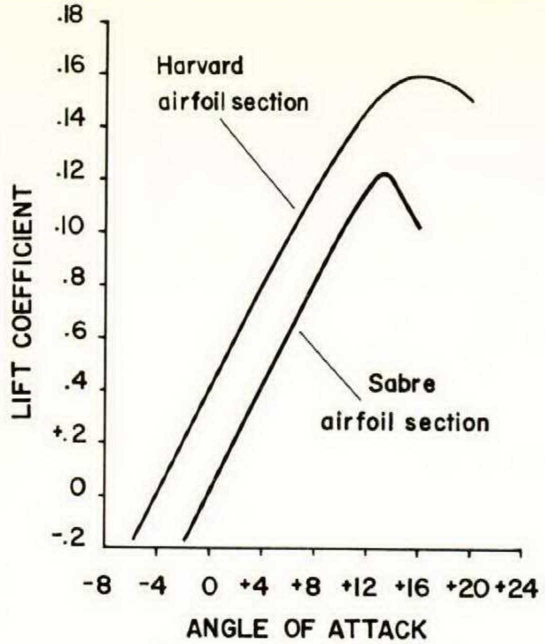

Fig.4 - Typical airfoil lift coefficient characteristics.

sections, the same argument is generally applicable to aircraft wings as a whole. However, we have yet to consider some additional problems created by swept-back, low aspect ratio, high speed wings. Wing sweep increases the critical Mach number but the structural and aerodynamic problems of the wing as a whole are more complicated. Low aspect ratios increase the drag in the lower speed regions but this effect becomes almost negligible at high speeds. Thin wings result in an increased critical Mach number but the structural and stowage problems are vastly complicated.

When landing a jet aircraft—at an angle of attack of, say, 14°—the pilot will notice that when he reduces power there is the same high rate of sink that he would experience with a conventional piston engine aircraft. If the angle of attack is further increased—to, say, 20 degrees—there will be a small rise in lift and a large rise in drag. As a result the airspeed will drop off and the rate of sink will increase so that the pilot must ease the stick forward and shove on power to maintain control. However, slow acceleration or response is a basic trait in all jet engines; and the pilot who is not intimately familiar with such a characteristic may find himself in serious difficulties if he allows an excessive rate of sink on the approach, and yet expects to have an immediate response when an emergency crops up. This slow engine response, coupled with a high rate of sink, forms the basic reason why so many pilots inadvertently land short of the runway or have a rough time getting down.

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The preceding has been a brief, general discussion of the subject. The points dealt with are not necessarily applicable to all high speed aircraft as there are many other factors involved—fuselage effects, downwash, ground effect, angle of sweep, manoeuvre boundary and manoeuvre margin, to name a few. The intent of this article has been to point out that the conversion to high speed jet aircraft does give the pilot more to think about than conversion from one conventional to another. Before checking out in a high performance aeroplane, a pilot should learn all he can about its aerodynamic and stalling characteristics, its performance and handling qualities, engine characteristics, and limitations. Unless he has a sound knowledge along these lines, flying that aircraft is only asking for trouble. When he is satisfied he knows his machine he should prove to himself in the air what he has learned on the ground.

COMPRESSIBILITY EFFECTS

Next we come to a few hints which should be of help to the pilot who is checking out on a high performance aeroplane for the first time.

- Drag Rise - The drag rise has a limiting effect on the level flight and range performance of jet aircraft. The wing specifications—e.g. sweep-back and thickness/chord ratio—and the thrust available are important factors governing high speed performance. It is interesting to note that the thrust required to raise the speed of the Meteor to 626 mph is double what the aircraft needed to attain its world speed record of 616 mph.

- Longitudinal Trim Changes - Trim changes, sometimes sudden and violent, are often experienced in the transonic region. These changes may be either nose up or down, depending upon the aircraft, and are particularly dangerous when they occur in dives and pullouts. Trim change problems led to the development of power controls and movable tailplanes. Once a trim change occurs, it is advisable not to trim out the change but to hold the force manually. The Vampire has a definite longitudinal trim change as the critical Mach number is reached, first nose up and then down, abruptly accompanied by a sharp wing drop.

- Manoeuvre Margin - Stick force per G usually increases with Mach number, due to a reduction of tailplane effectiveness. Thus it may be difficult to pull the aircraft out of a high speed dive, particularly if a nose down trim change has occurred. Due to reduced damping, the stick force per G usually decreases with increasing altitude.

- Reduction in C_L Max with Mach Number - This effect is particularly serious at altitude because of the low indicated airspeeds required to attain high Mach numbers. Thus, depending upon the Mach number and wing loading, a G stall may be caused by gusts or very mild manoeuvres. In general, at high altitudes, a G stall will usually occur before the structural limitations of the aircraft are exceeded.

- Wing Dropping and Lateral Trim Changes - Wing dropping usually occurs on most high speed aircraft at or near the limiting Mach number, and may vary from a gentle change of lateral trim—as in the Sabre—to a wing drop violent enough to put the aircraft on its back—as in some marks of the Meteor. On most aircraft, excluding the Sabre, the ailerons are usually ineffective in picking up the wing. Wing dropping is often the limiting factor of control in compressibility.

- Buffeting - Most aircraft begin to buffet when the limiting Mach number is reached. This buffeting, which may be associated with the wing, tail or control surfaces, can be classed as moderate to heavy and will probably be uncomfortable when first encountered.

- Control Effects - When operating at high speeds, a number of compressibility effects may be felt through the aircraft controls—sensations like aileron buzz or snatching, control heaviness or overbalancing. These effects may be minimized or overcome by the use of irreversible power control systems.

- Lateral and Directional Oscillations - Moderately rapid oscillations of the rudder resulting in "snaking" may be experienced on many high speed types. A lateral oscillation or "Dutch roll" may occur on aircraft which have a large rolling moment due to sideslip. In the T-33 this effect is most noticeable at high altitudes.

- Longitudinal Oscillations - Severe, short period, longitudinal oscillations (or "porpoising") involving high positive and negative "G" may occur at high speeds. Recovery is effected by reducing speed, which can be done by using speed brakes, retarding the throttle or simply easing back on the stick.

* *

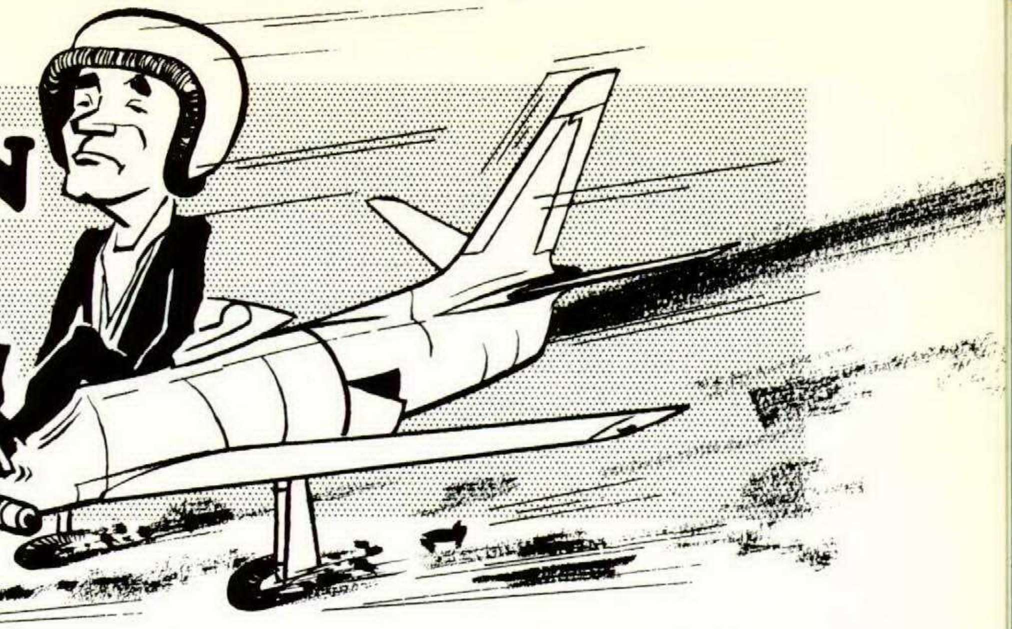
When converting to high speed aircraft, pilots should first be familiarized with the effects of high altitude on their performance. The following points appertain generally:

- Mach number, corresponding to a given IAS, increases with altitude.
- Stick force per "G" decreases with altitude.
- Aircraft manoeuverability and stability decrease with altitude.
- When subjected to high "G", the aircraft will usually stall before structural damage occurs.

In short, if control difficulties are encountered at high speeds at high altitudes, it is advisable to reduce speed by using the speed brakes first. At lower altitudes it is usually best to throttle back and then use the speed brakes.

ACCIDENT REPORTS - We have a request to make of unit photographers. As you well know, a magazine without pictures is heavy going. While some D14s from the field are accompanied by photographs taken by veritable Karshs—big, sharp and clear, with excellent detail—others come in with no shots at all. Remember that the next man may learn something from those pictures. The staff of FLIGHT COMMENT would be grateful for such help from the field.—ED.

UNEVEN WEAR



FROM CANADAIR comes a report which will be of interest to Sabre pilots. Service experience has revealed cases where the main landing gear brakes have little or no lining left on the disc remote from the wheel—that is, the disc next to the pressure plate. The linings show progressively less wear from inboard to outboard of the brake assembly, the outboard lining indicating very little deterioration. The uneven wear has been attributed to three factors:

- The condition may occur if the pilot
  - Unconsciously rests his toe on the brake pedal while taxiing
  - Uses light touches with his toe rather than a firm, intermittent pressure on the brake pedal
  - Steers with the brakes instead of using nose wheel steering.
- A damaged Aeroquip brake line quick-disconnect fitting may cause a restricted flow of fluid when the brakes are released.
  - Improper use of the wheel retaining nut wrench, during removal and installation of a wheel, can damage the disconnect and cause improper seating when the two halves of the disconnect assembly are again joined together.
- Too low a setting on the automatic adjuster pin friction blocks, causing dragging brakes.
  - When the friction is too low there is insufficient clearance between the stator and rotor plates of the brake assembly.

The Directorate of Maintenance Engineering has confirmed that, when brake linings have worn unevenly, it is permissible to replace the worn stator plates as required without replacing the unworn plates.

DECELERATE IN COMFORT

"The instructor did not have his safety harness locked and he suffered two broken vertebrae. The student, who did have his harness locked, suffered only minor bruises."

Extracted from a report on the crash landing of a T-33, this is typical of the many statements on file at DFS attesting to the importance of using one's safety harness properly. In many cases, serious injuries have been inflicted needlessly because of downright negligence on the part of aircrew. Safety harnesses are provided for a definite purpose. Why are they so often ignored?

