FLIGHT COMMENT

ROYAL CANADIAN AIR FORCE

MARCH • APRIL • 1961

DOUBLE CHOCK

27 AIRCRAFT DAMAGED BY WIND IN TWO YEARS

EDITORIAL

When an aircraft is signed out as serviceable the pilot has every right to expect a serviceable aircraft. This does not mean that the aircraft is safe to fly because there are numerous checks that the pilot must perform before the aircraft is safe for flight.

To the ground technician the term serviceable means there are no unserviceabilities against the aircraft. The pilot who accepts the aircraft must have every confidence that after completing the pre-flight checks, the aircraft will perform satisfactorily.

In recent months there have been many unnecessary accidents and incidents attributed to such items as, tape left on the pitot and static system, and to loose panels coming off in the air. In one case a fatal accident was the result. It seems ironic that a conscientious technical staff can carry out a highly complicated check on a piece of equipment, and then leave a panel improperly fastened. It seems ironic that a highly trained technical staff can carry out a systems check on equipment associated with the pitot and static system and then leave the vents covered with tape.

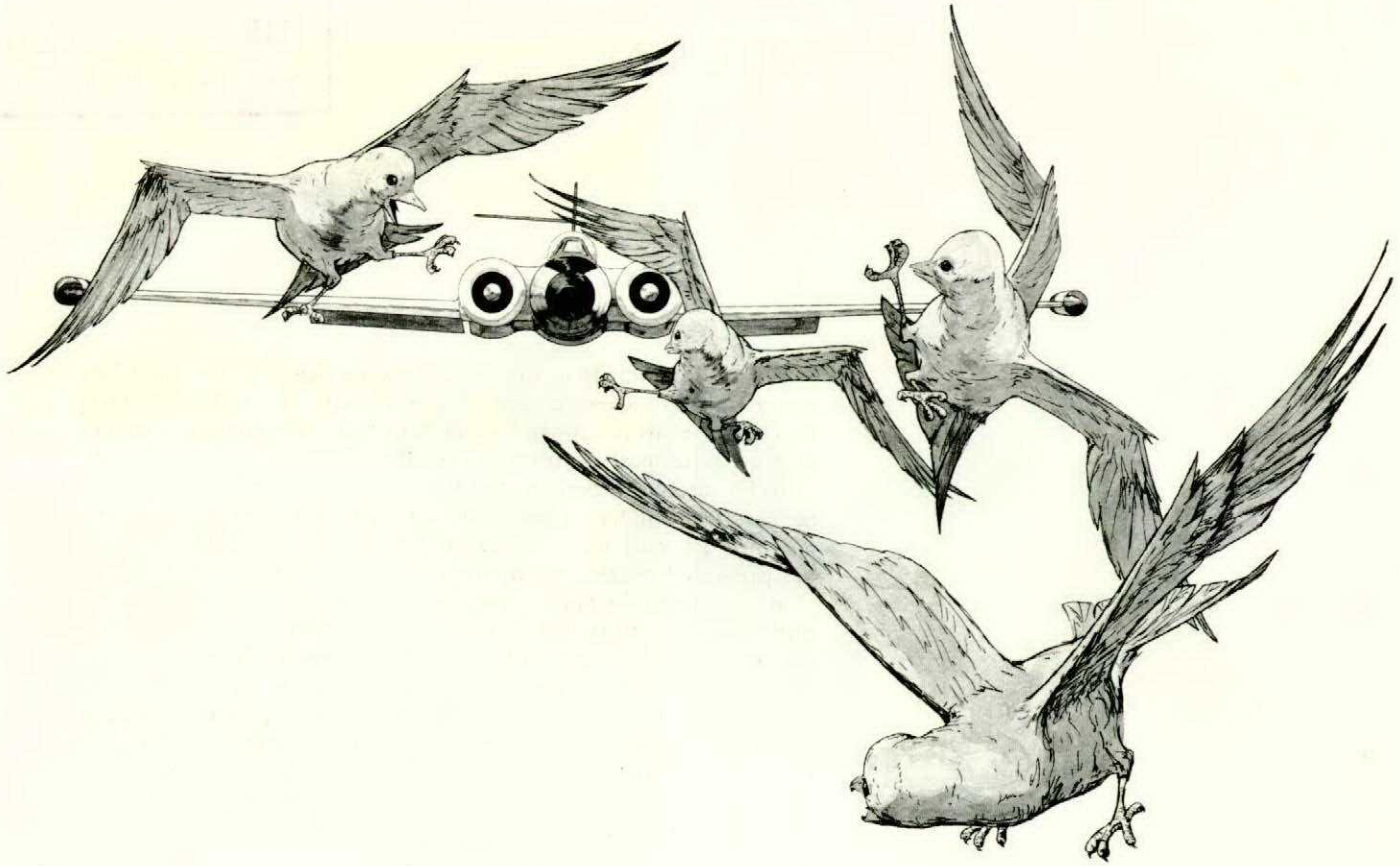
These omissions by the technical personnel have a far reaching effect on the accident prevention program, and on the overall RCAF operational capability.

It has been pointed out that the responsibility of ensuring that panels and other associated equipment are securely fastened and serviceable rests with the maintenance and servicing crews. The aircrew officer who carries out an external check and misses any discrepancy by the groundcrew is not exempt from blame. There are certain items that are particularly vulnerable to oversight, and aircrew must include these items in their external check.

It is said, "To err is human". This may be so, but in this flying game, we have inspections to eliminate the human error from our accident program. So do your part and help your fellow man to stay alive.

J. J. Jordan

J. J. JORDAN, GROUP CAPTAIN
DIRECTOR OF FLIGHT SAFETY



The Unguided Missile

Today is the day of the missile. Technology has advanced far since the date of the first missile, when a brass cannon fired a solid round missile, called a cannon-ball. The missiles have advanced too. The lethal punch of today's guided missiles cannot be compared to the missile fired from the ancient cannon. The killing power of the cannon-ball was limited, if the artillery man managed a hit, but nevertheless it was effective.

We have had with us down through the ages an unguided missile that can be compared to the cannon-ball in killing power. This missile is not a solid round ball, but has a light framework of bone, stuffed with gizzards and things, and covered with skin and feathers. While unguided, this missile can take off vertically, hover, project itself in any direction, and is most difficult to avoid. The missile can weigh anywhere from a few ounces to several pounds. The muzzle velocity of this missile is dependent upon the collision speed of the target and the missile. An aircraft being hit by this feathered missile can be compared to a hit by a cannon-ball of the ancient variety. The amount of damage that can be caused is dependent on the velocity, the weight of the missile, whether it is a direct hit, or whether the hit is in a vulnerable part of the airframe or engine. A hit by a feathered missile can cause damage ranging from minor to major.

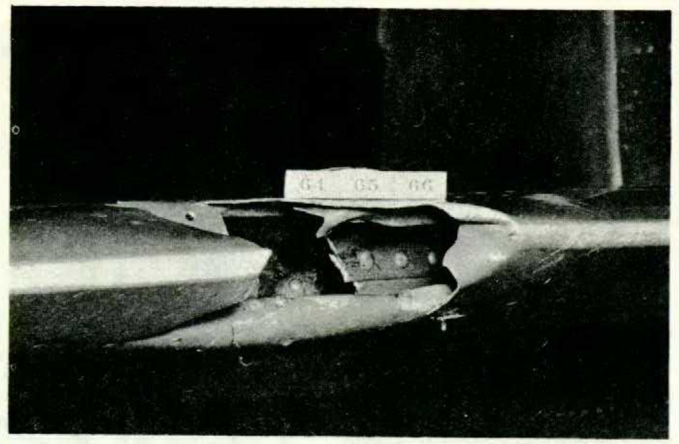
A review of accident records indicate that the RCAF has suffered over 250 accidents, caused by bird strikes in the last 10 years. This computes to over two bird strikes a month. It is difficult, if not impossible, to come up with a formula to avoid bird strikes. It is interesting to know that birds that fly in flocks are known to fly beneath a low overcast. We know that ducks and geese are in the habit of flying below a cloud layer at between 2000 and 3000 feet. A large majority of the strikes happen just after takeoff and before the aircraft has reached 500 feet. A large number also occur while carrying out low level cross-countries. An analysis of the bird strikes to date indicate that 56% occur below 500 feet, 25% between 500 and 2000 feet, and 19% above 2000 feet.

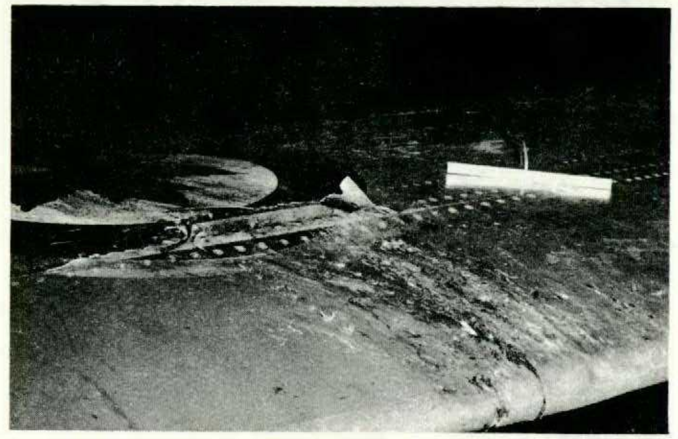
Other than staying on the ground, avoiding known migratory corridors, or staying clear of the underside of the low stratus deck, there is not much to say to assist you in avoiding these feathered missiles.

