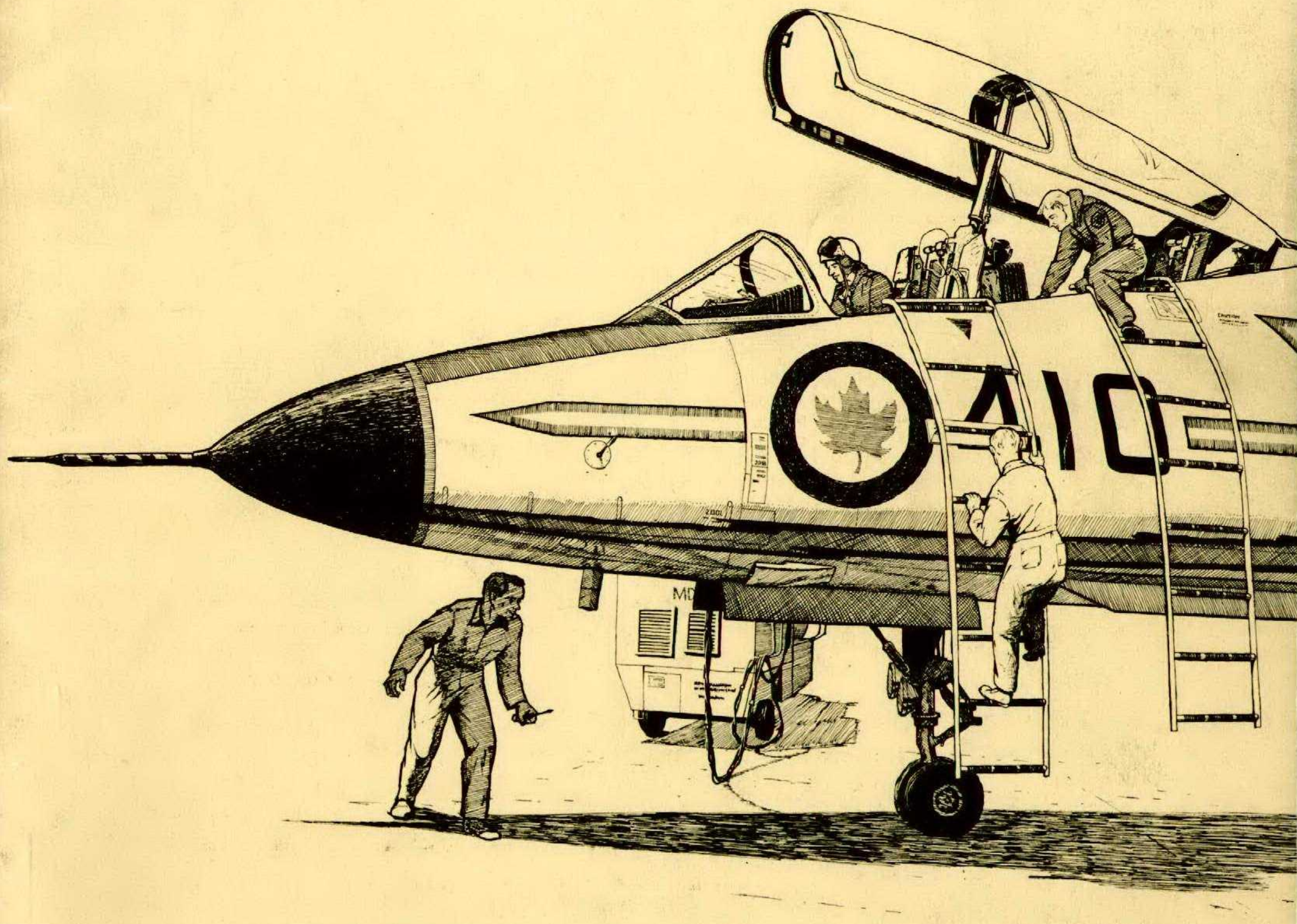
RCAF

FLIGHT COMMENT



FLIGHT SAFETY IN ADC

MAY • JUNE • 1962

FLIGHT COMMENT

May • June • 1962

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ROYAL CANADIAN AIR FORCE
DIRECTORATE OF FLIGHT SAFETY

The flying safety aspects of "round-the-clock" operations in Air Defence Command are of vital importance to success in our assigned role. Although Flight Safety cannot properly be regarded as an end in itself in military air operations, it is a major requirement if essential resources are to be conserved from needless waste. This Command has a continuing requirement to derive from the resources allocated to it the maximum in defensive potential and cannot afford needless depreciation of material and personnel assets due to accidents. Our flight safety program, therefore, remains of extreme importance and will continue to influence all facets of operations.