- Because pilots have too much confidence in their ability?
- Because pilots have too much confidence in their aircraft?
- Because the harness is a "sissy" device?
- Because the harness is uncomfortable?
- Because pilots have no confidence in the harness?

Let's review some of these questions. First, the one about confidence—or is it that old "it-can't-happen-to-me" attitude? Every time a pilot gets into an aeroplane he does so with the intention of landing it safely at the end of the trip. On practically all occasions he does exactly that. However, sometimes things go wrong—like having an engine failure and a forced landing. Pilots have also flown into the ground during instrument approaches. Or perhaps a tire will burst on landing, causing an undercarriage to collapse. These accidents can happen and do happen. And each one will cause such violent deceleration that, unless the pilot is properly restrained in his seat, he stands an excellent chance of suffering severe injury—or of killing himself.

What about the "sissy" attitude? Aircrew and groundcrew have been seen to leave the harness off on occasions. Apparently such bravado is intended to show that the harness is strictly for those who are afraid of what might happen. Perhaps this apprehension angle could be employed more effectively to convince aircrew personnel of the stupid risk that a man takes when he refuses to use the protection of his safety harness.

Is the harness uncomfortable? If so, does it have to be? There are different ways of tackling this problem. First, take your time in getting strapped in. Make sure the harness is properly adjusted; if it isn't, adjust it so that it does fit properly. In some aircraft such as the Sabre, Expeditor and Mitchell, a standard lap strap is used in conjunction with shoulder straps. As a safety feature it is satisfactory, but as a neat installation it leaves much to be desired. Units have the right to make comments on any unsatisfactory condition by means of the UCR (Unsatisfactory Condition Report); and they may also make recommendations for an alternative harness.

The T-33 and Harvard aircraft probably have the most desirable harness available. It is a type in which the shoulder straps are essential to effect complete and comfortable fastening. Insofar as efficiency is concerned, all pilot harnesses or lap straps are built to withstand a maximum strain of about 20 G deceleration. If deceleration greater than this occurs, other damage to the airframe usually overrides the safety factor of a properly attached harness. However, the human body can stand considerably in excess of 20 G for short periods so that, with his harness on, a pilot is infinitely safer in a crash landing than without it.

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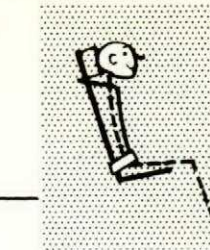
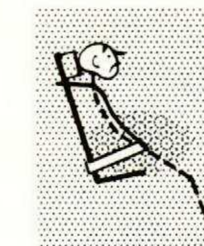
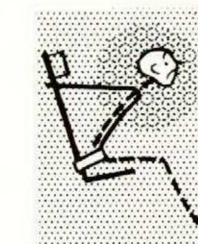


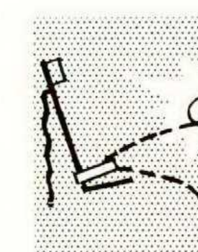
Snug lap strap.
Locked shoulder strap.



Loose lap strap.



Shoulder strap unlocked.



No shoulder strap.

Now for a few additional thoughts on safety harnesses. On the shoulder type harness, a lock is provided to restrict forward movement if rapid deceleration occurs. With the harness unlocked, serious injury can occur; with it locked, the chances of injury are greatly reduced. There are some considerations to be given to the best use of the lap and shoulder strap combination. Because the C of G of the body is near the hips, it is essential that the lap strap be pulled down snugly. This precaution will prevent any force on the shoulder straps from pulling the lap strap up the body. It is conceivable that in extreme cases the lap strap might be lifted high enough to allow the lower part of the trunk to slide forward. A snug lap strap will prevent this. Many pilots of Expeditors and Mitchells never wear their shoulder straps, probably for one of the four reasons mentioned earlier—none of which can be justified. Let's not just be half safe!

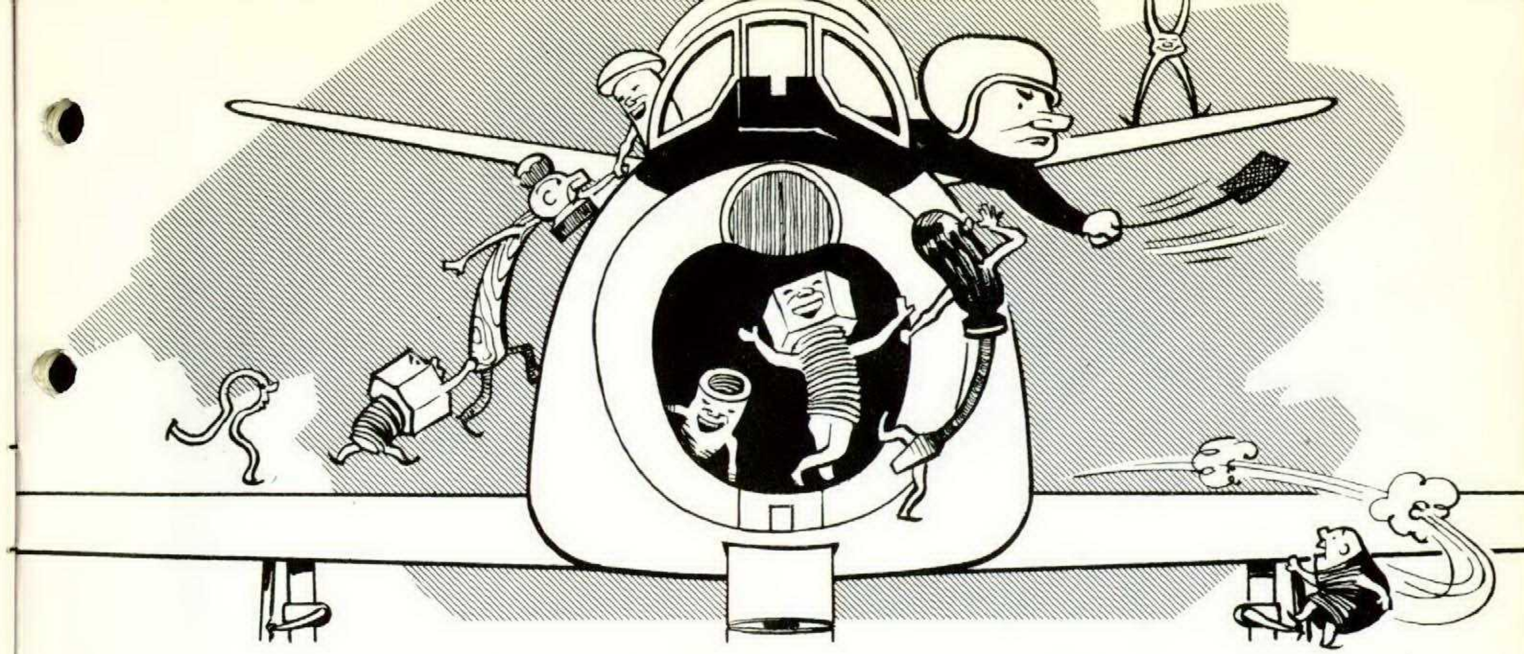
So far we have dealt only with the pilot's harness. The same instructions apply for passengers. Captains should insist that all crew members and passengers keep their harnesses fastened. Did you notice the photograph appearing with this article? It shows the remains of an Expeditor which flew into the ground in bad weather. One of the occupants suffered a broken leg, but the others received only minor injuries. THEIR HARNESSES WERE ALL FASTENED.

KEEP THE "SAFETY" IN SAFETY HARNESS

KEEP IT FASTENED

SPILLED GASOLINE - Do you know that a single gallon of gasoline spilled on a concrete surface will cover from 30 to 40 square feet, and that if a spill of that size is ignited it's about all a man with a 15-pound CO2 bottle can control? Five gallons of gasoline makes a spill of nearly 130 square feet, and if ignited, 2 or 3 men each with a 15-pound CO2 will have a battle on their hands that they won't forget—they may wish they had several hundred pounds of CO2. Don't underestimate the danger of spilled gasoline just because extinguishers are at hand. Spilled gasoline means you may have a helluva hot, fast battle on your hands—and you may lose.