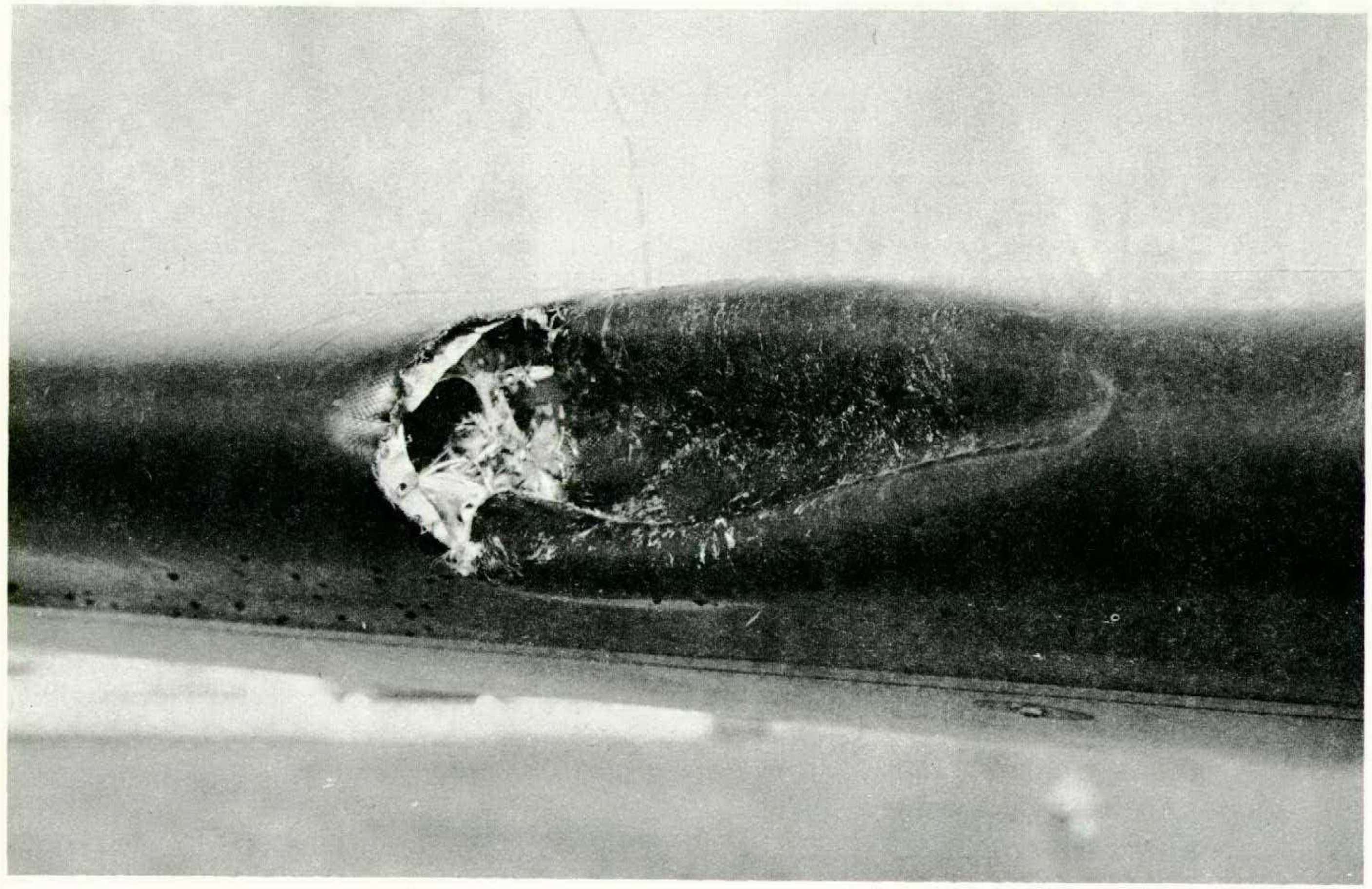
What happens after you have suffered a bird strike is a different matter. A leader of a diamond formation in a Sabre aircraft approached at low level at 410 knots to carry out a loop. His aircraft was struck by a bird and a hole was made in the leading edge of the fin. At 410 knots plus the muzzle velocity of this feathered missile, which was presumed to be a sea-gull, is sufficient to cause major structural damage to an airframe. Despite the hole in the tail surface the pilot carried on with the formation loop, and fortunately his aircraft stayed together. A pilot in a CF100 suffered a direct hit just after takeoff, causing damage to the leading edge of the wing but as control seemed normal he carried on with the exercise. On landing, investigation revealed that the wing was damaged beyond repair. The report stated that it was fortunate indeed that the wing did not fail in flight.

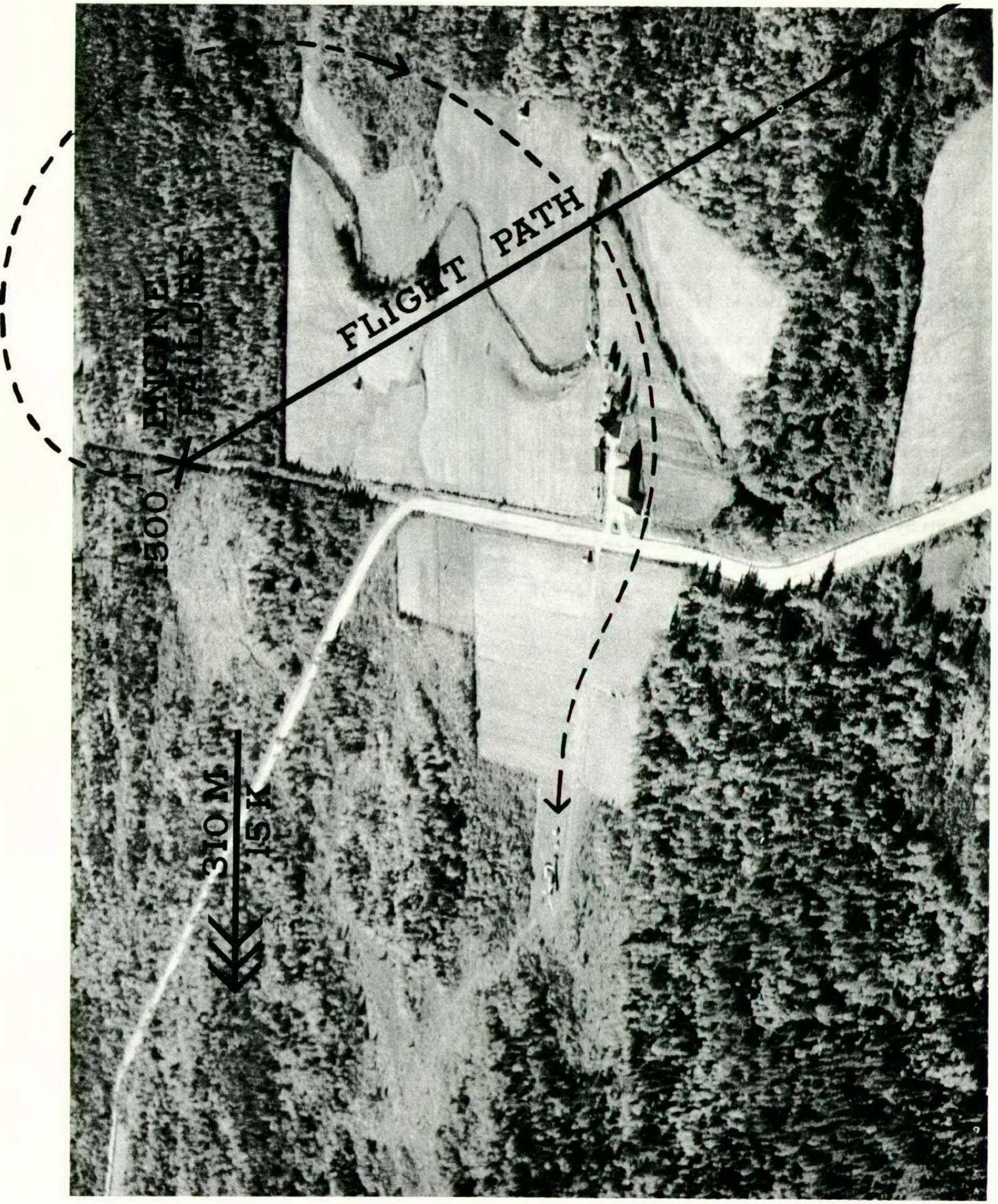
There are dozens of cases where the pilot elected to carry on with the exercise after the bird strike. Most of them were lucky enough to get away with it. Others took the professional attitude. After the bird strike they carried out a slow speed check to determine the handling characteristics of the damaged aircraft in the landing configuration, then carried out a safe landing.

The effects of a bird strike can be compared to a hit by the ancient cannon-ball. You would not carry on with the exercise if you were hit by a cannon-ball, so why try it after being hit by a bird.









F/L D.W. McCuaig

After completing a polio evacuation trip, F/L McCuaig landed an H21A at Chatham, N.B., to refuel. The aircraft was refueled and a night takeoff was made for the return trip to Greenwood. The weather at the time was 5000 feet overcast, with visibility 15 miles. After takeoff, course was set for Moncton, and when the aircraft was approximately five miles south of Chatham, at a height of 1500 feet, the engine backfired. F/L McCuaig checked the cockpit and realized he had a complete engine failure. He turned off the magneto switches, turned on the landing light, the search light, and transmitted a MAYDAY call to the Chatham tower. He turned the aircraft into wind and noted that he was over solid bush country. He continued the turn and after turning through 300°, spotted an open field.

F/L McCuaig carried out an auto-rotation and landed the aircraft, using the searchlight beam to determine the aircraft's height. The aircraft was undamaged. The action taken by this pilot — force landing his helicopter at night — evidenced airmanship of the highest order. Professional flying at its best.

NOT TOO FAST

ADAPTED FROM F.S.F. BULLETIN

The folly of operating an aircraft beyond its allowable speed is well known to all pilots. If taken in one large dose, the aircraft can come apart at the seams and even in smaller doses, it may cause unseen structural damage which at a later date could result in a disastrous failure. Thus, while an offending pilot may not kill himself, his folly may kill his best friend flying that same airplane at some future date.

All aircraft are designed within certain structural limits. To operate beyond these limits is to invite trouble. Typical limit designations are normal cruising speed and the maximum allowable speed.

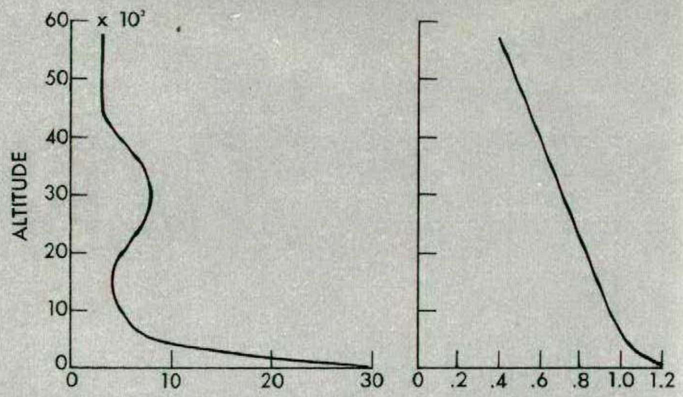
The jet operates closer to its high speed limits than the piston airplane. A jet at low altitudes—22,000 feet—at maximum cruise is flying at the top side of the normal cruise speed. Lowering the nose rather than reducing power to accomplish an altitude change may quickly slide the aircraft beyond its safe range (limiting Mach).

A jet gives its best miles-per-pound-of-fuel performance at high altitude. Therefore, it is advantageous to stay high as long as possible. The complexities of air traffic often make quick descents necessary, and a jet picks up speed very quickly. Under these conditions, it is a simple matter to exceed a safe airspeed, in fact, there are times when conditions may force the pilot to do so if he accepts the clearance. When excessive high speed is approached at high altitude, buffeting occurs. This can, and has been mistaken for light turbulence, so pilots should be suspicious when encountering buffeting at high altitude and high speeds.

For pilots, eternal vigilance is the word. All crew members should be quick to call attention to excess speed. A good aircraft captain does not object, instead he should encourage his crew members to bring irregularities to his attention. Most air traffic controllers are beginning to realize jet pilots' problems, and they try their best to give him the time required for a normal descent. Although very seldom heard in jet operations the expression "make best possible time", directed to a descending jet pilot, can be the beckoning finger that invites him to exceed limits. This is especially dangerous if turbulence is encountered.

A serious and an alarming situation was uncovered recently when velocity, acceleration, altitude, time, recorders were installed on turbo aircraft, operated by a dozen of the world's airlines. The purpose of this installation was to study turbulence, especially clear air, high altitude turbulence. Figures 1 and 2 represent the results of this co-operative effort. Note the increased amount of rough air between 20,000 feet to 40,000 feet, and figures at the lower levels. Note also the increase in intensity at low altitude.

VARIATION OF CLEAR AIR TURBULENCE WITH ALTITUDE



PERCENTAGE ROUGH AIR
FIG. I

RELATIVE INTENSITY
FIG. II

The data also showed that turbo-prop transports frequently have been operated at speeds above the normal operating limits, and have reached maximum allowable speeds more frequently than have piston engine transports in operation.