In recent years a positive approach to flying accident prevention coupled with increasing experience and a reduction in technical difficulties has produced a significant progressive decrease in the accident rate within the Command. For the first time we were able to report two completely accident-free months during 1961. The supervisory staff, aircrew, and technical personnel responsible for this achievement may be justly proud of their success.

Now, however, a new and formidable challenge emerges. The next few months will see the introduction to service of the CF101B and the CF104 weapons systems in rapidly increasing numbers. Statistically it can be shown that, in the past, a substantial increase in accidents has invariably followed a re-equipment project of this nature.

The immediate aim of those concerned with flight safety, directly or indirectly, must be to establish a precedent during this critical period by maintaining the accident rate at or below that which exists at present.

This aim can be achieved, despite the difficulties involved, by energetic application of the principles which have served us well in the past. Renewed awareness of the problem and a conscientious attempt by all to adopt a truly professional attitude toward their duties will ensure that everything possible is done to minimize accidents and thus to maintain the combat potential of Air Defence Command.

(WR MacBrien) A/V/M
Air Officer Commanding
Air Defence Command

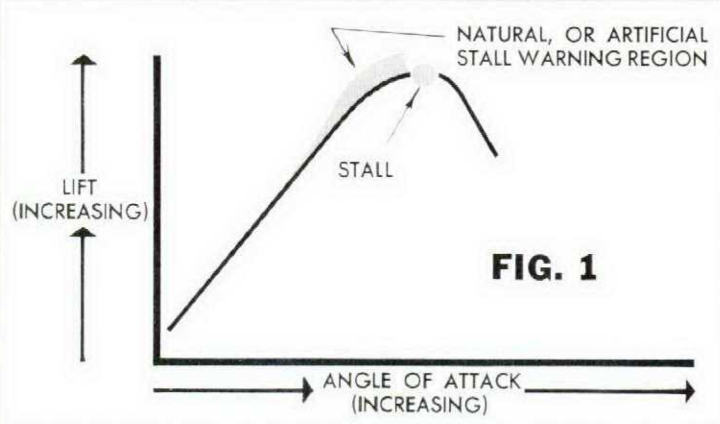
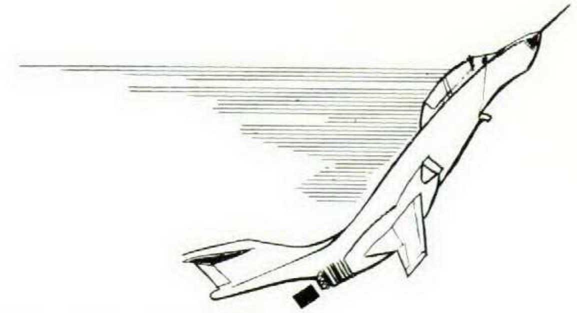


FIG. 1

PITCH-UP...