—Flight Safety Foundation—

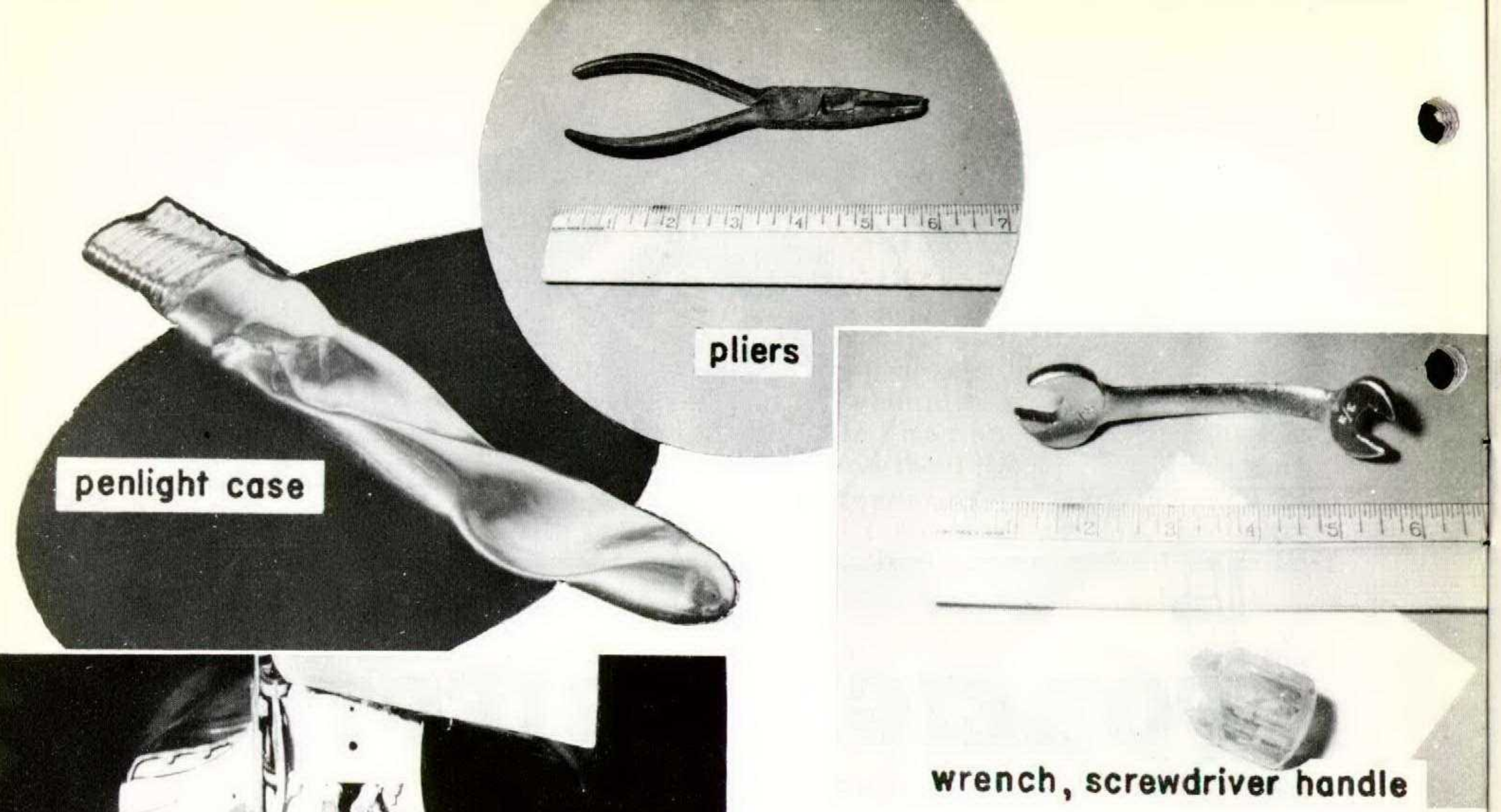


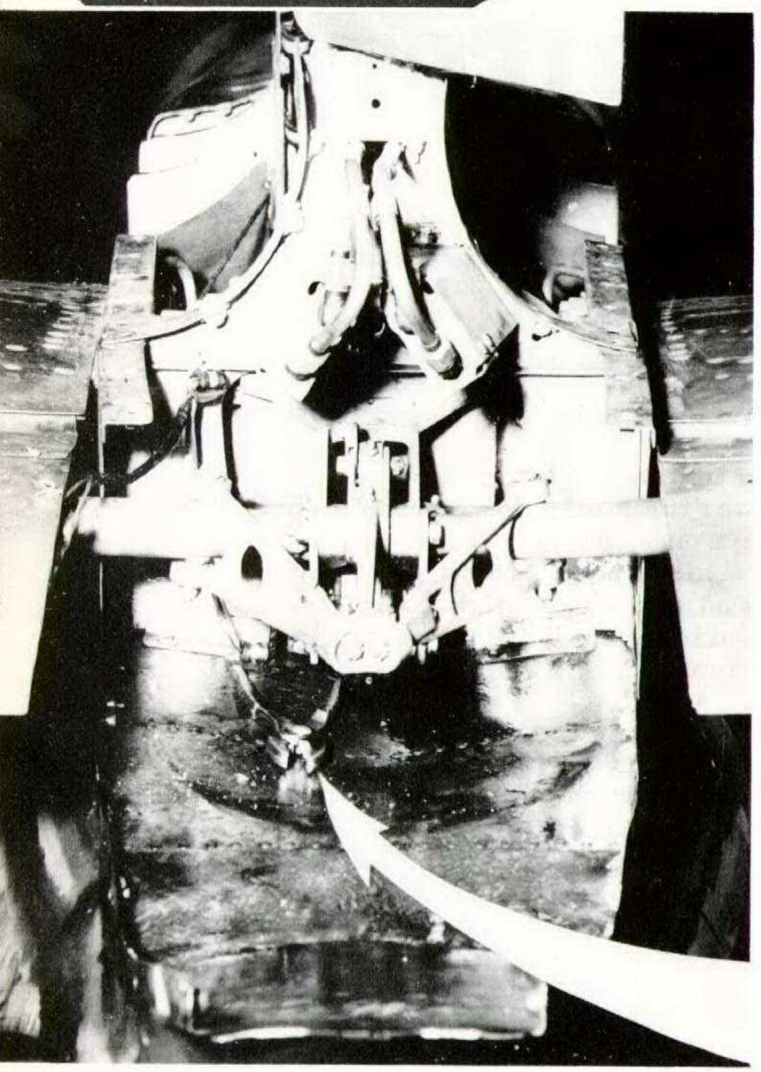
FOREIGN OBJECTS

The presence of loose objects, dirt and debris in aeroplanes is not a new phenomenon. It is a condition that has been with us as long as the aircraft itself. Doubtless you have heard some old timer tell an amusing tale of an inverted flying manoeuvre that brought a hail of wrenches and assorted hardware clattering about the coupe top around his head. The situation is no longer amusing. High altitude, high performance aircraft are here to stay; and as their complexities increase there is less and less room for extraneous junk.

Cases of controls jammed by foreign objects in older type aircraft are well known. However, these slower machines were often forgiving, and the pilot usually managed to regain control. Other instances of jamming resulted in crashes. Today's high speed aircraft present quite a different picture. The speeds involved are so great that time for correction, should anything go wrong, is dangerously reduced. Air loads alone are sufficient to render correction difficult to the point of impossibility.

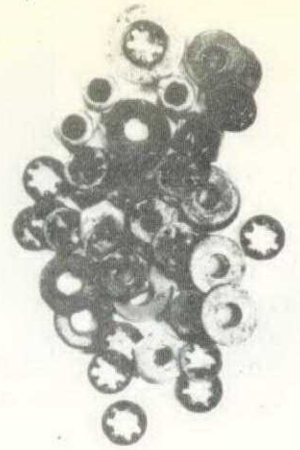
Much has been published on the subject of foreign objects by the USAF, the RAF, and commercial air lines; but, despite repeated reminders of the potential consequences of dirty aircraft, wide varieties of odds and ends continue to be found. When items like those pictured here are found in crash wreckage, an immediate question mark is introduced. Disintegration is usually so complete as to render proof elusive. But could that wrench or these pliers or this pen-flashlight case, or that screwdriver have become jammed in some vital control area? Could one of them thereby throw an aircraft out of control, finishing it off along with its pilot?

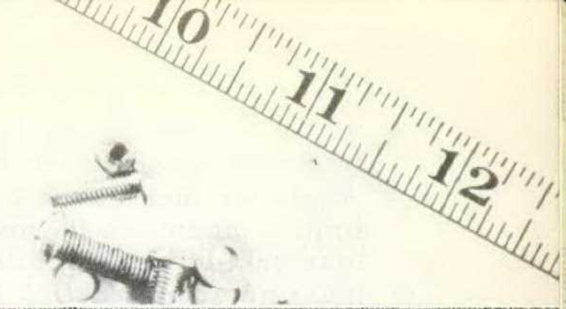


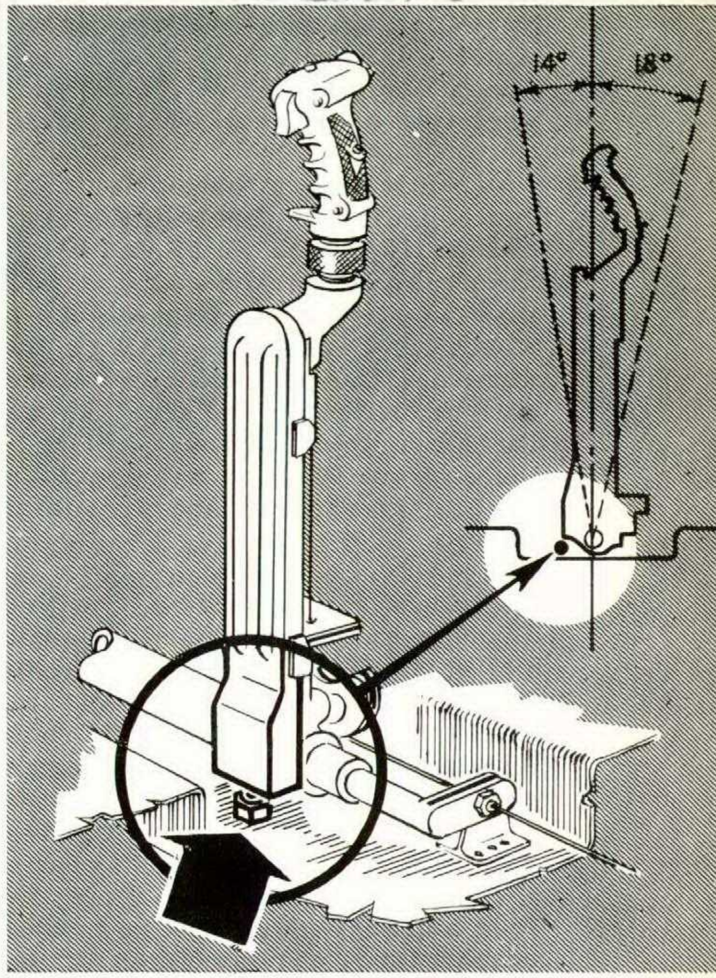


Early in 1954 an incident involving jammed elevator controls in a Sabre touched off an aircraft inspection which brought to light a host of foreign objects in countless aircraft. The situation was serious enough to call for the publication of a special A.I. BRIEF in May of 1954. Readers will recall that the BRIEF depicted what was found in one of the inspected aircraft. Needless to report, the owner of those pliers has never called for them.

A second A.I. BRIEF on a similar subject appeared last August. In the report cited, no accident occurred. The pilot, luckily, was able to land his Canuck and report the control restriction. Investigation disclosed that a hydraulic line blanking plug had jammed between the control column and the cockpit sub-floor, dangerously restricting forward movement of the control column.







Inspections, to be of any value, must be thorough. The objects shown here were removed from two Sabres soon after their arrival at an overseas base. Prior to the long ferry flight these aircraft had actually been inspected in accordance with EO 05-5C-5/60 for the presence of foreign objects!

In the accompanying photo we present the items that dodged the "inspection":

- A screwdriver that had secreted itself under the cockpit flooring below the aileron bell crank
- Miscellaneous hardware that showed up in the port radio bay of the same aircraft
- More junk that was removed from the port radio bay of the second aircraft.

When is an inspection not an inspection? It's a good question. That this situation could exist in aircraft which had undergone "inspection" for the purpose of uncovering foreign objects is a serious matter. One explanation might be carelessness—to the point of negligence. Another might be ignorance of where to look and how to go about locating debris. Whatever the reason for overlooking the presence of foreign material, improvements in the methods of inspection are badly needed. The careless should be disciplined; and those who aren't doing the job properly must be educated. A healthy step in the right direction has been taken by manufacturers who have instituted a system of poster presentations illustrating the need for ensuring that nothing is left in an aircraft that doesn't belong there, and punching home the consequences angle by depicting crashes in which foreign objects were discovered.

While the situation is doubtless improving, a report received recently indicates that vigilance cannot be relaxed. A pilot was preparing to test fly a T-33 which had been in repair squadron on a P200. Finding the port aileron to be short in up travel he looked further and noticed that the aileron counterweight—number three from the port wing flap—was hitting something under the skin of the mainplane, causing it to dimple. The port aileron was removed and a turnbuckle barrel (aileron type) with one end taped up was found to be resting where number three counterweight was hitting. The aileron had not been removed on the current P200 or any previous inspection. The turnbuckle was not a part of the aircraft and presumably had been left there by the manufacturer.