Operation above placard speeds is potentially unsafe and should be avoided. The coupling of high speeds with rough air during descent for example, is a real strain on the molecules that hold your plane together. The recorder also shows that turbo-prop transport experience relatively higher structural load factors than the piston types at high speeds. The design load factor for both turbo-prop and piston aircraft is the same.

Remember—all aircraft are designed with certain structural limits. To operate beyond those limits is to invite trouble.

SPARK PLUG TROUBLE

We know from experience that the greatest percentage of trouble in an internal combustion engine originates in the components of the combustion chamber. The spark plug is the only one of these components we can examine without too much difficulty. Since it is affected directly by everything that occurs inside the combustion chamber, we can accurately diagnose many combustion chamber troubles if we evaluate properly what the spark plug tells us.

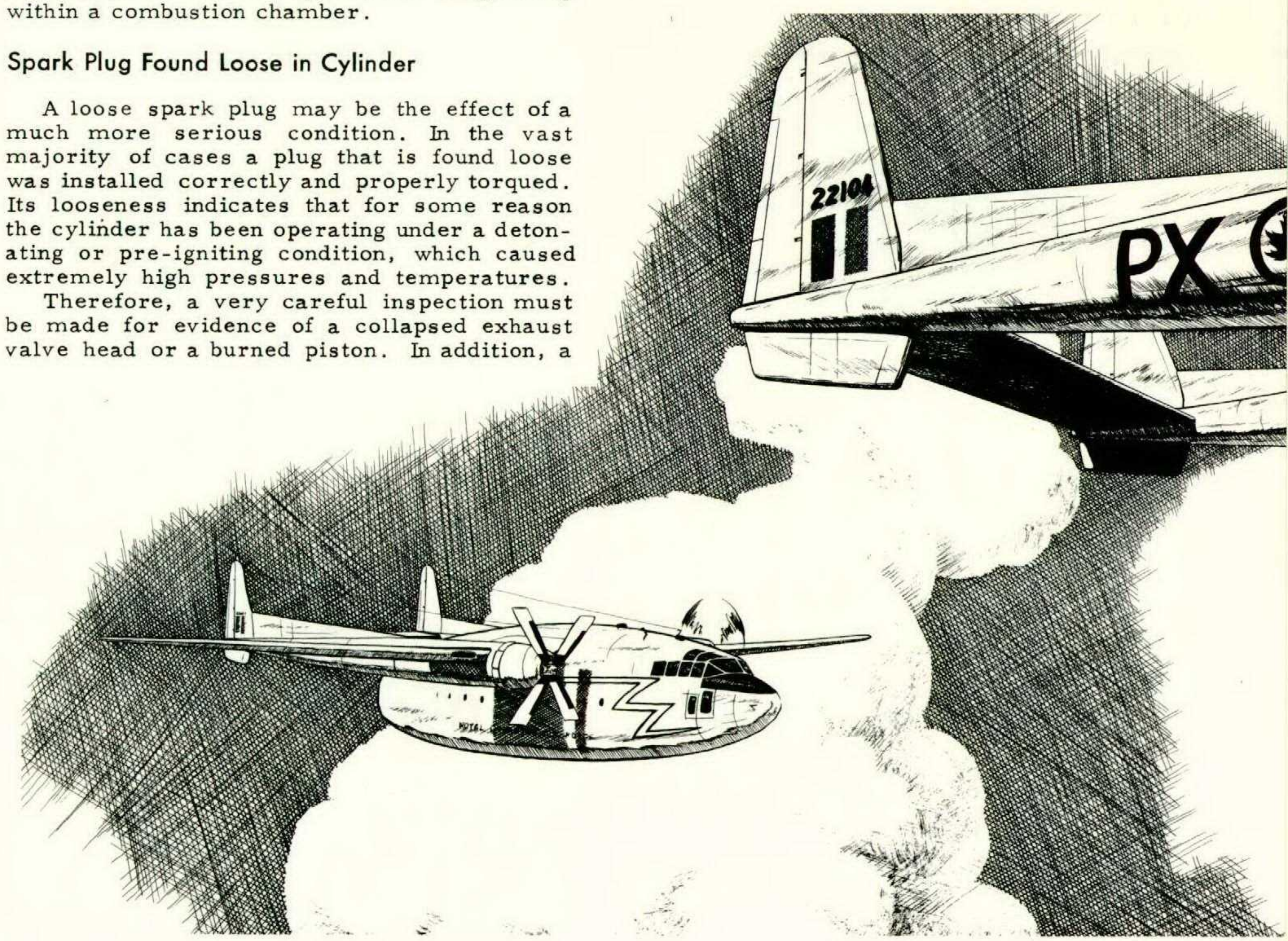
Of course, such a message is of no value unless we find it through careful inspection and understand what it means. The purpose of this article is to define the things a spark plug can tell us about the irregularities originating within a combustion chamber.

Spark Plug Found Loose in Cylinder

A loose spark plug may be the effect of a much more serious condition. In the vast majority of cases a plug that is found loose was installed correctly and properly torqued. Its looseness indicates that for some reason the cylinder has been operating under a detonating or pre-igniting condition, which caused extremely high pressures and temperatures.

Therefore, a very careful inspection must be made for evidence of a collapsed exhaust valve head or a burned piston. In addition, a compression check should be made, and a very careful inspection of the cylinder head finning. Warped fins indicate a bulged cylinder head. The opposite spark plug, as well as the loose plug, should be inspected for signs of a failed nose ceramic. Such a condition in either plug will undoubtedly be the basic cause for pre-ignition during operation.

If a spark plug is left loose at installation, the effect can be the same as though it loosened in service. A loose plug will not cool properly, and during engine operation it will overheat to the point where the nose ceramic acts as a "glow-plug", causing pre-ignition in the cyl-

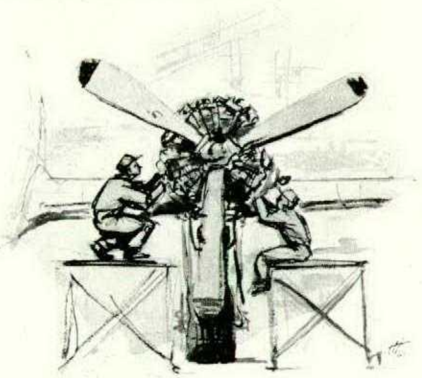


inders. This means that any loose spark plug requires the inspections outlined in the preceding paragraph.

Mechanically Damaged or Peened Spark Plug Electrodes

Peened or mechanically damaged electrodes indicate that there are loose parts bouncing around inside the cylinder. Unfortunately, the fact that the electrodes are peened is not always readily apparent. The plugs may appear to be only badly oil-fouled. There are instances on record where clean plugs installed under such circumstances functioned properly until the engine failed because of foreign material in the cylinder.

Every oil-fouled spark plug should be inspected very carefully for damage to the center or ground electrodes. Where there is any doubt, the plug should be washed and inspected again. Loose bolts, nuts, cotter pins, screws, washers, bits of pistons, piston rings, pieces of valves, blower parts and carburetor parts have shown up in cylinders during operation. In all cases the spark plug is the best indicator. Don't overlook the evidence.



Sprayed Metal Deposits on Nose of Spark Plug

Where a serious failure has occurred, the metal plastered in the end of a spark plug is very obvious. However, incipient failures frequently release very little metal, and what we see with a "quickee" look appears to be a badly oil-fouled plug. Here again, a close inspection is required to determine if any metal is present.

If the metal spray is confined to one cylinder, you will certainly find a burned piston. If there is metal spray in the spark plugs all around the engine, expect to find a dragging blower impeller shedding aluminum dust.

There is a relatively rare type of exhaust valve failure that releases metallic sodium from the valve head. This shows up either as a heavy powder deposit in the spark plug nose, or as metallic sodium.

Obviously, whenever metal spray is found in the spark plugs nose, a very extensive check of the combustion chamber must be made to determine the cause.

Fused Center and Ground Electrodes

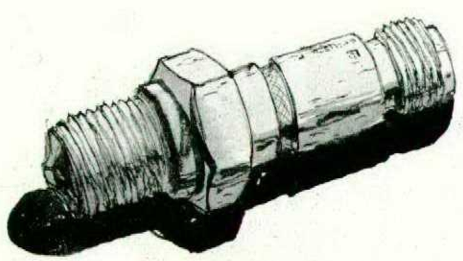
Melted and fused spark plug electrodes indicate that the cylinder has been operating in pre-ignition. Pre-ignition can be caused by any component in the combustion chamber whose temperature is raised to the point where it ignites the charge of fuel early in the compression stroke. When this occurs, the piston is forced over top dead center (TDC) against the exploding charge. There is probably no more destructive force developed in an aircraft engine than the pressures and temperatures resulting from this condition.

An abnormal deposit, a burned valve, or a failing piston can develop local hot spots that will cause pre-ignition. However, the most common cause is the failure of the spark plug nose ceramic. The broken piece of ceramic, trapped behind the ground electrodes, becomes heated to the critical temperature.

Another condition which has caused pre-ignition is the incorrect timing of an individual cylinder, due to crossed leads at the distributor plate. In this case the spark plug is fired far in advance of normal timing, creating a condition identical to that of the broken ceramic.

There have been occasional cases where a nose ceramic has failed, causing the cylinder to operate in pre-ignition, the plug to fuse, and the engine to back-fire. A momentary reduction of the throttle will halt the pre-ignition and permit the engine to operate relatively normally; but the cylinder will be dead because of shorted plugs. After a limited amount of operation, these plugs will merely appear badly oil-fouled, making it difficult to detect their fused condition. Where new plugs were installed to eliminate the trouble in such cases, the badly damaged cylinder and piston later failed.

Again, mechanics must be extremely suspicious of any oil-fouled spark plug. In the case of fused electrodes, the cylinder and piston must be inspected very carefully for evidence of damage.



Badly Eroded Center Electrodes

This type of erosion becomes apparent when the nose of the center electrode loses its copper core. The gaps of the plug are wide, with definite thinning of the ground electrode. Usually this condition appears in varying degrees through the entire set of spark plugs. It indicates an overheat condition of serious proportions.

Advanced ignition timing should be suspected, along with the possibility of abnormally lean carburetor flows during high powered operations. If copper run-out is noted, all of the combustion chambers should be carefully checked for damage. The timing and compression should also be checked, and the carburetor and ADI system considered as possible sources of trouble.

Fuel Fouling

Soft, fluffy and dry black carbon deposits means a too rich fuel-air mixture. This may be due to excessive idling or faulty carburetor adjustment.

Lead Fouling

Lead oxide and other lead salts may appear as a light, tan-colored film or fluffy coating, or as a dark colored glaze. These compounds have little effect on the performance of a plug at low speed operation, but at high speeds and high loads and high temperatures they form good electrical conductors which tend to short out the plug. Plugs that are severely fouled with lead salts deposits should be discarded.

Oil Fouled Spark Plugs

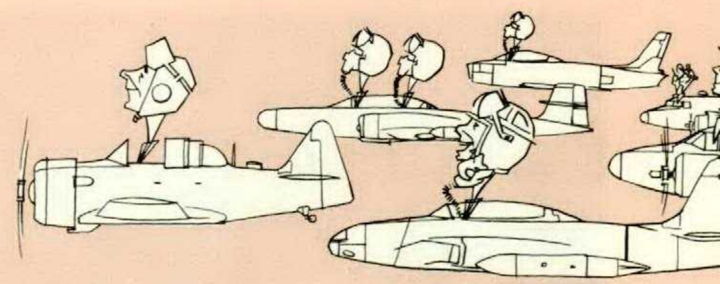
Much has been said already concerning oil-fouled spark plugs and the necessity of examining them carefully for damage of one kind or another. It is true that where only one spark plug in a cylinder is fouled, it is usually a simple case of fouling. The black, wet deposits that cause a miss, even at reduced engine output, may be only a normal oil accumulation common for the lower cylinders. However, when both the spark plugs removed from a single cylinder are found to be badly fouled with oil and carbon, some form of mechanical failure should always be suspected, and the cylinder checked accordingly.