by S/L D. Warren



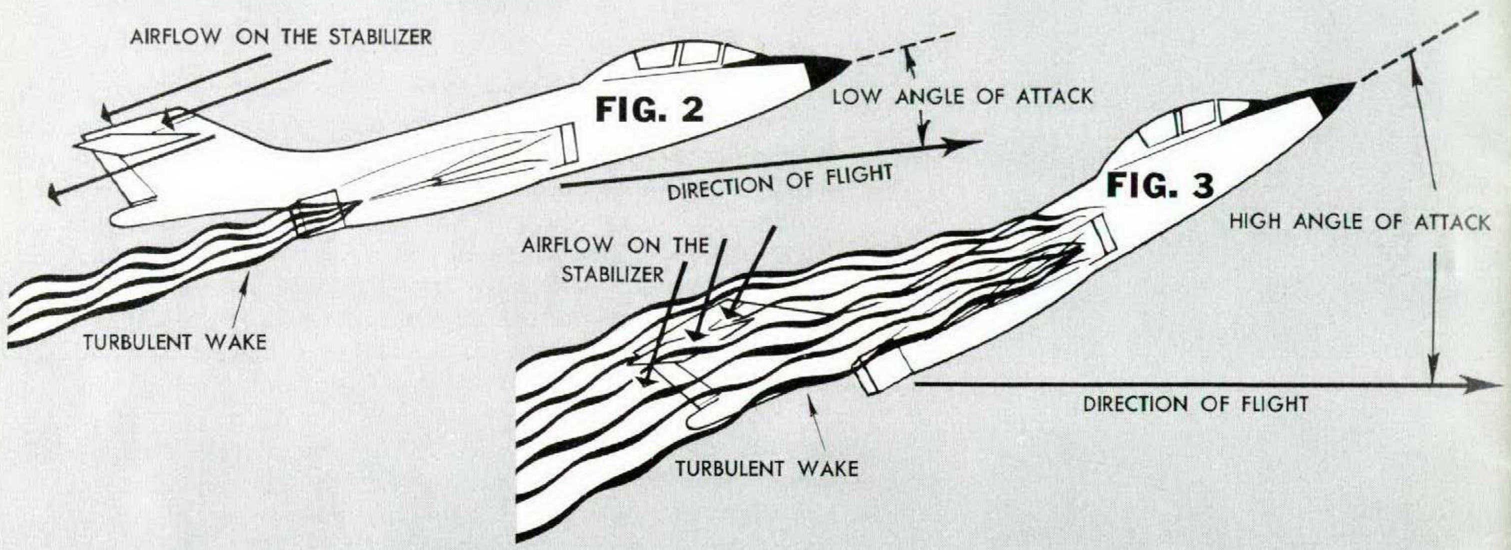


FIG. 2

FIG. 3

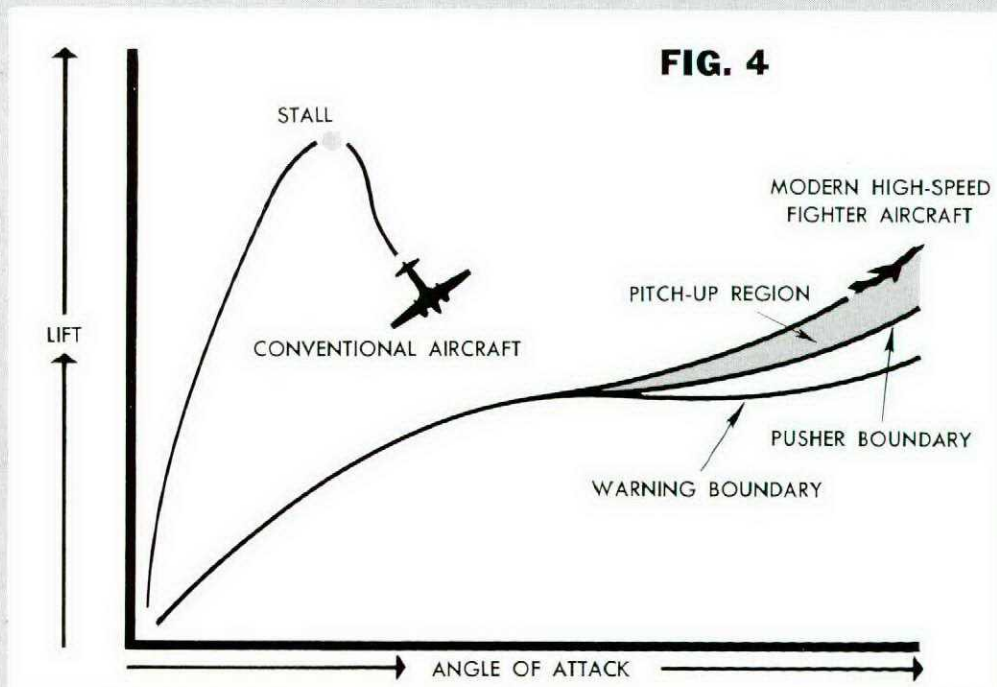


FIG. 4

As the second generation of the supersonic fighter aircraft has developed over the past decade, a new phrase has been introduced into the aviation vocabulary to describe deterioration of flight characteristics at high angles of attack. When deterioration reaches the point at which longitudinal instability results the name popularly used to describe the phenomenon is "pitch-up".