So far we have dealt with items of comparatively large size. Trouble has been caused as well by the shorting of electrical switches and contacts in jet aircraft through the presence of small washers, bolts, nuts and bits of scrap metal. Many cases of runaway trim have been traced to just such an origin. Careful inspections disclosed similar garbage in many other aircraft. Thorough cleaning of the aircraft and insulation of the trim terminals eliminated the trouble.

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The seriousness of this problem of "dirty" aircraft can not be overemphasized, especially as it applies to jet types; and it is a logical assumption that the inherent danger will increase as aircraft speeds and complexities themselves increase. Eternal vigilance being the price of safety we can all do our share by remembering to:

- Pick up tools and equipment when the job is done.
- See that nothing drops from our pockets into the aircraft.
- Clean aircraft regularly, particularly moving parts.

KEEP THEM CLEAN—KEEP THEM SAFE
KEEP THEM FLYING

MITCHELL ENGINE FAILURES

A communication from Training Command cites two interesting Near Miss experiences arising from engine failures in two Mitchell aircraft. Fortunately the Mitchells landed safely although the pilots employed distinctly different methods in handling the emergency. As you read these reports ask yourself, "What would I do in a similar emergency?" "Am I fully acquainted with all the procedures laid down for emergency use?"

Mitchell one was being ferried at night, the pilot operating under IFR conditions at an altitude of 7000 feet. The engines were at cruising settings of 28" mp, 1800 rpm—in lean mixture. Temperatures and pressures checked normally right up until the incident occurred, the last check having been completed approximately 30 seconds before the engine failed.

Just as the pilot was about to establish radio contact with the next reporting point, an explosion shook the aircraft as violently as if it had collided with some obstacle. The port throttle was kicked to the fully closed position. When the pilot set his mixture controls to full rich and made a power check, the throttle kicked back again, so he left it closed. By now the oil pressure was fluctuating rapidly and the port engine was on fire. Immediately the pilot feathered his propeller by the normal method: throttle closed, pitch coarse, mixture to idle cut-off, switch off, feather, gas off. Three to five seconds after feathering, the fire blew out, so the extinguisher was not used. The pilot informed his nearest control point of the emergency and was given an unrestricted letdown on the range. Breaking cloud at 2000 feet he managed a safe, single engine landing on the aerodrome.

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Mitchell two was also on an IFR flight. The pilot had just levelled out at his assigned altitude of 8000 feet when he heard a muffled explosion which was followed by a rapid closure of the starboard throttle. A hurried cockpit check revealed no noticeable malfunction. The throttle was then advanced slowly and when it reached 20" mp and 2200 rpm it closed simultaneously with an explosion in the carburettor air intake scoop. Three times the pilot repeated this procedure—and three times he caused explosions of such force that they buckled the cowling in the carburettor area. Rather than risk severe engine damage, controls were set to gain best engine performance at 18" mp and 2200 rpm and the pilot kept a close check on all temperatures and pressures. The good engine was set up for single engine performance.

When the pilot began encountering intermittent instrument conditions he cancelled IFR and tried to maintain VFR in the descent. Ceiling in the area was reported as "800 to 1000 feet, broken to overcast". After levelling out below the cloud base he was unable to maintain altitude with maximum power settings and selected a field for a forced landing. However, at 800 feet above ground he feathered the propeller of the unserviceable engine and this action enabled the aircraft to remain airborne with little or no trouble. The pilot eventually landed the Mitchell at an aerodrome without further complications.

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There you have the two situations. Obviously the first pilot behaved in exemplary fashion. It is difficult to conceive the second man committing more blunders than he did:

- He neglected to feather the propeller on the bad engine as soon as trouble developed.
- He did not attempt to maintain altitude.
- He omitted to request an emergency letdown procedure.
- He cancelled his IFR flight plan under adverse weather conditions and tried to continue VFR.

As a result of this combination of errors, he almost failed to reach his selected airport. At the last minute he saved himself from disaster by deciding to feather the propeller on the bad engine.

From a flight safety standpoint there is plenty for us to think about here—plenty for us to learn from these two "Near Misses". Picture the conditions yourself and reflect on what your own reactions would have been. Lastly, ask yourself this question about every tight spot you can imagine getting into: "HOW MUCH DO I REALLY KNOW ABOUT EMERGENCY PROCEDURES?"

Experience is the best teacher
If the lessons learned are applied

CO-PILOT'S LAMENT

I'm the co-pilot, I sit on the right;
I'm not important, just part of the flight.
I never talk back lest I have regrets,
But I have to remember what the pilot forgets.
I make out the flight plans, study the weather,
Pull up the gear and stand by to feather;
Fill out the forms and do the reporting,
And fly the old crate when the pilot's a-courting.
I take the readings, adjust the power,
Handle the flags and call the tower;
Find out position on the darkest of nights
And do all the bookwork without any lights.
I call for my pilot and buy him cokes,
I always laugh at his corny jokes;
And once in awhile, when his landings are rusty,
I'm right on the spot with a "Gawd but its gusty."
All in all I'm a general stooge
As I sit on the right of the man I call "Scrooge".
I guess you think that is past understanding—
But maybe someday he'll give me a landing.

ATC Monthly Newsletter

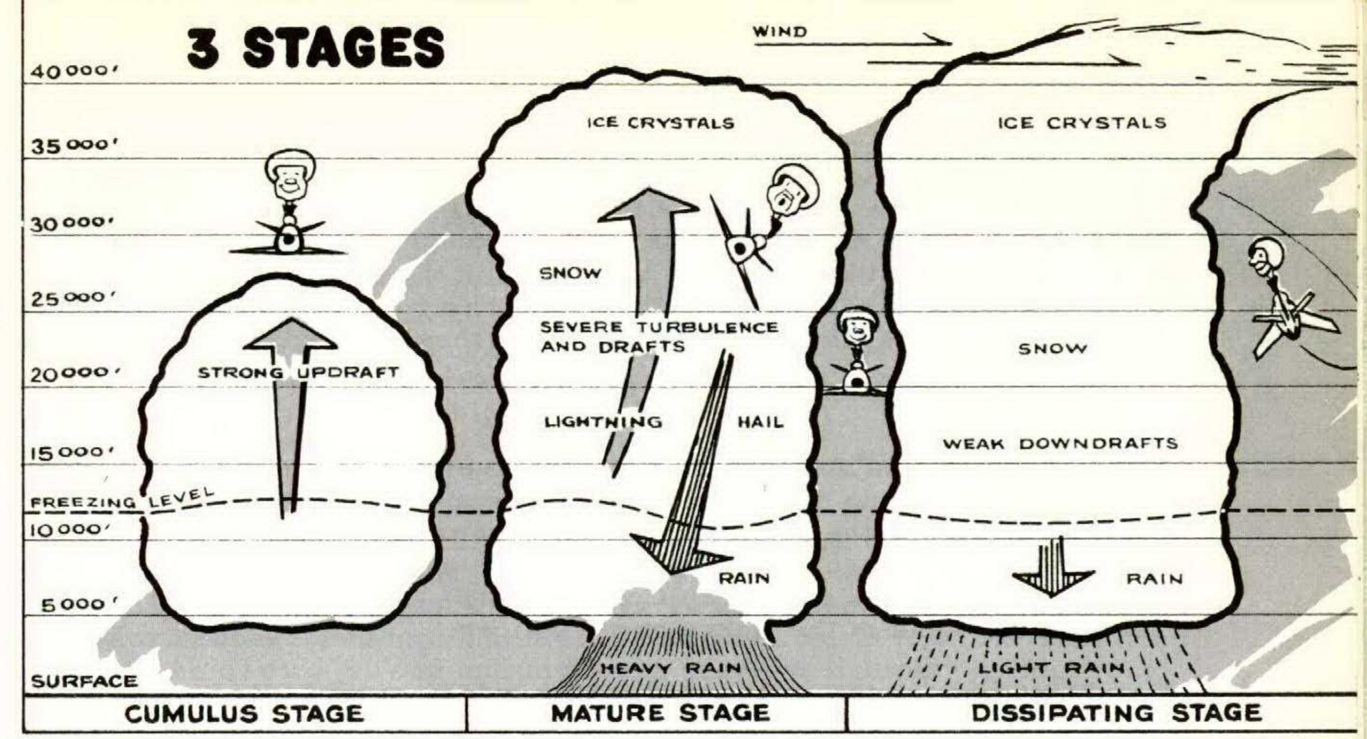
DON'T GET MAD—FIND OUT WHY

One of the principal aims of the Flight Safety Foundation is to combat complacency, whether present in crews, mechanics or management. In the past three weeks cases have been reported where the captain or co-pilot spent a large part of his flight time while flying on busy airways reading manuals, magazines or newspapers. Other reports have come in of all crew members eating at the same time, failure to use check-lists, coffee served in climb. The immediate reaction is one of frustration, anger, disciplinary measures. But this is not the reaction that leads to a remedy. These examples of complacency may be symptomatic of something far deeper. WHY are people complacent? A physician looks at symptoms objectively. He does not get angry; he tries to find the underlying cause. In aviation it might be that an educational program is weak, that morale is bad, safety suggestions are unacknowledged, that training is inadequate, or cockpit management is not properly stressed. Management may be more to blame than the employee.

Flight Safety Foundation

Thunderstorms

by G.L. PINCOCK
Senior Meteorological Officer
RCAF Station Rockcliffe



THE THUNDERSTORM is one of nature's most spectacular displays of power, exceeded only in concentrated force by the tornado. A recent estimate indicates that a single air mass thunderstorm releases energy exceeding that of ten atomic bombs. In the case of the thunderstorm of course, the energy is released over a period of about an hour rather than in one instantaneous burst.

*

Thunderstorms have always presented a hazard to those who fly. As early as 1843 an American Balloonist, John Wise, was sucked up into a thundercloud while on a crosscountry flight. The following is a quotation from his account of what happened:

> "I found myself whirling upward with a fearful rapidity, the balloon gyrating and the car describing a large circle in the cloud."

That the flight ended without Wise losing his life is probably the most remarkable part of this happening. While in the thundercloud, incidentally, he experienced both icing conditions and hail.

Thunderstorms are still a threat to safe flight, as is borne out by a study of recent accident investigation reports released by the Civil Aeronautics Board in the United States. Three of the reports clearly illustrate this hazard. In one case an aircraft was forced to the ground in a strong downdraft; in another there was failure of a wing caused by turbulence; and in the third case—because of gusty and variable winds, and aircraft lost airpseed rapidly just after takeoff and settled to the ground. Hail can be dangerous. Flying between Killaloe and Ottawa at

20,000 feet during the summer of 1954, a T-33 suffered considerable damage from hail as can be seen in the photograph on this page. Despite the hazards, flight planning through thunderstorm activity areas is a standard part of summer flying activities in the RCAF. It is therefore imperative that aircrew understand what they are up against and that they learn how they themselves can reduce these hazards to a minimum.