The history of the engine should also be considered. Certain models have experienced what might be termed chronic failure of the upper land of the pistons. On one model, oil-fouling of both spark plugs in the same cylinder can be taken as the announcement of a valve failure.

Summary

Our summary is short. Be extremely suspicious in any case where both spark plugs are dead in a cylinder. The chances are you are looking at something much more serious than spark plug trouble.

FSF: Aviation Mechanics Bulletin



HEADS - UP FLYING

EMERGENCY STRIP LANDING

F/L Chrysler was captain and F/O Carlson was first officer on a C119 during a flight from Goose Bay to St Hubert. In the vicinity of Eon Lake the port engine rpm suddenly increased to 2300. The pitch lever was retarded and the propellers stayed in synchronization for approximately six minutes. The rpm began to increase again and could not be controlled by the pitch lever. The navigator was asked to prepare a CP for Goose Bay, and the port engine was feathered.

During the feathering operation and the turn towards Goose Bay, the aircraft lost altitude, dropping from 6000 to 5000 feet. The aircraft could not maintain altitude with the maximum allowable power setting on the starboard engine. Rather than risk a long low-altitude flight over a route on which the safety altitude is 3500 feet, the aircraft was landed on the gravel strip at Lake Eon.

Fuel was offloaded there into barrels, until only enough remained for a flight to Seven Islands plus alternate. Personnel and equipment were sent out on other aircraft. A hydraulic component in the propeller hub was changed and the C119 was flown to Seven Islands.

This crew knew its aircraft and the hazards of the situation. The decision to use the emergency strip, the initiative in forwarding personnel and equipment, and the skilful handling of the aircraft, were indeed Heads-Up flying—a professional aircrew handling an emergency in a professional manner.

DON'T WAIT TOO LONG

What is the safe altitude to eject? Ever since the ejection seat was brought into use to assist aircrew in abandoning aircraft the question has been asked many times. The answer is a difficult one, because there are many variables that have direct bearing on the height. Volumes have been written to explain the behaviour of the man-seat combination on ejection, the horizontal displacement and vertical displacement that can be expected when an ejection takes place. The vertical displacement which indicates the actual height lost during an ejection will be discussed later in this article.

This is all very well, but when you apply this information to the information that is presented to the pilot in the aircraft cockpit, when he is faced with an ejection, how do they match up? In researching this article it was realized that the altimeter, which is the only indication of altitude, is not too reliable. You are all familiar with the fact that the altimeter is subject to error, but it is only when we correlate these errors to the question "what is a safe indicated altitude to eject?" that the error assumes a greater importance. Therefore, to answer the question logically, we are faced with two problems, first, the altimeter itself, and second the height that is lost in a normal ejection.

The Altimeter

The normal pressure altimeter as used in modern aircraft consists of a sensitive capsule, to which is attached appropriate mechanism and a dial calibrated to show the movement of the capsule with a change of air pressure as a change in altitude. The capsule is calibrated to a normal standard atmosphere scale. Associated with this type of instrument are the following errors:

(a) Scale Error
(b) Hysteresis Error
(c) Friction Error
(d) Lag Error
(e) Position Error
(f) Variation of Pressure to Standard Atmosphere
(g) Variation of Altimeter Pressure Setting to Actual Ground Height Above Sea Level.

For the purpose of ejecting from an aircraft we are concerned with the position error, the lag error, and the variation of altimeter pressure to the actual ground height above sea level. The latter cannot be tabled, so you, the aircrew, must be aware of the ground height above sea level.

The position error is common to all aircraft. The effect of position error assumes greater importance at the lower levels. Have you ever noticed how low an aircraft is to the ground during a high speed pass? Normally, the pilot is cleared to cross the field at a minimum altitude of 500 feet, and he does cross the field at 500 feet indicated. Refer to Fig. I and you will see that at 500 knots IAS, the altimeter at sea level will read 420 feet too high. In other words, the pilot flew the low pass at 500 feet indicated but in fact he was 80 feet above ground level. It will be noted that as the speed of the aircraft increases the error also increases.

While the position error is important at low

FIG. I

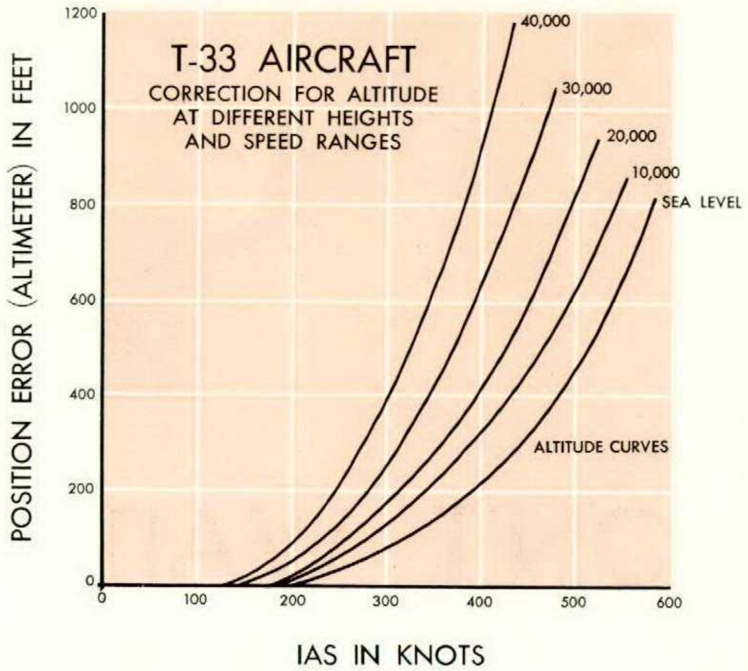
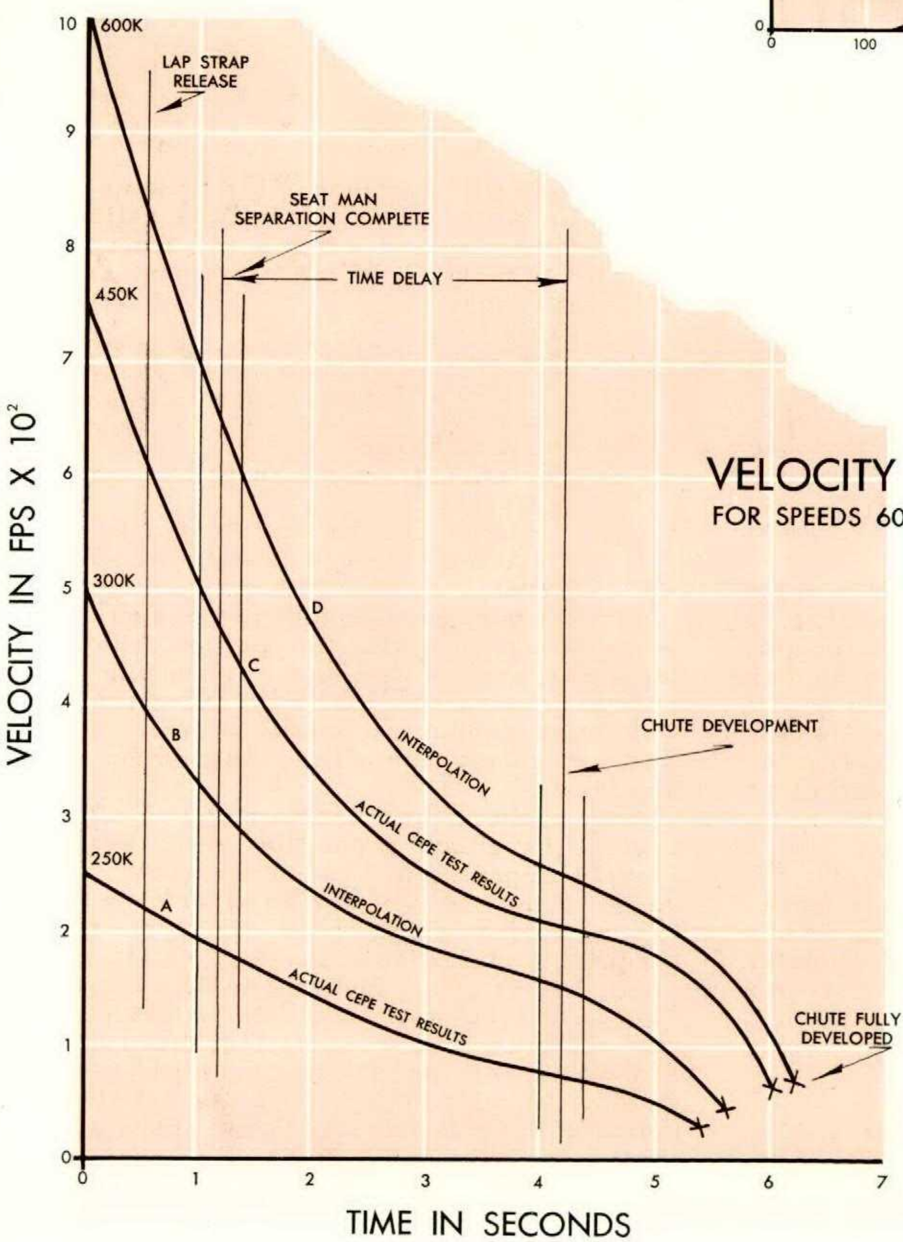


FIG. II



level, at high altitude the lag error is most vital and must be understood. The hysteresis and friction error can be considered as part of the mechanical design of the altimeter, and they will not be dealt with separately. The lag error that directly concerns the pilot is the error that is caused by the mechanical limitations of the instrument itself.

During a descent of 250 fps, which represents a vertical descent of 150 knots, there is a lag error of approximately 2500 feet. As the rate of descent increases beyond 250 fps the lag error increases rapidly until a rate of descent of between 600 and 625 fps (36,000 to 37,000 fpm) is reached. This represents a vertical speed of between 360 and 375 knots. This is the maximum unwind speed of the instrument itself. At any rate of descent over 600 fps (360 to 370 knots), not only do you have the overall lag to contend with, but the instrument just isn't keeping up with your rate of descent. The error in the instrument reading under these circumstances varies in each instance, but when you realize that the aircraft is descending faster than the unwind speed of the indicator, the resulting lag renders the instrument useless to indicate your height above ground.

Height Required in Bail Out

In order to develop trajectory curves for the man-seat combination for varying speeds and attitudes relative to the horizontal, a mathematical analysis of pure trajectory curves, assuming the terminal velocity of the man-seat combination and man alone being a constant, was made and super-imposed on these results the graphical analysis of CEPE's T-33 Aircraft Ejection Seat Trials. By using this method the pure mathematical analysis was distorted to bring it into line with the experimental results which in effect accounts for the varying terminal velocity of the man-seat combination.

Method

Figure II shows the velocity vs time curves obtained from the test analysis of T-33 Aircraft—Ejection Seat Trials carried out by CEPE. From these curves it will be seen that by integrating the area under the curves up until the time the chute is fully open, the distance travelled by the trajected body may be found for varying speeds up to 600 knots. It will be noted that curves A & C are average results for twelve velocity vs time plots as recorded in the tests. Curves B & D are interpolated in accordance with the general theory of trajectory curves.