McDonnell Aircraft Corporation, producers of the RCAF's new CF101B "Voodoo" fighters, gives this definition:

"'Pitch-up' is the nose-up tendency developed at high angles of attack that will, if not recognized and compensated for, lead to the temporary loss of controlled flight. 'Pitch-up' provides an upper limit to the useable angle of attack flight boundary similar to the conventional stall boundary in low-speed aircraft. It is a function of airplane angle of attack and not related to pitch attitude.

"In order to better understand pitch-up, let us first examine the phenomena of the conventional stall.

"An airplane is stable in the longitudinal direction if an increase in angle of attack produces an increase in nose-down moment. Thus, in a longitudinally stable aircraft, if the pilot is to increase angle of attack he must apply increasing amounts of nose-up elevator to counteract the increasing forces tending to push to nose-down.

"Normal stall occurs as the increase in angle of attack causes a deterioration of the lifting flow on the wing until the point is reached where lift starts to decrease with additional increases in angle of attack. The degree of longitudinal stability present establishes the amount of control stick force and travel required to bring an airplane up to this stall point.

"At stall, the conventional airplane is at a high angle of attack. The wing lift starts to decrease and the nose drops. With the aid of nose-down control, flying speed is regained rapidly and a normal pull-up completes recovery. Artificial stall warning devices are usually installed in aircraft that do not have sufficient natural prestall buffet to warn of approach to the stall." (See fig. 1.)

The longitudinal stability characteristics of modern fighter aircraft deteriorate at high angles of attack; the reason for this phenomenon will be described in the following paragraphs. Pilots should not forget that attempting to fly modern fighters in the pitch-up area is as foolish as trying to fly an older type of aircraft past the stall limit. In both instances, one no longer has control; one is merely a passenger.

The primary cause of pitch-up is the intensified downwash over the stabilizer of a modern aircraft at high angles of attack. Fig. 2 shows the airflow at low angles of attack, that is, in level flight; fig. 3 shows the changed conditions of airflow experienced at high angles of attack.

Other influences on the amount and intensity of downwash are, chiefly: location and size of engine inlets, type of wing-fuselage joint, and relationship of the horizontal stabilizer to the wing, in so far as it is mounted "high" or "low".

Downwash is, therefore, the downward

component imparted to the flow over the wing by the trailing vortex field. The intensity of downwash is proportional to the lift generated by the wing and the distribution of this lift. Thus, the downwash pressure experienced by the horizontal stabilizer is increased greatly at extreme angles of attack by the concentration of wing lift on the inboard portion of the wing as tip stall develops.

If the aircraft is left to continue into a fully developed pitch-up condition, the nose comes up like the head of a Western bronco—and the rider gets the same type of ride—rough! Recovery technique varies with the type of aircraft—so read the AOIs.

The operational pilot has several devices to warn and protect him from entering this undesirable flight condition. Pitch Control Systems (PCS) may vary among types of aircraft, but all:

(a) warn the pilot that he is approaching that portion of the flight envelope at which pitch-up takes place; and
(b) take corrective action automatically if the aircraft continues to approach pitch-up after the pilot has been warned.

These systems are an integral part of the aircraft, and have been incorporated in the design ever since pitch-up was first discovered to be a hazard.

The pitch control systems consist of devices which give a central computer the following information:

Angle of attack — from angle of attack probes;
Mach number — from pitot static system;
Rate of control-column movement — from a sensor on the controls;
G forces; and
Position of undercarriage and flaps.

This information is fed into the central "black box" of the PCS which (a) warns the pilot that he is approaching pitch-up, either by horn, light, or physically "shaking" the control column; and (b) applies a force of about 30 lbs. to the control column if the first warning is disregarded or the pilot's reaction is slow.

The stage of flight at which the warning is given is called the PCS Warning Boundary; the stage at which corrective action is taken is called "Corrective" or "Pusher" Boundary.

Because Pitch Control systems are automatic, they are sometimes called Automatic Pitch Control systems (APC) depending on the aircraft manufacturer. Naturally, black boxes vary in size and number from one aircraft to another, but essentially they do the same job.