*

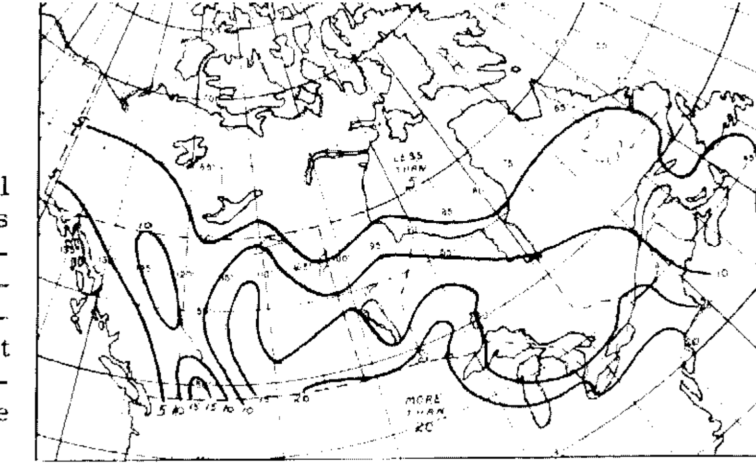
The accompanying map shows the average frequency of thunderstorms over Canada during the summer months. The Arctic regions, Newfoundland and the Pacific coast have comparatively few; the areas of maximum frequency are southwestern Ontario, the southern prairies, the interior regions of British Columbia and—worst of all—the stretch between the Head of the Lakes and Winnipeg.

Most of our current knowledge of thunderstorms is the result of the "Thunderstorm Project" which was conducted jointly by four U.S. government agencies immediately following World War II. Ten P-61C Black Widow pursuit aircraft, equipped with special instruments, carried out more than 1,300 penetrations of thunderstorm areas during the two-year operation, and examined all flight levels up to 25,000 feet. Florida was the site of the project during the first year, Ohio in the second.

*

Although hail, lightning and icing conditions are all hazards, the most serious dangers in thunderstorm flying are those due to turbulence. While all parts of a thundercloud are turbulent, the lower levels are slightly less so and should be chosen whenever possible. However, nothing lower than 2000 feet above the ground should be considered because of the downdrafts that must be expected below that height. The altitudes to be avoided are those from 10,000 feet upwards. At high altitudes—say 25,000 feet, the active clouds occupy less than ten percent of the available space so that these levels are good when aircraft performance permits their use. However, one should always remember that the cumulonimbus thunderheads themselves are dangerous even at 40,000 feet.

Indicated airspeed fluctuates so rapidly in turbulent air that it is essential to keep one's average reading well above the stalling speed. However, too high a speed is dangerous since the stresses imposed by turbulence on the aircraft structure are proportional to the speed at which the aircraft is moving. The recommended procedure is to ride with the storm, keeping airspeed control with the throttle. The attitude of the aircraft should be as close to a normal flying attitude as possible and high rate turns should be avoided.



The Thunderstorm Project found the heaviest turbulence in that part of a cloud where the largest water drops occur. Radar can thus be usefully employed as an aid in avoiding areas of excessive turbulence because large water drops give the strongest radar echoes. Perhaps the most important rule is to avoid the dark areas of the cloud by day and areas of heaviest lightning by night for these are the most active parts of the thundercloud. Static crashes caused by lightning increase in volume and number near thunderstorms, a fact that is of some help in avoiding invisible thunderheads embedded within layer clouds.

In general, the same altitude rules apply for avoiding hail, lightning and icing as for turbulence: either avoid entering the thundercloud or fly through it at a low level. The highest temperatures are found near the base of the cloud where turbulence is less severe. Icing is avoided at temperatures above 0° Centigrade and lightning dangers decrease at temperatures higher than 5° Centigrade. Hail is most likely near the freezing level and least likely where the temperature is high.

*

Finally, there are the risks involved in landing and taking off in the gusty and changeable surface winds associated with thunderstorms. Peak gusts to above 50 mph are common. Gusty conditions are generally at their worst over irregular terrain. The first gust which follows the shift in wind direction with passage of a storm is often the strongest; and this period of wind shift is most hazardous during landing or takeoff. With most thunderstorms the critical time arrives just after the rain begins. Extreme caution should be used by the pilot who is making a takeoff or landing just as a thunderstorm nears his aerodrome. Where possible the pilot should delay his takeoff until the wind direction has changed. Fly AROUND a thunderstorm whenever possible. If you must go through one, stay two or three thousand feet above the terrain.

you can't play it smarter than by playing it safe

Members of the first class to take the RCAF's Flight Safety Officers' Course. Left to right, front row: F/L J.C. Uhthoff (Instructor), F/O E.A. Lowery, F/L A.M. Robb, F/L R.C. Race, F/O F.D. Kaye, F/O D.D. Mills, F/L R.G. Herbert, S/L E.K. Fallis (Instructor), S/L E.R. McDowall (Course Co-ordinator), S/L B.C. Hartman (Instructor). Second row: F/L A.J. Campbell (Instructor), F/O J.F. Finan, F/O P. Koslo, F/O W.J. Chambers, F/O M.G. Casselman, F/O M. Hetherington, F/L C.R. Ensom, F/L D.W. McNichol, S/L J.E.L. John (Instructor). Third row: S/L W.J. McIndoo (Instructor), F/L P.G. Walker, F/L W.F. Schram, S/L C.A.S. Anderson, F/L A. Morton, F/L W.K. Thompson, F/L D.C. MacLeod, W/C D.C. Skene (Instructor). Absent: F/L E.A. Glover.

FLIGHT SAFETY OFFICERS' COURSE

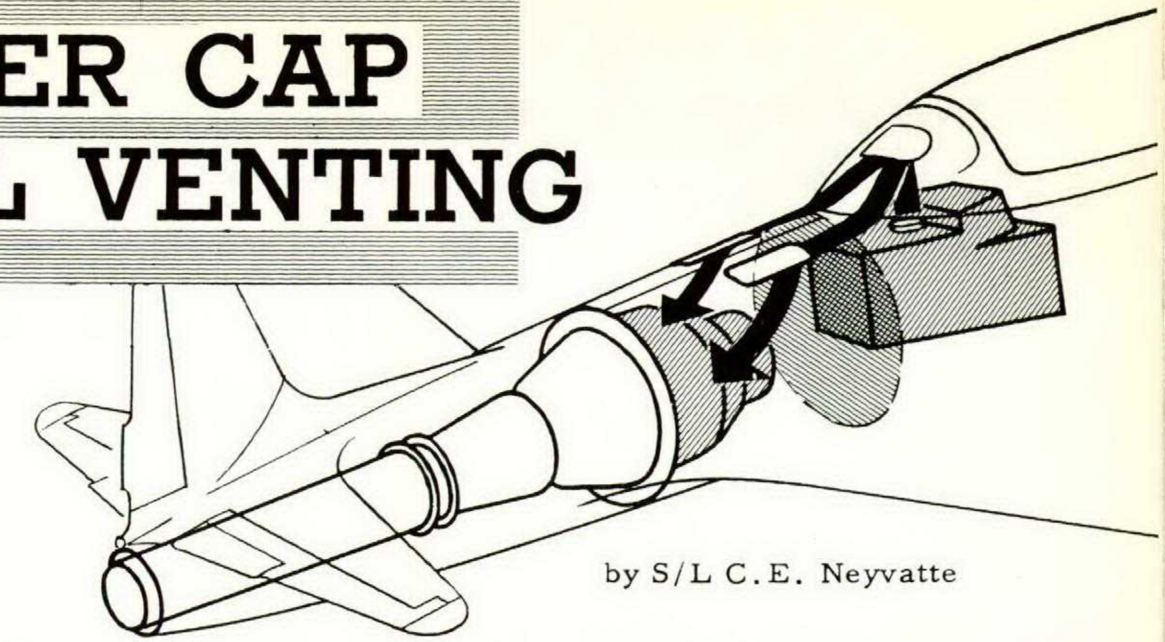
Fifty-eight Flight Safety Officers have recently returned to their respective RCAF commands, stations and units across the country to put into practice the know-how acquired on a five-weeks' Flight Safety course.

The course opened in February of this year and three groups, totalling 58 officers, have passed through since then. Three weeks of the time was spent at Trenton and two at the Institute of Aviation Medicine in Toronto. Sponsored by the Directorate of Flight Safety and administered by Training Command, the curriculum provides intensive instruction in six subjects closely identified with flight safety.

Accident Prevention provides its "students" with background in the statistics of cause, frequency and cost. It also explains the need for a flight safety program, details the duties of an FSO, and describes the methods by which a flight safety survey is conducted. Accident Investigation and Reporting deals with proper accident reporting and investigating techniques. Lectures spent on Aeronautical Engineering emphasize engineering principles, aero-dynamics, and the structures and fundamentals of aircraft systems. The FSOs are taught how to locate technical information when they need it, and they acquire a good working knowledge of the knack of discussing technical details. The classes in Instruction Technique are designed to develop an understanding of the main principles and practices of good classroom instruction. Aviation Psychology provides some background knowledge of this subject and its specific application to accident prevention and flight safety; Aviation Medicine covers the physiological aspects of flight and the relation they bear to safety in the air, and goes into the "why" of protective clothing, oxygen and safety equipment and the part it plays in the health and general well-being of personnel.

Back on their respective stamping grounds these officers will use the knowledge and experience gained on the FSO's course to further the aims of the RCAF's program of "accident prevention through flight safety education."

FILLER CAP FUEL VENTING



by S/L C.E. Neyvatte

Fuel tank caps on T-33 aircraft have demonstrated for some time a number of serious shortcomings. They are difficult to manipulate during installation and are easily damaged in service. Investigation has shown that improvements are possible. Air Materiel Command's "Bulletin" for January and February, 1955, notes that Canadair has developed a modified fuel cap which should overcome many of the problems encountered. The re-designed cap evolved from an idea proposed by Sgt R. Shrimpton of the RCAF station at Portage la Prairie. The new cap has a smaller diameter which reduces the awkward manoeuvering in and out of position; and the standard bayonet fittings have been replaced by needle bearing rollers. The bearings help to cut down the heavy wear and torque and eliminate inadvertent crossing during installation.

Insecure fuel caps are dangerous on any aircraft. They are particularly dangerous on the fuselage tank of the T-33 aircraft because of the design of the aircraft fuel system and the location of the filler cap. Readers will recall that three float valves, mounted on the top surface of the fuselage tank, control the transfer of fuel from the tip and wing tanks. When these valves are operating correctly the fuel in the fuselage tank remains below the level of the filler neck during normal flight. However, when the valves are not operating correctly, fuel may spill from the tank if the cap is not properly positioned. Even when the valves are operating correctly, some flight attitudes by themselves will cause trouble. For example, the combination of climb and acceleration will pile fuel against the aft face of the fuselage tank where the filler opening is situated. Similarly, if tip or wing tanks are feeding to the fuselage tank during a steep climb, the float valve may allow a relatively higher fuel level in this tank. Another possibility which cannot be ignored is the effect created by a low pressure area aft of the canopy where fuel may be lifted from the tank if the cap is insecure. Although a drain is provided in the scupper to carry any excess spilled during fuelling operations, the drain is not large enough to handle the large quantity of fuel which would accumulate in the scupper if the filler cap was not sealed properly and there existed the conditions of high fuel level previously mentioned.