Figure III is a table of the values of the vertical displacement when time is 6.8 seconds (average chute opening value) for a trajectory envelope with the attitude of the aircraft varying from +15° to -90° at speeds from 150 to 600 knots. The trajectory envelope is shown as Fig. IV. It is readily apparent from this illustration that if the aircraft is in the +15° attitude, a climb attitude, no height is lost during an ejection. For example, if you follow the +15° curve (normal climbing attitude of most jet aircraft) to the 150 knot line you will note that the altitude gain is approximately 40 feet, the 300 knot line indicates a gain of approxi-

FIG. III

ATTITUDE OF AIRCRAFT RELATIVE TO THE HORIZONTAL (Time lapse between ejection and fully open parachute, 6.8 seconds)	VERTICAL DISPLACEMENT IN FEET AT 150K	300K	450K	600K
+15° (Normal climbing attitude of most jet aircraft)	+40	+140	+350	+550
0° (Horizontal Flight—power must be available)	−300	−250	−170	−80
−15° (Normal gliding attitude of most jet aircraft)	−550	−620	−710	−800
−30°	−730	−900	−1150	−1390
−40°	−840	−1220	−1520	−1960
−60°	−920	−1330	−1920	−2600
−90°	−1140	−1640	−2400	−3100

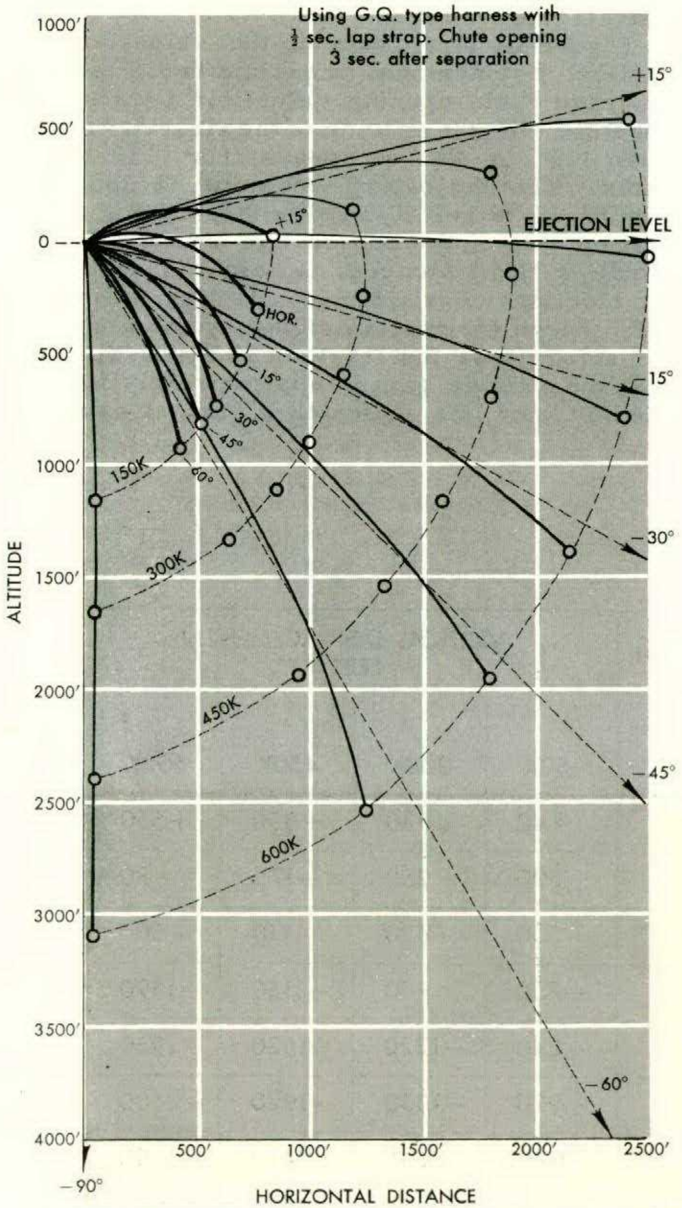
Graphs and Charts prepared by S/L Hugh Kerr mately 180 feet. If you follow the -15° curve (approximate gliding attitude of most jet aircraft) the loss of altitude at 150 knots is 300 feet, at 450 knots the loss is 560 feet. If the aircraft is in a 60° dive the loss of altitude at 600 knots is 2550 feet.

Altimeter Reading Required for Safe Bail Out

While this illustration tells us the altitude lost during an ejection, other than in a nose up attitude, it does not tell us the indicated altitude at which a safe ejection can be made. The next step is to relate this safe height to an altimeter reading when in these different attitudes and speeds to ensure that the time is

FIG. IV

TRAJECTORY ENVELOPE
FOR
SPEEDS 150K TO 600K
THROUGH +15° TO −90°



available to allow the chute to deploy. In order to accomplish this it is necessary to consider all the errors inherent in a pressure altimeter, along with the height consumed by the crew or crews to go through the necessary procedure to effect ejection at the safe height requirements of the trajectory envelope.

Let us consider two examples. The first, when the aircraft is under control, and the second when the aircraft is out of control.

In the first case, let's go back to Fig. IV. It is clear that the attitude and the speed of the aircraft is an important factor. If the nose of the aircraft is pulled up to the 15° attitude, no height will be lost during an ejection. If ejection takes place in a nose down attitude, the graph clearly illustrates the height that will be lost. In other words, get the nose of the aircraft up before you eject. This is vital at low levels.

In the second example, let us assume that the aircraft is out of control. In cases such as this we can expect the aircraft to assume a definite nose down attitude and the airspeed to build up. In this case, the lag error is of paramount importance, and as it has been explained earlier in the article, the altimeter error is such that the altimeter is unreliable to indicate your height.

In one case, a pilot in a CF100 was letting down from 40,000 feet. A tape recording of his R/T transmissions during the descent indicated that all was well when he was passing through 30,000 feet. At 23,000 feet he indicated that he was having difficulty in controlling his aircraft. At 14,000 feet he told his observer to stay with him and then a D/F tone was heard, indicating bail out. The observer had cleared the aircraft but his parachute did not have time to open. The pilot did not have time to eject. This case is worth close examination. The time that elapsed between 23,000 feet and ground impact was 23 seconds. The time that elapsed between the pilot's call to his observer and the beginning of the D/F tone was 14 seconds. This works out to a vertical speed of 1000 fps.

A time factor study involving an emergency escape from a tandem crewed aircraft was conducted by DRML.* In this study, experienced pilots and navigators performed escape sequences in a full scale mock-up of a tandem crewed aircraft equipped with Martin-Baker seats. The time factor using a normal sequence with patter took an average of 6.8 seconds to complete, the maximum time taken was 11 seconds. The canopy opening and seat travel time must be added to this sequence time. This time is 1.4 seconds, therefore, the time that is required to effect a successful ejection in a tandem crewed aircraft is an average of 7.2 seconds and a high of 12.4 seconds. The altitude that is lost during the ejection sequence,

*Defence Research Medical Laboratories

assuming a vertical descent of 1000 fps is from 7200 to 12,400 feet.

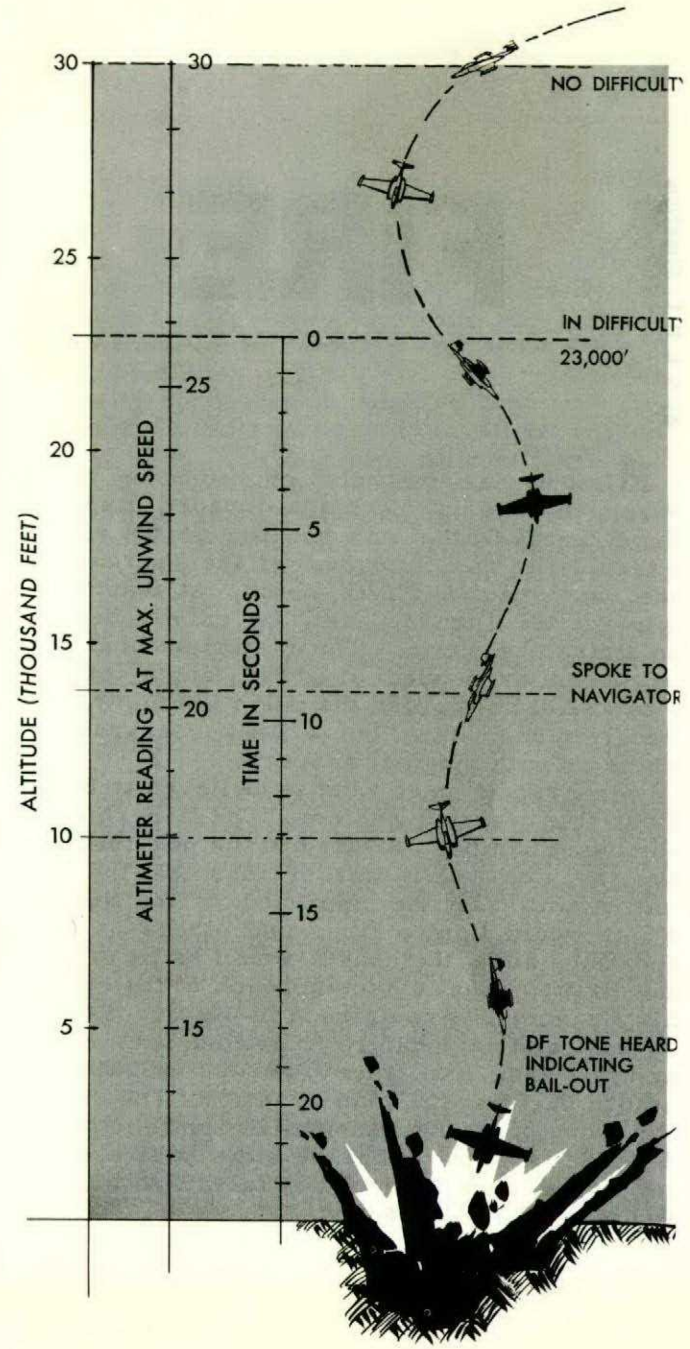
The time required to effect lap strap release, man-seat separation, time delay and parachute development, will vary with different seat installations, but the average time is between 3 and 4 seconds. The rate of vertical descent will decrease on ejection due to wind speed deceleration (drag), but this decrease is ignored as a built-in safety factor in computing the altitude that is required to effect a safe ejection. Using the 1000 fps vertical speed, a further 3000 to 4000 feet is required to allow parachute development, therefore, the height required for a safe ejection from a tandem crewed aircraft is from a 10,200 foot average to 16,400 feet.

In a single occupant aircraft the problem is not as great. The pilot can activate the ejection system in 1 to 1.3 seconds. To this add the 1.4 seconds for canopy release and seat travel, and 4 seconds to chute deployment, and the time is 6.7 seconds. At 1000 fps the altitude required is 6700 feet.

In one case the pilot of a Sabre aircraft entered a spin at altitude. For reasons unknown, he could not recover from the spin. He squawked MAYDAY and continued his efforts to recover. He advised passing through 15 and 10,000 feet and stated that he was in a spiral dive at that time. A D/F tone was picked up and lasted for 2 seconds. It was computed that the automatic change-over from the frequency that the pilot was using, to 121.5 would take 2 seconds, therefore, the time from ejection to ground contact was approximately 4 seconds. The pilot ejected from the aircraft and seat separation took place before ground contact was made. The parachute did not open. There were other factors involved in this particular case, but the importance of time and the need to come to a quick decisive decision is clearly illustrated.