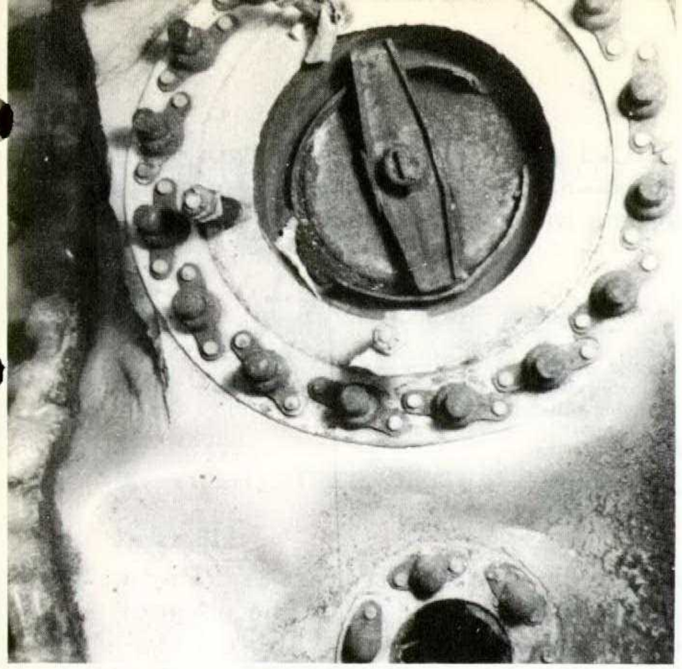
In flight the overflow of fuel from the scupper drain flows aft, vaporizes through the action of the incoming slipstream, and is then drawn through the plenum chamber doors into the plenum chamber. (The plenum chamber doors, remember, are open under conditions of engine acceleration such as exist on takeoff.) The low pressure existing under these conditions ensures that the maximum amount of spilled fuel will be drawn into the plenum chamber to await the conditions of mixture and ignition necessary to cause a fire. The severity of the fire will depend upon the quantity of fuel present. At this point it is important to note that, even if fire does not occur, fumes will be directed into the cockpit through the heating and ventilating systems. While this condition can be alleviated by closing the heat outlets and opening the dump valves, pity the poor pilot flying solo who forgot to close the heat ducts in the rear cockpit before takeoff!

*

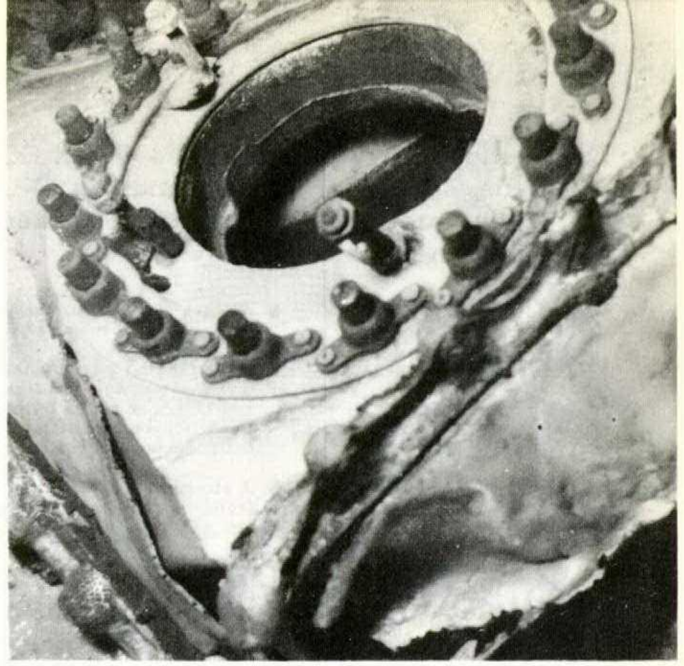
Investigation into one aircraft accident revealed that the pilot was apparently in such a plight. In the words of one spectator, "I was standing outside my house when I heard a jet aircraft passing. The sound attracted my attention because at first it sounded normal like the other aircraft; but then it made a sound like a "woomph" three times, about two or three seconds apart." Another witness stated, "I saw the jet aircraft at approximately 400 to 500 feet doing a descending turn to the right. The aircraft continued to descend until very near the ground and then abruptly began a pullout; at the same time smoke was coming from his engine. He disappeared below treetop level and when I saw him again he was doing a roll to the right close to the ground. It appeared that during the roll he was in a stalled condition because of his high angle of attack which was very apparent from our position. He disappeared below the treetops before his roll was completed. A moment later I saw a burst of flame which appeared above treetop level." The aircraft was completely demolished and the pilot killed.

Later it was established that this T-33 MkIII aircraft had been flying with its fuselage tank filler cap improperly positioned. Takeoff conditions prevailed (a touch-and-go landing had been completed); there had been flash fires in the plenum chamber; and another, starting near the scupper of the fuselage tank, was of sufficient intensity to burn a hole in the aluminum structure of the aircraft.

What happened here? Did a trusting pilot take the word of a technician that the tank caps were properly secured? Did the pilot neglect to do a complete preflight check? Did the pilot himself replace the filler cap incorrectly? Or was the cause ignorance or carelessness on



Lethal fuel tank cap. Note that the cap and sealing ring are off-centre and that the cap is secured by one side of the bayonet bar only.



The edge on the cam section of this filler adaptor is obviously worn. Such wear results in a loose-fitting cap and probable fuel leakage.

the part of a technician? The answers to these questions will likely never be known. But regardless of the cause, this accident emphasizes the need for pilots and technicians to be unfailing where flight safety is concerned. It is better to prevent fuel venting from filler caps by a thorough preflight inspection than to be forced to rely upon emergency action in the air. Here are some points worth remembering:

- Know your aircraft's fuel system
- Know how to fasten fuel tank caps correctly
- Look for signs of previous leakage
- Examine the cap, seal and filler neck for serviceability on each preflight check or fuel cap removal.
- Be careful not to damage the filler neck by careless use of the fuel delivery nozzle
- See that index marks are applied to fuel tank caps to indicate the properly-secured position
- Keep these marks in a legible condition; renew them if new caps or filler adaptors are fitted
- Report unserviceabilities on form L14 and replace defective parts immediately.

Should you get into a situation where fuel venting from the filler cap occurs in flight, there are many ways in which the danger may be minimized by judicious use of fuel transfer pumps and the fuselage fuel tank by-pass system to lower the fuel level in the offending tank. Here's where a complete knowledge of emergency handling procedure is important. Figures 1 - 7 of EO 05-50C-1 are schematic drawings of the T-33 fuel system and will—if studied—assist the pilot to choose the best method. When making a decision on a preventive measure remember these points:

- A loose tip tank cap may make it impossible to completely empty the tank and it may have to be jettisoned.
- If the leading edge tanks are switched on before the main wing tanks—or vice versa—as much as forty gallons may be transferred from one to the other by syphoning action through the vent lines. This condition might result in a miscalculation regarding the endurance of the individual groups of tanks.
- A stuck float valve in the fuselage tank may cause fuel overflow from the vent lines. Fuel lost this way will not register on the fuel counter.

Pilots and technicians alike must know their aircraft if "flight safety" is to be more than just another empty expression. The subject of fuel venting is primarily one of fuel handling and fuel system maintenance. If technicians perform a high standard of maintenance, and if pilots know their fuel systems, make thorough preflight checks, and practise proper fuel handling, then fuel venting incidents should be isolated. Here again are the aspects of fuel venting which chiefly concern technicians:

- Perform careful fuel system maintenance
- Practise sound fuelling procedures
- Replace fuel tank caps correctly
- Investigate any large fuel overflow.

And pilots:

- Make careful preflight checks of tank caps
- Check the heat ducts when flying solo
- Know your fuel system and emergency procedures
- Report unserviceabilities on the L14.

NOTE: Canadair has delivered 14 modified fuel caps to the RCAF—four to each of the three western T-33 schools and two to Air Materiel Command HQ. When field trials of the new cap are finished, consideration will be given to a complete retrofit.

THE AUTHOR, S/L Neyvatte, was born in Mount Dennis, Ontario and attended school in Toronto. He enlisted in the RCAF in January, 1930, later became a Fitter AE(AE Tech), and attained the rank of WO1 in 1942.

After attending the RCAF School of Aeronautical Engineering in 1943 he was commissioned in the RCAF Special Reserve. Released from the Special Reserve on "R" Day in October 1946 he was re-commissioned in the RCAF Regular as an F/O.

During World War II he occupied a variety of posts—technical WO on fighter squadrons, engineering officer on bomber reconnaissance squadrons, OC Repair at Trenton, and then with Eastern Air Command's aircraft maintenance staff. Today S/L Neyvatte is on the aircraft maintenance staff of Training Command HQ.

LETTERS TO THE EDITOR

WHAT SHARP EYES, GRANDMA!

Dear Sir:

Your excellent publication, Flight Comment, invariably exhorts we intrepid birdmen to become more accident prevention conscious through the medium of well written articles and accompanying photographs. Thus, how can you allow such a glaring transgression of the rules of safety to appear on the cover of the February issue? I refer, of course, to the occupant of the rear seat of the T-33, blithely cleaving the air whilst improperly dressed. Wot! No "bone-dome"?

F/L P. Kent
3 (AW) (F) OTU
North Bay, Ont.

Maybe it was a dummy. Maybe he's wearing a black helmet. Maybe he wasn't even issued one. Aw, what's the use! We missed it. Thanks, Hawkeye. By the way—what's the rental on that high-powered magnifying glass of yours?—ED.

GOOD SHOW

Dear Sir:

......May I suggest that items which are selected for publication in the Good Show section be those which are not subject to debate or to a completely opposite opinion. If there are no such cases then the space should be left blank....

W/C F.P. Clark
SOPA, Training Command
Trenton, Ont.

Considerable pains are taken in evaluating an occurrence before it is accepted. It is first examined by our DFS staff and is then referred to the Editorial Committee. (Referring to your suggestion), I question if such a case can be found. Those which have been considered to date (and many have been rejected) have occasioned a variety of comment, and only where a majority is in favor is a case published.

Apropos of Good Shows we do not have one for this issue. We have the writeups, but no picture. When you send us a Good Show, please remember to include: a detailed report of the occurrence; any pictures you may have to support the story; and a 2-1/4 x 3-1/4 portrait of your subject (wearing head dress and tunic) on single weight, glossy paper. Thank you.—ED.

Troubleshootin'

The purpose of an aircraft maintenance section is to assure many efficient flying hours and to maintain auxiliary equipment in such condition that operational personnel can accomplish the missions of their organization. Failure of a maintenance section to meet its requirements can often be charged to improper and inadequate troubleshooting techniques.

To assist maintenance men in troubleshooting, many of the possible malfunctions are listed in the maintenance manuals, together with probable causes, isolation procedures and remedial actions. As experience is gained on a particular model aircraft, other possible malfunctions become evident and can be added to the list. In time the list may become quite long, and if it becomes long enough, it can be of great value to maintenance personnel.

However, we must realize that the total number of possible malfunctions and probable causes are almost infinite. Therefore, we can see that only a small portion of troubleshooting can ever be reduced simply to scanning a list, which at best is nothing more than a catalogue of a small portion of the total possibilities. Effective troubleshooting will always require a lot of "thinking it through".

To assist you in this part of your work (original thinking), the following procedure is offered as a logical and systematic method to be applied in isolating the cause of malfunctions. It is essentially the same procedure that is used in compiling the listings just mentioned, and it is the best procedure to follow when a malfunction occurs that has not been previously covered and catalogued.

1. Ascertain all facts pertinent to the malfunction. This should include any history as well as current symptoms pertaining to the condition.

2. Review the system or systems involved. A thorough knowledge of the complete system in which malfunction exists will always be the most important single factor in performing effective troubleshooting.

3. List all possibilities and rearrange them in order of probability. Don't completely ignore all "long shots". Write them down before you forget. Probability may shift it to the bottom of the list. But so long as it remains a possibility take no chances of forgetting it.

4. Make inspections or tests to prove or disprove each possibility. It may be more expedient or practical to conduct inspections and tests in different order than listed, depending upon their complexity as compared to degrees of probability.

If this procedure has been followed and the cause of malfunction is still a mystery, it may be that some pertinent fact of step 1 has been overlooked or misunderstood. Or, at step 2, some relevant feature of the system or its components has not been considered. It is easy to overlook several important features of even a relatively simple aircraft system.

When studying a system, the mechanic can use the following key words to advantage:

Electrical	Hydraulic	Pneumatic
Electronic	Mechanical	Structural

The system as a whole, or the individual components within the system, will usually have three, four or more of the features listed. Whether studying from a book or working on an airplane, diligently search for all of the above features. Remember that most features of a complex device will not be very obvious.

For your convenience, the four-step procedure for troubleshooting is listed below in short form:

1. Ascertain all facts
2. Review systems
3. List possibilities
4. Perform inspections or tests to prove or disprove each possibility.

Conscientious use of the foregoing method of troubleshooting can save time, effort and material.

North American Aviation News
and Canadair SIC

Accident Resumé

HOT APPROACH

The pilot made his approach at a higher-than-normal air speed. The runway was wet and slushy but he knew that beyond his point of touchdown braking action for the remaining 5000 feet was reported fair to good. In addition he was told that he might use five hundred feet of solid overshoot area if necessary. Following the landing run, during which little deceleration was apparent, the pilot flamed out his engine when he realized he could not stop. The Sabre struck a snowbank at about 40 miles per hour, suffering "B" damage. Examination of wheel marks on the runway revealed little indication of the use of brakes although these were subsequently checked as serviceable.

CAUTION IN PRECAUTIONARIES

The pilot led his three plane formation back to base from a gunnery exercise. On being advised that braking action was fair, he elected to do a precautionary landing. He undershot on the approach and struck a snow bank, causing category "D" damage to the aircraft. Criticism has been levelled against the pilot for his attempt at a precautionary landing when a normal landing would have sufficed since braking action was reported as fair. He should not have lead a formation into a precautionary landing because the following aircraft would have no speed latitude. When leading a formation, always consider the problems of your fellow pilots before executing any manoeuvre.

FUEL STATE AGAIN

At the conclusion of a period of high level attacks the pilot was returning towards base at an altitude of 40,000 feet when he was "attacked" by another Sabre. Although he had only 800 pounds of fuel remaining he entered the engagement and fought down to 2000 feet, where the other aircraft broke off, returned to base and landed.

At this stage the pilot experienced partial power failure; but, at 500 feet, with 200 pounds of fuel indicated, the engine picked up and the aircraft was climbed to 3000 feet where the engine flamed out. The pilot ejected. The accident is assessed "Pilot Error" because the pilot entered an engagement knowing he was low on fuel and unsure of his exact position. The implications are obvious.

LONG CABLE—LONG PULL

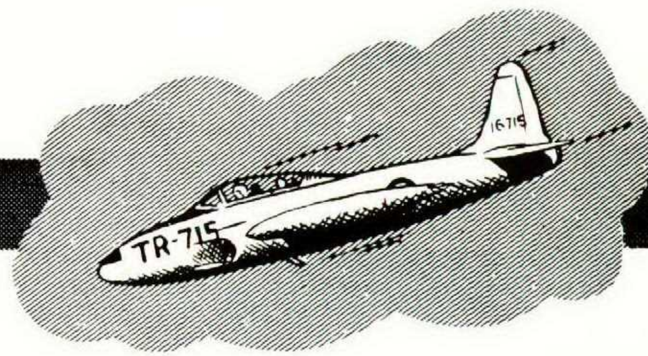
While in the circuit the pilot discovered that the nose wheel would not lower although hydraulic and electrical power systems were normal. During two overshoots the pilot tried three reselections, G applications, low speed flying and numerous attempts to pump the nose wheel down by the emergency method. Eventually, because of fuel shortage, he selected wheels up and forced landed on the airfield.

Technical investigation of the undercarriage system disclosed the presence of a small plastic chip which had probably held the contacts closed in the nose gear down lock switch, thus causing a faulty gear-down-and-locked indication. However, further investigation revealed that the trouble could have been overcome if the pilot had pulled the emergency down cable to its full extent and held it out long enough for the gear to lock down. When operating emergency equipment don't be in too great a hurry—give it time to act!

APPROACH SPEEDS ARE IMPORTANT

The pilot was preparing to land on a wet runway in gusty wind conditions. On final the aircraft stalled and dropped in 150 yards short of the runway. The nose wheel broke off and the aircraft suffered category "B" damage. Preoccupation with the problems of a wet runway likely contributed to the pilot's failure to take the normal precautions for an approach in gusty wind conditions.

T·33



NIGHT COLLISION

During night flying the student pilot found his windscreen iced over following a D/F beacon descent. Simultaneously his oxygen regulator became unserviceable and forced the student onto pressure breathing. He was cleared to land but missed his first approach, overshot, and came around in a closed pattern. His approach was fast but the landing was successful. This aircraft had been cleared to land before a previous T-33 had cleared the runway. Rain reduced both visibility and brake effectiveness. Because of his fast approach he overtook the first T-33 and the inevitable happened.

Flying control, in view of the weather conditions, should not have cleared the student to land while the first T-33 was still on the runway, especially when pilot experience is considered. On his part the student should have informed the tower of his iced-up windscreen and should have orbitted until the ice cleared—a manoeuvre for which he had sufficient fuel.

JC MANOEUVRE?

During his first attempt to fly a cuban eight the student pilot decided that he would be unable to complete the second loop so he attempted a nose high recovery by applying left aileron and rudder. The T-33 did not respond but flicked into what the student thought to be a normal spin. However, normal spin recovery action failed to bring the aircraft under control. A few more similar attempts at recovery were tried without success when the student suddenly realized that the aircraft was on its back as he was hanging in the harness. Because of rapidly diminishing altitude and his lack of knowledge of recovery techniques for inverted spins, the student jettisoned the canopy, unfastened the harness and abandoned the aircraft. The accident cause has been assessed as "Briefing" in that the nose high recovery technique used was taught but is not the approved technique. A standard nose high recovery technique is now being taught at all schools.

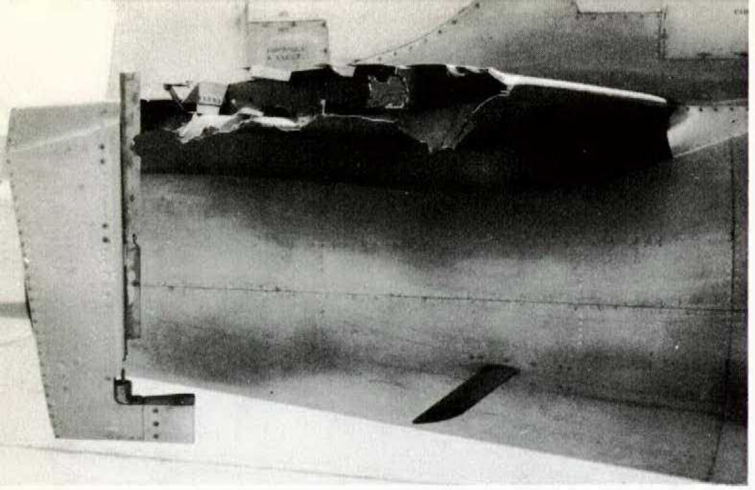
USE YOUR GUNS—NOT YOUR AIRCRAFT

Accidents occurring during air armament exercises sparked the A.I. Brief we have reproduced on our inside back cover. The eleven tips listed were designed to keep a pilot out of trouble—IF OBSERVED! These accidents continue to be reported, but the one under consideration is somewhat unique in that it not only exemplifies pilot error but shows the strength of the aircraft. Despite the damage sustained the student pilot brought the aircraft home and landed it.

He was on his first air-to-air firing exercise, had completed four passes, and was twice warned about his positioning. On the fifth attack he failed to break off at the 15° limit, collided with the flag, and damaged his aircraft as follows:

- starboard elevator and horizontal stabilizer sheared off at station 50;
- starboard main plane leading edge torn at the bomb pylon position;
- eight-inch tear in the fuselage skin, starboard, immediately below the windscreen.

(See inside back cover)



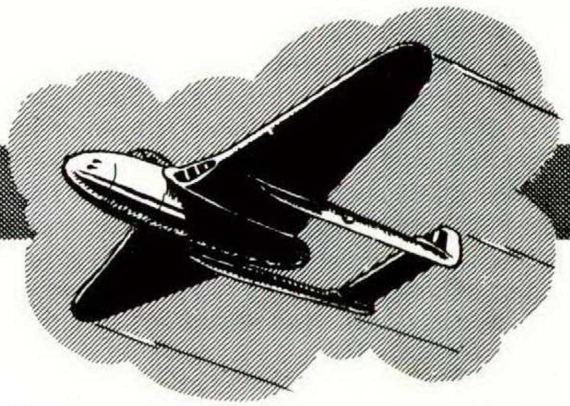
This student pilot has reason to be grateful to both Lady Luck and a sturdy aircraft. But why should any man have an unnecessary accident? Review those armament and range orders and take another look at our inside back cover. In a collision the aircraft invariably comes off second best—and it's your life that's at stake.