The Altimeter Reading

In the two cases that were explained, the crew of the CF100 and the pilot of the Sabre waited too long before deciding to eject. In the CF100 the vertical speed was computed to be 1000 fps (Fig.V). The time from 23,000 feet to ground level was 23 seconds. The rate of descent was approximately 60,000 fpm or 1000 fps. The unwind speed of the altimeter is 36,000 fpm or 600 fps, therefore, the altimeter reading was decreasing at the rate of 600 fps while the aircraft was descending at 1000 fps. In 23 seconds the altimeter reading would decrease by 13,800 feet. The reading on the instrument would be 9200 feet. Add to this the average height that is required by a tandem aircrew to effect the ejection sequence which is 10,200 feet and this adds up to 19,200 feet. Taking into consideration the position error, which is 2500 feet, the pilot of this



aircraft should have ejected when the altimeter was reading approximately 21,700 feet.

We have many cases where aircraft have gone out of control and crashed, and the aircrew did not attempt to bail out. It is a normal reaction to try to regain control, and this is effective in many cases, but if the decision as to when to eject is based on the altimeter reading, the odds are against the aircrew.

At a high uncontrolled rate of descent in sub-sonic aircraft, the rate of descent is approximately 1000 fps (600 knots). You know how long it takes to effect a safe bail out from your aircraft, it is vital that you—DON'T WAIT TOO LONG.

FIRE

by S/L G.L. Sheahan

History has the habit of repeating itself. When the Spanish Armada invaded England, Sir Francis Drake was bowling on the village green. He was informed of the approach of the vast Spanish Fleet which, at that time, was off the Lizard. Yet, he calmly decided to finish the game. The historians and biographers expounded at great length that Sir Francis did not press the panic button when he received the news, but a little research has come up with the real answer.

Sir Francis used what is believed to be the first fire warning system. The fishermen on the coast had been alerted to the possibility of the invasion and it was decided that the first native who saw the approach of the Spanish Fleet would light a fire, and others at fixed locations along the coast, would be lit to warn the British Fleet of the approach of the enemy. Sir Francis had confidence in the fire warning system and fortunately it proved serviceable and this gave him time to assess the situation before deciding his plan of action. The rest of the story of Sir Francis Drake and the Spanish Armada is history, but the story of fire warning lights, and particularly false fire warning lights was just beginning.

In all engines the source of power is heat and the source of heat is fire. When the fire is contained in the fire pot there is no difficulty, but when it spills over and starts burning the hardware we have to know about it fast. To give an immediate indication of a fire we have a fire warning system. Basically, the system is a simple electrical device that is activated by excess heat. Probes are located in areas where an overheat is most probable and when the overheat takes place the pilot gets an instantaneous indication in the cockpit. Now if we were blessed with a fire warning system that was 100% reliable, the action of the pilot, after receiving a fire warning, would be straight forward. This is not the case. In the last 367 cases of fire warnings indicated in the cockpit, 165 warning lights were activated by an actual overheat condition, 190 warnings proved false, and in 12 cases an actual fire existed. Because a fire warning can be false, it is too easy to be lulled into a false security. Instead of treating all fire warnings as an actual fire situation, we are apt to treat all fire warnings as false. This is an extremely unhealthy situation and it recalls to mind too vividly the story of the boy who called wolf.

There are two types of fire warning lights, a red and an amber indication. Some aircraft are fitted with a red warning light only, while others have both. When the aircraft is fitted with the red and amber lights, the red light indicates a fire or overheat in the forward engine compartment or ahead of the fire wall and the amber light indicates a fire or an overheat in the aft compartment behind the fire wall, such as in the tail section. When the aircraft is fitted with the red indication only, there is no way to determine if the fire is in the fore or aft section of the engine.

Fire warning lights illuminate under three conditions; fire, an overheat, or a false warning. In all cases of a fire warning light illumination the first action to be taken is to retard the throttle.

A Fire

When a fire warning is indicated in the cockpit and there is evidence of fire in the engine, immediate action must be taken. In a single engine jet aircraft this means bail-out, or crash-land if low altitude does not permit bail-out. In a multi-engine jet or a piston engine aircraft the action that is taken depends on the circumstances and the instructions contained in the dash 1 EO.

An Overheat

An overheat condition will activate the fire warning system. Normally, when the throttle is retarded, the light will go out. By using a low power setting the aircraft can usually be landed safely. An example of this type of overheat could be a split air casing in a T-Bird or a blow-by in a CF100. There is also danger of getting a false indication under these circumstances. A case is known where the light went out when the throttle was retarded, and the aircraft was returned to base. An investigation revealed that there was a fire and the reason the light went out was the fact that the wire leading to the probe had burned through.

False Fire Warning

This is the curse of all aircrew and maintenance personnel. There is no positive way of determining if a fire warning light is false. The steps to follow in the EO are clear and when you take the correct action and there is no evidence of fire, decide whether to land the aircraft or to bail out. This bail out applies to single engine aircraft. If there is no evidence of fire and the light stays on, you can never be sure if there is a fire or not. As a matter of fact, you can't be sure that there isn't a fire even if the light goes out.

A review of DFS files on accidents and incidents, where fire warning lights were involved, reveals two important factors. Firstly, the aircrew are becoming complacent when they get a fire warning, and secondly, a number of aircrew are most uninformed of the fire warning system of their aircraft. Because of this lack of knowledge of the warning systems, the actions that are taken in the air, when a fire warning light illuminates, leave much to be desired. An example of this lack of knowledge is clearly illustrated in the following example. A pilot with over 1200 hours of jet experience and over 300 hours on type had completed an air test in a T-33 after an APX25 Mod. This particular modification requires extensive re-wiring of the aircraft systems. During a beacon letdown, the pilot thought he saw the amber warning light blink, but he wasn't sure. He continued the letdown and maintained a careful check of the instruments. The JPT, rpm and warning lights were normal. At 8000 feet, in the penetration turn, the amber (aft) light again began blinking. He raised the speed brakes and reduced the throttle to idle and the amber fire warning light came on steady. A cockpit check revealed all instruments reading normal. He declared an emergency and flamed out the engine. In his report he stated that he realized he could not make base with the engine flamed out and as he knew the cloud base was between 3500 and 4000 feet, he continued the glide and broke cloud just under 4000. He spotted an abandoned airfield and realized that he could not make it without power, so he relit the engine. After relight, the tail pipe temperature and rpm again read normal. He used a maximum of 70% rpm and flamed out the engine again when he was in a position to carry out a forced landing. The forced landing was successful.

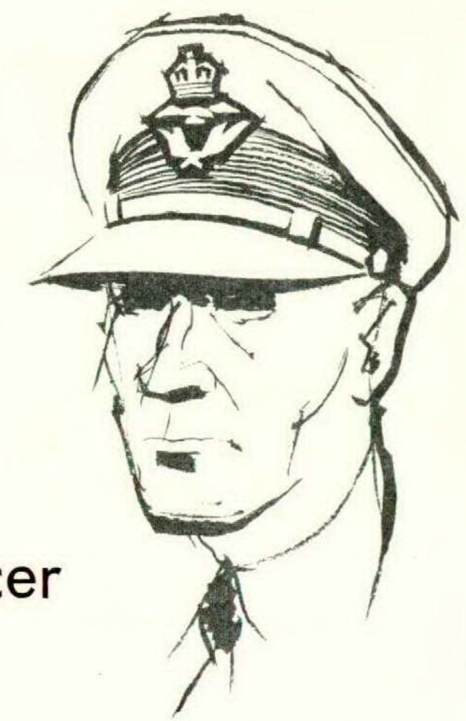
In this case the pilot must have assumed an actual fire condition, because he flamed out the engine. In doing so he committed himself to a bail out. By staying with the aircraft down to 3500 feet and then deciding to restart the engine with a fire warning light staring him in the face, is living dangerously, and he was fortunate that the fire warning was false.

The instructions in EO 05-50C-1, para 37R (2), page 60, outlines the action to be taken when the tail section light (amber) comes on in a T-33.

"Just airborne or during flight: Throttle back but maintain flying speed and check for tail-pipe temperature above limits or zero (due to burned wires and connections) or black smoke from tail section. If the tail-pipe temperature is high but no smoke is seen, it is probable that an overheat condition exists. Continue flight at reduced power settings and land as soon as possible. If smoke is apparent, a fire probably exists. Close the throttle, main fuel shut-off switch and all fuel switches, and jettison tip tanks containing fuel. Decide whether to force land or eject."

This business of fire warnings is a most serious one. Every warning must be treated as a real thing until proved otherwise. To combat aircrew complacency every effort is being made to improve the fire warning system to reduce the incidents of false fire warnings. To combat the lack of knowledge among the aircrew of the fire warning systems a local educational program must be instituted at squadron level. Aircrew must know the procedures as laid down in the respective EO. Because a pilot has 500 hours on type is no indication that he is up to date on the fire warning system of the aircraft.

So get on the ball—be like Sir Francis Drake. He was organized, he knew his fire warning system and he had time to assess the situation. You be organized and you can make the right decision when the fire warning lights up.



The Value of a Good First Officer

by F/L R. Emery - 4 OTU

This is not intended to be just a pep talk to those who consider themselves unfortunate to be flying as First Officers. Its purpose is to cause them, and all aircrew, to reappraise the co-pilot's job in the light of today's flying, and see the vital link which he has become, almost unnoticed, in recent years.

In these days of ever increasing congestion at terminals and on the airways, with aircraft growing bigger and more complex, and radio and navigation equipment becoming increasingly elaborate, who would deny the need for an extra pair of hands, an extra pair of eyes, an extra pair of ears, in the cockpit. The First Officer's primary task, then, is to relieve the captain of enough of the extra work involved in modern flying that he can concentrate on the aircraft and its safety.

In one way first officers are a bit like wives. First you have to make up your mind if you really need one, and once you've decided that you do—better get a good one. But there the similarity ends, because while luck plays such an important part in the selection of a wife the author has had little success in changing the habits of his spouse (she still squeezes the toothpaste tube in the middle after 17 years). On the other hand first officers can be taught to do a good job, and show considerable ability to adapt themselves to the whims of command and squadron, and if they can achieve the right mental approach to their job, they will continually strive for improvement. This is the mark of the professional flyer, and a man should welcome the opportunity to be a first officer. This is the time of training, of acquiring the experience and background that will stand him in good stead when his turn comes to be the captain of an aircraft worth several million dollars.

His Job on the Team

In the first place, it is necessary for everyone concerned to remember that in a modern aircraft the crew must be a team—a team bound together by their common desire to maintain the safety of the aircraft and the high standards of the RCAF, and by their mutual respect for each other's professional ability. And in that team the first officer has a vital role. In it he should be given every opportunity to display those virtues so necessary if he is to become a captain, and should be helped and encouraged in every way by his skipper. Let us consider first what his duties are.