STRICTLY VFR

Out on a VFR navigation exercise, the student disregarded his briefing by entering cloud. He remained in the cloud for 5 minutes before turning back towards base. When in the clear again he performed aerobatics for 30 minutes over broken cloud and then headed for home. He was unable to receive station passage using the radio compass and guessed at his position when called by the tower for a position and fuel check.

More fuel was used at low level when he descended and tried to find and recognize a land mark using a square search. Not until the second call was received from the tower did he declare an emergency—and was fixed far from base. When the engine flamed out from fuel starvation the pilot ejected successfully. As is the case in many accidents, a number of errors are involved here; but it is surely only elementary good airmanship to keep track of one's position.

VAMPIRE

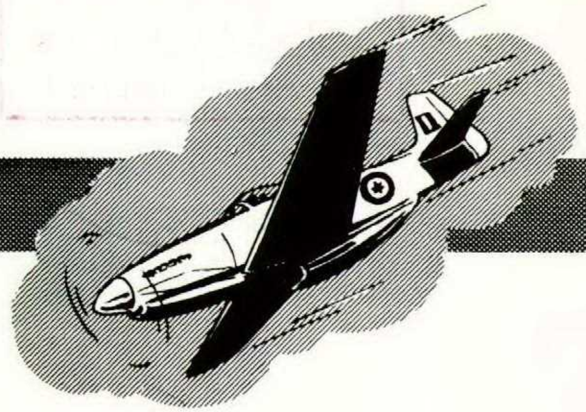


FORMATION COLLISION

A formation of two Vampires had become spread during the climb following a low pass over the field. Number two was attempting to close from the right when his leader instituted a starboard turn. Because of his disadvantageous position the pilot of number two was unable to avoid a collision. The lead aircraft was at once thrown out of control but its pilot managed to gain enough altitude to bail out. Number two crashed killing the pilot.

The leader was blamed for turning without knowing exactly the whereabouts of the other aircraft; and number two should not have gotten into a position which made collision unavoidable. In formation flying the value of alertness and close team cooperation can not be overrated.

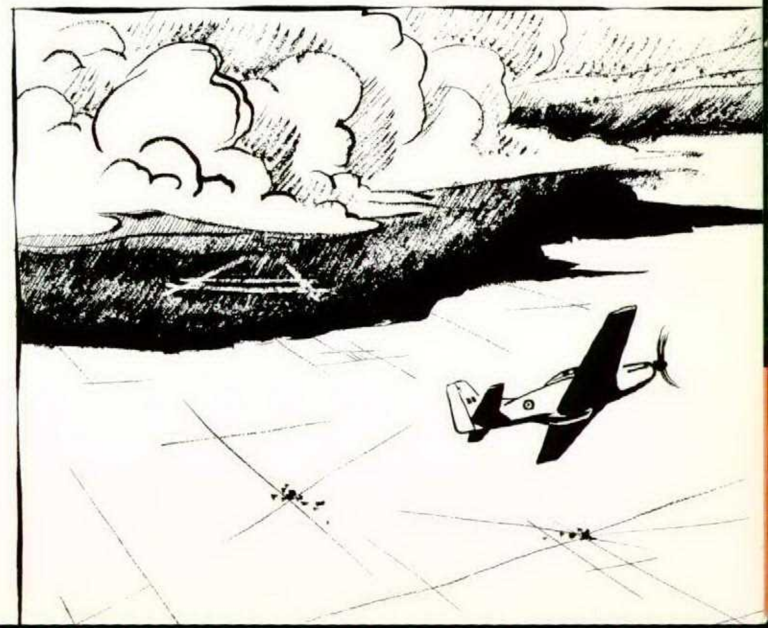
MUSTANG



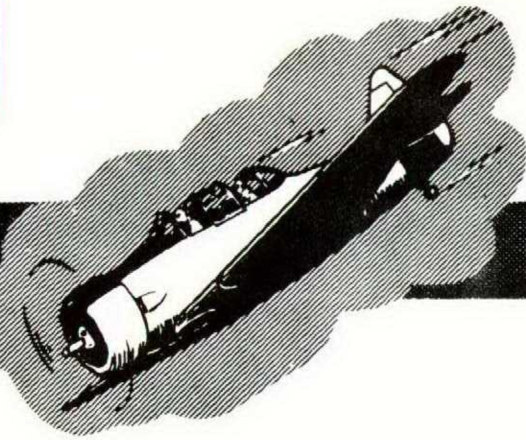
AIRSPEEDS AND CURVED APPROACHES

Approaching to land, the number two pilot of a two-plane formation was turning final when his port (inside) wing dropped rapidly. He applied power and opposite controls, but the wing tip dragged along the ground and the aircraft cartwheeled. Fortunately the pilot escaped from the wreckage. He had allowed insufficient airspeed for a curved approach. The application of positive G in the last stages of final initiated an accelerated stall, and sudden application of power tended to aggravate the rolling motion.

KNOW YOUR LIMITATIONS



This Mustang was observed in the circuit at a time when very heavy rain and severe electrical disturbances were present. The pilot had been warned of deteriorating weather and was cleared for a direct approach. However, he elected to fly a circuit and was last seen at low altitude entering an area of very heavy rain. At this time RT contact was lost; but within five minutes visibility improved to the point where flying control personnel could see the wreckage of an aircraft lying some 2000 feet short of the end of the runway. It was the Mustang; and its pilot was dead. Apparently he had lost control in a turn in poor visibility. Had he diverted to another field or held in a clear area, the accident could have been avoided. All pilots are advised to review their capabilities and responsibilities where weather and aircraft are concerned.



HARVARD

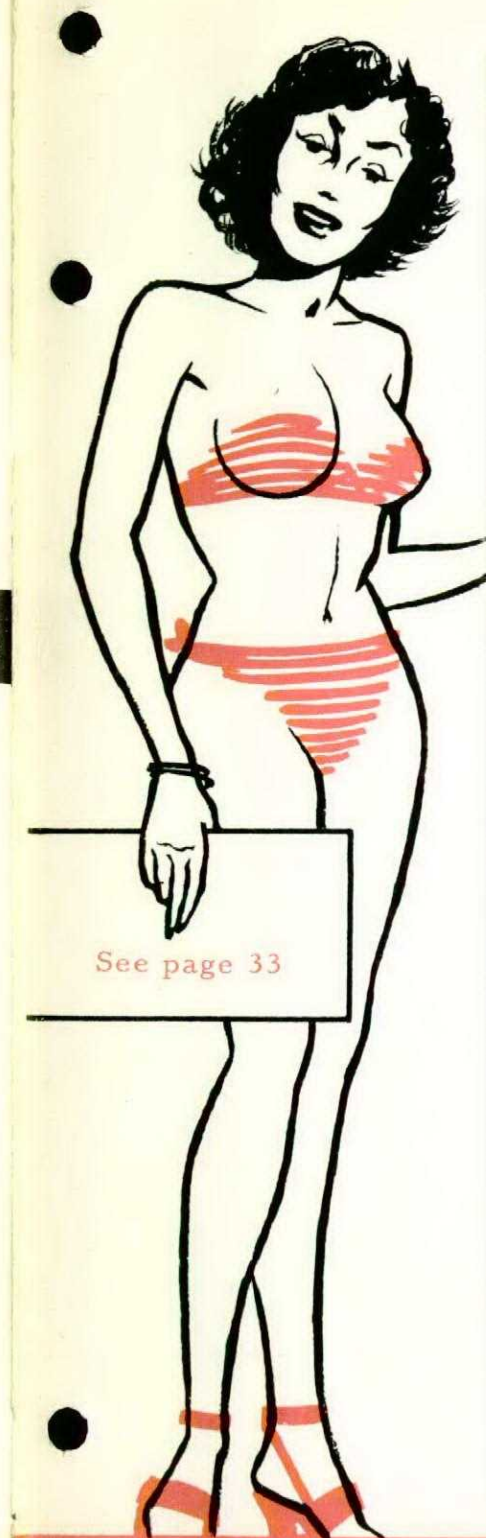
FLAPS, DRIFT AND CROSSWIND

This student pilot attempted to land using full flap in conditions of a 45-degree crosswind at 18 knots. The main wheels touched, the starboard wing came up, and the aircraft ballooned, probably because of the student's attempt to get the tail down. While the aircraft was clear of the runway, drift again took effect; and when the port wheel next touched, a swing developed which the student could not control. The errors in this case consist of:

- use of full flap in a strong crosswind
- failure to overshoot after ballooning

DON'T FORGET THE WHEELS

During night flying practice the student was asked by the tower for a ceiling check. He reported the ceiling as the altitude at which he was flying, climbed, but did not enter cloud, then returned to circuit height to continue his landing pattern. His large circuit required engine power sufficient to prevent the undercarriage warning horn from sounding. With cockpit checks incomplete he made a wheels up landing. Remember your drill of vital actions!



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A.I. Briefs

AIR TO AIR

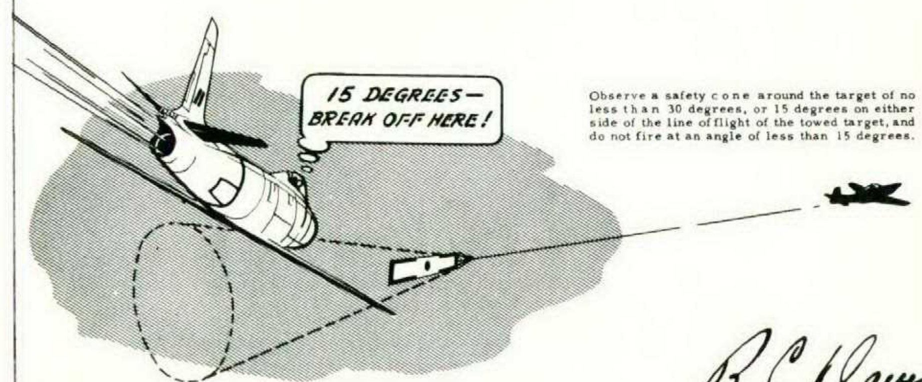
THE SCORE FOR THREE YEARS

8 FATALITIES : 5 AIRCRAFT DESTROYED : 18 DAMAGED

resulting from poorly executed attacks during air-to-air armament exercises.

FOR YOUR PROTECTION

- Gain experience before trying to press attacks to minimum range
- Break away above the target—never below
- Stay above the target level
- Never fire up at a target
- Do not fire on a bad pass
- Pull up immediately if you lose sight of the target
- Do not make passes into the sun
- Keep your windshield and canopy clean
- Know the position of the aircraft ahead
- If radio communication is not clear cancel the exercise



Observe a safety cone around the target of no less than 30 degrees, or 15 degrees on either side of the line of flight of the towed target, and do not fire at an angle of less than 15 degrees.

ALWAYS REMEMBER HIGH CLOSING SPEEDS!

R. C. Davis

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Director of Flight Safety,
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