He should assist the captain in the selection of the best route for each flight and ensure that all publications and charts are available and up to date. If the proposed flight is via airways he should prepare the flight log in order to be familiar with all the peculiarities of the route. At the weather briefing he should be consulted, and should understand the reasons for the decisions taken by the captain, then prepare the flight plan and assist in any way the captain may require. He should precede the rest of the crew to the aircraft, and carry out all the aircraft checks prior to starting, so that when the captain has finished briefing the passengers, there will be no delay in starting engines and getting away. The radio tuning will normally be left to him and he should be able to anticipate the captain's requirements most of the time. He will be responsible for all R/T, for copying all clearances and weather sequences received, and for maintaining a fuel log and weather cross-section throughout the flight. He should prepare passenger bulletins at regular intervals and carry out the navigation and maintenance of the flight log whilst on airways. Through all of this his first responsibility is to maintain a careful lookout both on the ground and in the air. Yes, he has plenty to keep him busy, and if he is a good first officer, we see certain personality patterns emerging. What are they?

Characteristics of a Good First Officer

The characteristics that mark a good first officer are the same as those that make a good captain—or a good officer in any field. He must have a professional approach to his job, and strive for the highest possible standards in his flying and knowledge of his work. This requires continual training and study in many fields. In particular, he must know all the rules and regulations which govern his actions—no easy task these days because of the frequent changes made necessary by a rapidly expanding military and civilian aerial fleet. He should be familiar with the duties, and the limitations of the other members of the crew, so that he knows what assistance he can receive, and understand the conditions which sometimes make that assistance unreliable or even unavailable.

He must strive continually to gain the confidence of his crew by displaying good judgement, and having confidence in them is half the battle. He should not expect standards of other members of the crew which he does not uphold himself and in fact, he should strive to be an example in every way. His dress and deportment should show a pride in his uniform and the service it represents. He should always be clean shaven and well groomed so that the impression which he creates with the crew and passengers is always favourable. He should practice moderation in all his habits, never allowing himself to be accused of not being fit for the responsibility of caring for many peoples' lives.

He should display initiative at all times so that the minimum of supervision is required in his areas of responsibility, and he can render the maximum assistance to his captain.

Perhaps no single virtue carries more weight with the rest of the crew than that of reliability—that sureness borne of repeated day to day sound judgement and good practice. He should know his work, his aircraft and its equipment, and his own limitations.

He should practise self-control and learn to obey orders without hesitation. He should be sure that he understands the orders, requesting clarification if necessary, and be sure that they do not conflict with regulations.

He must always remain courteous to those he meets. The passengers on his aircraft will gain confidence from a prompt and simple answer to their questions, and peoples' impressions will be coloured by the treatment

Part of a team

they receive on RCAF aircraft. This is particularly true of any representatives of the press or radio whose opinions and impressions are relayed by the written and spoken word and have such a big effect on public opinion. At foreign bases it is equally important to leave a good impression of our service and Canadians generally.

One extra way in which a good first officer can go beyond the call of duty is in his relationship to his captain. He will win a lasting friend and always be welcome if he will endeavour to complement the mood of the skipper. All human relationships become strained at times, and if the captain's mood is occasionally more abrupt than seems warranted, the first officer can be the oil on troubled water, or he can needle the captain into further irritation. True, the path of mediator isn't everybody's meat, but the rewards are great for those who can manage it.

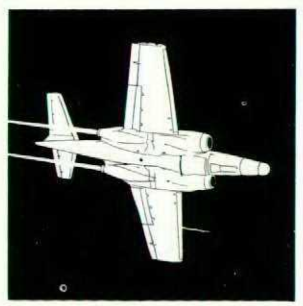
The Captain's Responsibility

If you are already a captain, how does your first officer compare with this description? Is he the paragon we've described? Almost certainly not in every detail. But does he compare favourably? If he does, you are indeed a fortunate man and should be truly grateful. If he does not, the chances are that somewhere you have not been as good a captain as you should. How did you compare with the description? After all, you are continually an example to him and he may feel free to slip in those areas where he has observed you slipping.

The captain has a responsibility to ensure that his first officer gains the maximum in experience from every flight, so that he will become fit as rapidly as possible to take his place as a captain. Be sure that your commands are clear and easily understood, and that they do not conflict with any orders or regulations. Be prepared to accept constructive suggestions and weigh them without prejudice, explaining fully the reasons if you cannot adopt them. Give your first officer every opportunity to accept some of the responsibility for each flight, and to do his share of the flying consistent with his ability and flying conditions at the time. Not only will this retain his interest and keep him busy, but it will add tremendously to his confidence and his experience, and make him both a better first officer and a better potential captain. In particular, don't only give him those duties which he does well. He needs the practice in the duties with which he has difficulty. If he is to step into your shoes, he needs to be an all-rounder, good at all the things that will be expected of him. Encourage him to give passenger briefings and do other duties which are traditionally the prerogative of the captain.

To be a good first officer is a worthy aspiration—to have one in a crew is a blessing. It is the best insurance for a safe flight.

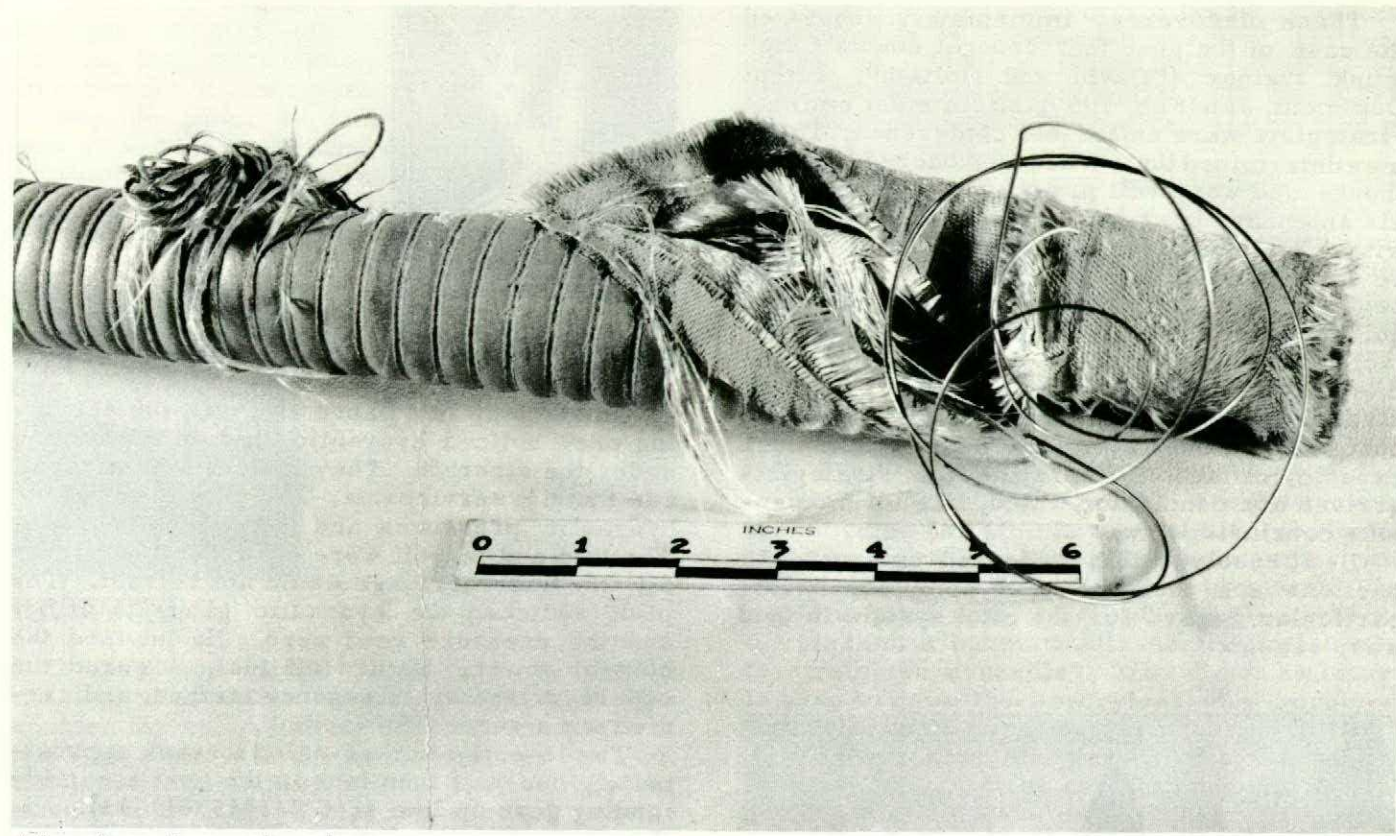
Arrivals and Departures



DISCREPANCY

Just after takeoff in a CF100 a loud banging noise was heard. The noise seemed to originate from the rear of the fuselage. A quick cockpit check indicated that all instruments were reading normal. At this time the control column began moving erratically. Speed was reduced and although the banging persisted and the control column continued to shake, the pilot carried out a slow speed check that indicated that the aircraft was controllable. The circuit was continued and a landing was carried out.

An inspection of the gun bay area revealed that the starboard high temperature flexible hose, EO 05-25F-4, part 2, page 646, figure 149, item 10, had become detached from the elbow assembly. This hose directs air to the air conditioning unit. The air pressure was sufficient to cause the hose to whip around inside the gun bay. This buffetting caused the nylon wrapping to unwind from the hose which released the wire core. The loose wire then became entangled in the control cables, causing uncontrollable oscillations of the control surfaces. It was discovered that only one hose clamp had been used while the dash 4 EO clearly indicates the need for two hose clamps—at each end of the hose—to hold the hose assembly securely into position. A random inspection of four aircraft at this unit disclosed two other aircraft in the same condition. This aircraft had had a P400 inspection prior to this incident and the technician referred to the dash 2 EO, where only one clamp is indicated. The cause factor in this incident was directed to the contractor for the failure to provide the necessary two clamps. It is ironic however, that a discrepancy in the dash 4 EO and the dash 2 EO was not picked up previously.



A banging noise was heard

HASTE MAKES WASTE

A maintenance crew, consisting of two group 3 technicians, was carrying out a P300 on a Canuck aircraft. The crew had filled the starboard engine with oil when they were directed to another aircraft which urgently required a starboard engine change, in order to have sufficient aircraft serviceable for an impending operation.

After completing the engine change the aircraft was hurriedly removed to dispersal for run-up.

During run-up internal damage was caused because this crew did not replenish the starboard oil tank.

The incident was blamed on inadequate supervision and the haste imposed on the technicians.

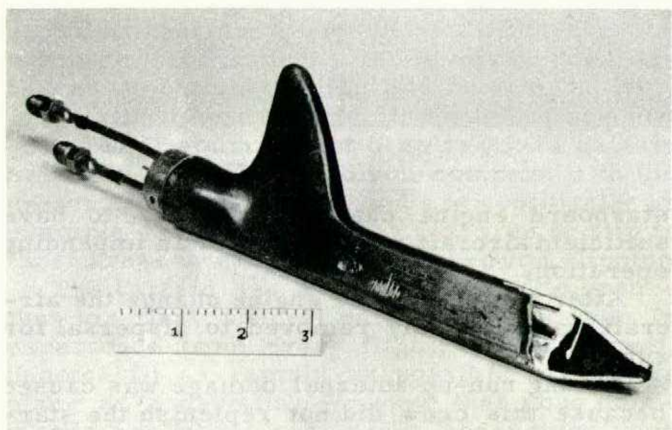
JET AGE INSECTS

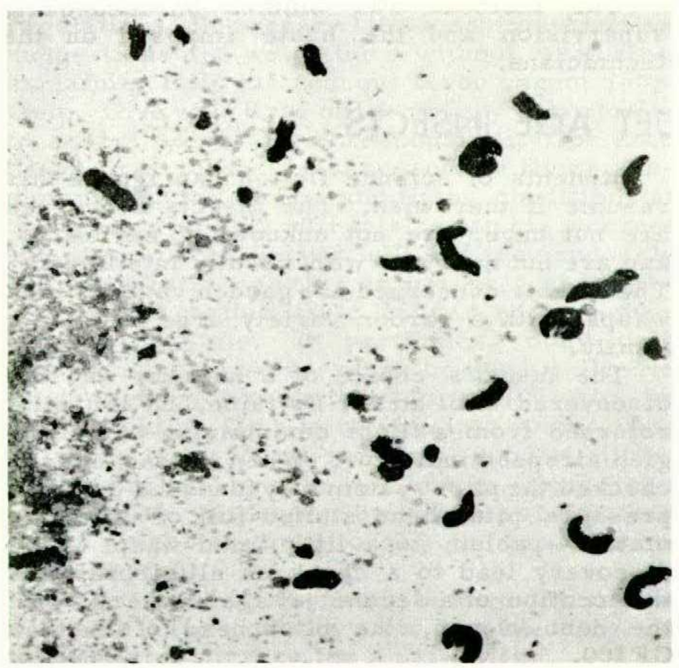
Students of science fiction can ignore this resume if they wish. The insects concerned are not huge, are not unknown to earthlings, and are not endowed with cosmic intelligence. The insects concerned are garden variety 'mud wasps' with a garden variety urge to raise a family.

The insect's choice of a nursery was not discovered until an Air Division, CF100 pilot returned from a flight complaining of a sluggish airspeed indicator. When the technicians checked the pitot system they found the dynamic pressure pitot head stuffed full of vegetable matter—pablum to a little mud wasp. This discovery lead to a check on all aircraft and the location of a second jet age nursery, with the door closed, the pitot head of another CF100.

These discoverers immediately suggested the case of the gnat that brought down a Chipmunk trainer ("David and Goliath", Flight Comment, Jan-Feb, 1959), so our most eminent strategists were called in to conference. These men determined that: When approached from the front a mud wasp will preen his whiskers, wave his antennae, buzz, and refuse to be reasoned with. When approached from the rear he will be downright unreasonable. Flank attacks fail because the mud wasp will do a 90° turn quicker 'n a cat—and one always finds oneself facing the unreasonable end. Attacks from the 6 or 12 o'clock position have lead to a medical discharge (ever try spearing a fly with a needle?) but never to a destroyed mud wasp. After much experiment and deliberation the strategists arrived at a conclusion which, like all momentous conclusions, was simple and safe.

Be it resolved that BFIs and external inspections are thorough and complete having particular regard for the pitot system in mud wasp season.

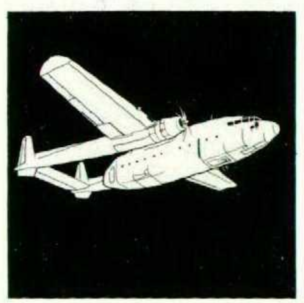




MAINTENANCE

On start-up in a Sabre aircraft, the servicing crew noticed hydraulic fluid on the tarmac under the aircraft. They checked the aircraft and found it serviceable. The pilot checked the hydraulic pressures and found them normal. The taxi and takeoff were normal. After takeoff, the undercarriage would not retract. The pilot switched the hydraulic gauge to utility and the pressure read zero. He advised the control tower, burned off fuel, lowered the undercarriage by emergency method, and carried out a successful landing.

The investigation revealed a crack approximately one-half inch long in the port assembly landing gear up line (26CT/19158811-11). Although hydraulic fluid leakage through this cracked line on the ground was not apparent, the servicing crew should have carried out a more thorough investigation before allowing the aircraft to take off. It is granted that the leak was not easily detected because there was no pressure in the up line, but the presence of fluid under the aircraft certainly indicated a defect in the aircraft hydraulic system. In maintenance, as in anything else, you can't take anything for granted.



HOW TO WIN FRIENDS

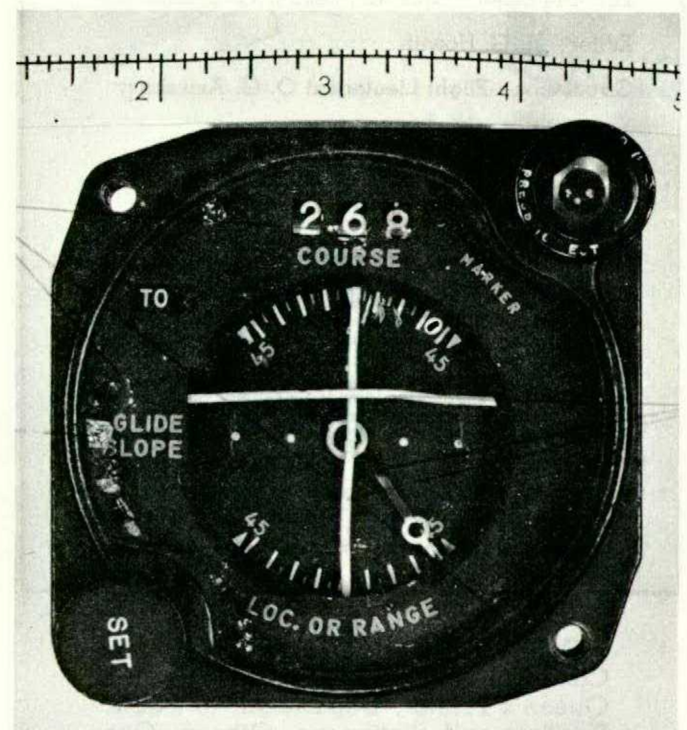
A C119 was parked at a civilian airport close to the passenger terminal. A runup was being carried out on the starboard engine of the C119 as a TCA aircraft parked on the ramp to de-plane passengers. A large piece of cowling, which had been left on the ground beside this C119, was blown by the prop blast towards the TCA aircraft barely missing the TCA groundcrew, the TCA aircraft, and came to rest under the TCA aircraft. The C119 was parked 120 feet ahead of the TCA aircraft.

The RCAF personnel who were running up this aircraft displayed poor airmanship. The parking area on the ramp, in the vicinity of a Department of Transport terminal building, is hardly the place to runup an engine at high power settings, particularly when there are civilian aircraft deplaning passengers.

This is not the way to win friends and influence people.

HAYWIRE

A crew was signed out to carry out a VOR training trip. After takeoff, radar departure advised the crew that the aircraft was north of the VOR airway. The captain checked his VOR equipment and noticed that the relative heading pointer was bent so that the vertical pointer could not pass it, and that the vertical needle had a large dent in it to the left. The No.2 VOR was not functioning properly, so the captain decided to break the glass on the No.1 VOR set and straighten the needles, since the instrument seemed to be serviceable otherwise.



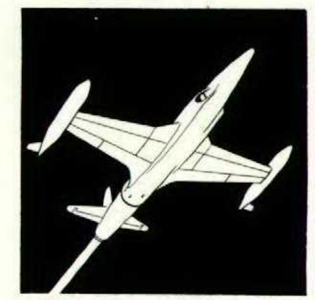
A broken glass—a broken instrument

He broke the glass on the No.1 instrument and tried to straighten the needles, but was unable to get the instrument to function. He then interchanged the 1 and 2 VOR receivers; the No.2 set was serviceable. He carried on with the training exercise.

We have had numerous occasions in the past in which aircrew had to take drastic action in the air to save aircraft from becoming involved in an accident. Twice, the crews had to chop holes in the aircraft floor to lower the nosewheel; on another occasion, an Expeditor pilot had to unfeather a rough-running engine to maintain altitude and to execute a safe landing. There are many similar happenings; in every one, the crew evidently knew the aircraft system, and displayed airmanship of a high order.

This time, however, the crew was on a training trip. The unserviceability was noted 10 minutes after takeoff. The weather was VFR. Safety of flight was not involved. Why would a pilot with years of experience break the glass of a hermetically-sealed instrument to straighten a needle? Why didn't he return to base to have the unserviceability repaired, so that he could carry out the proper VOR trip?

We don't know the answer, but the administrative deduction he has suffered should help remind him that the days of haywire repairs are over.



MULE CREASES T-33

During a BFI on a T-33, an airman required an energizer to supply ground power to the aircraft before the check could be completed. In the hangar the airman hooked the towbar eye of an energizer into the towing hitch of a 45D8 shop mule and proceeded to the aircraft. On arrival at the aircraft and parallel with the starboard side the mule was turned into position. At this point the energizer became detached and ran forward striking and damaging the trailing edge of the starboard flap and the nose of the energizer.

Investigation revealed the mule hitch and lock were in perfect working order and efforts to free a towbar properly locked in place were unsuccessful.

The assessment, Personnel - Negligence, in that the airman failed to properly secure the energizer towbar.

LETTERS TO THE EDITOR

I must protest against the direction your finger pointed in the "Near Miss" section of the November-December issue. I refer to the groundcrew who installed a rudder lock on a Dakota.

Granted he made a mistake by installing only the rudder lock instead of all locks, but the finger should point without wavering to the captain and co-pilot. They had FIVE separate opportunities during mandatory walk-around and cockpit checks to discover the non-operating rudder, and missed every time. As for taxiing and taking off without use of the rudder—words fail me.

Groundcrew generally make their share of mistakes (believe it or not, they ARE human) but they should not carry the can for something which is 10% their fault and 90% someone else's fault.

F. Rothery, WO1
AFHQ/AMTS

(I thought I had pointed the finger at just about everybody. I think everyone concerned in this hassle is 100% wrong.—Ed.)

Dear Sir:

The other day we learned that one of the three helicopters based here had pranged a short distance from the field. Being curious by nature, I had to snoop around a bit, view the wreckage (C class damage), and enquired about the cause. It seems this chopper was flying a large crate of live turkeys to a destination up the valley. Shortly after takeoff the birds panicked, busted out of the cage and began flapping hysterically about the cockpit. The pilot decided to terminate the flight and the landing, under less than optimum conditions, was goofed up.

I haven't given you much to go on, but we were wondering how your experts in DFS would cause-assess this accident. Possibly under one of the following headings?

(a) Pilot Error - He should have opened the door and let the turkeys out into the circuit.
(b) Materiel - The cage, of poor design came unglued.
(c) Briefing - Supervision - The birds should have been suitably tranquilized before emplaning.
(d) Acceptable - Bird strikes (internal).

(This one has us guessing.—Ed.)

FLIGHT COMMENT

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Editor—H. G. Howith
Circulation—Flight Lieutenant O. G. Amesbury
Artists—J. A. Dubord
H. K. Hames
Editorial Assistant—Mrs. N. L. Chenier

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BIRD WATCHERS' CORNER

WRITEOFFUS OBSCURUS

The final roosting grounds of this bird, more commonly known as Independent Ibis or Lonely Loon, is often a hole in the ground. He leaps from the perch and is never heard from again. When he gets into difficulty he doesn't squawk to others at the home nesting-grounds about his trouble, nor does he ask for assistance. He considers a squawk for help for the use of chicken-birds only.

This species is becoming more rare owing to the nature of its behaviour.

CALL: ICANHACKITICANHACKITICANHACKIT
WHA'HOPPEN?WHA'HOPPEN?WHA'HOPPEN?

BEWARE the IDES of MARCH

Forewarning is hereby given all legions to be watchful of the following evil omen:

I Gusty winds

II Thunderstorms

III Lightning

IV Hail

V Icing

ROMAN SAFETY LEAGUE