Pilots who fly the RCAF's new aircraft are thoroughly trained in the functions and performance of their aircraft, and agree that the pitch control system is vital to safe operation. The PCS, then, is one of a pilot's best friends. To see how this friend operates, have a look at fig. 4 page 2. Further information can be gleaned from "F101 Voodoo Pitch Control System" by the McDonnell Aircraft Corporation; "F104 Test Pilot's Note Book", by Glenn Reeves of the Lockheed Aircraft Corporation; the CF104D AOIs (EO 05-165B-1A); and the CF101B AOIs (EO 05-185A-1).

WIRED FOR DANGER

Recent accidents have demonstrated that on the landing roll, the BAK/6 arresting cable may bounce and damage main gear doors, brake lines, etc. The BAK/6 is used at United States Naval Air Stations and some U.S. Air Force Bases.

It is recommended to avoid takeoff and landing ground rolls over the BAK/6 when possible. No formation takeoff or landing should be made when it is necessary to roll over this barrier.

Pilots should check Flight Planning publications to find out where the BAK/6 barrier is installed.

VOR STICKING

There have been several recent occurrences of VOR indicators (To-From) sticking at station passage. Once, both sets failed simultaneously to indicate. It has been recommended that the following be emphasized: accurate estimates, close cross-checking of both sets, a tap on the instrument glass if a "hung flag" is suspected, and cross-checking with LF ADF if available.

Moreover, as a reminder, it's a good idea to compare RMI heading with magnetic compass continually. Several accidents are on record which suggest "suspected errors up to 45° in the fluxgate system.

Flight Safety Foundation

SGT. N.W. SPLANE

A pilot returning to Portage in a T-bird suspected a gyrosyn compass failure about 40 minutes out. When Kenora confirmed the failure, he notified Portage and arranged for a no-compass GCA run. Weather was reported to be above minima.

When the aircraft arrived over the AG beacon, the pilot commenced an ADF2, and contacted GCA through 10,000 feet. The weather was now deteriorating rapidly, with blowing snow, and braking action reported as nil. Similar conditions prevailed at the alternate, so the pilot decided not to divert.

Sgt. N.W. "Mickey" Splane, the #2 GCA controller, established radio contact and gave an excellent no-compass run—capable, confident and professional. Weather conditions on landing were such that without a highly-skilled controller, a safe landing was doubtful.

About five minutes later, another T-bird pilot was preparing for an emergency let-down with a dead UHF. By transmitting on 314 kcs, Sgt. Splane brought him in for a successful landing, again with adverse weather conditions, and despite the lack of radio contact.

Sgt. Splane deserves a Good Show for two highly-efficient talk-downs, without which both pilots might well have been in serious trouble.

FLIGHT SAFETY IN ADC

by Air Defence Command
Staff Officers

The professional approach is one quality which is common to all successful organizations engaged in the operation of aircraft. Whether the operation is large or small, military or civil, inherently risky or normally safe, optimum results can be attained only by the greatest possible contribution on the part of the individuals toward the goals of the group.

The goals of flying organizations are many and the degree of risk which can be accepted to achieve them also varies within wide limits. Despite this variation in risks and in goals any sound organization, whether operating for profit or fulfilling a military requirement, must safeguard its resources against waste by striving for the maximum in safety measures commensurate with the nature of its role.

Flying operations by Air Defence Command are designed, primarily, to contribute toward its assigned objective of providing combat-ready forces for the operational use of NORAD. In a broad sense, the vast majority of the flying may be described as operational training, whether it is carried out by an OTU trainee or by a veteran All-Weather crew.

The nature of the Command objective is such as to require a delicate balance to be struck between accident prevention, on the one hand, and the requirement for effective and realistic training on the other. Flight Safety cannot be regarded as an end in itself under these circumstances; instead it must be considered as a vitally important means to the end of accomplishing the objective of the Command.

The professional approach to the attainment of the Command's objective requires the elimination of all unnecessary hazards. Environmental, procedural, maintenance and materiel hazards must be sought out, identified, and eradicated without compromise. It can be argued, with justification, that some risks must be considered acceptable by the nature of the duties to be performed.

While this theory may be accepted, with reservations; it must be applied with discretion. Before methods or procedures known to be hazardous are accepted as being essential the operational value to be derived from their continued existence must be carefully weighed against the degree of risk involved.

A typical gathering of AW squadron aircrew. One of the twice-daily meteorological briefings prior to day or night operations.

If the prevention of flying accidents was the only objective of the Command it would be possible, by emphasis on safety measures, by avoidance of flying under difficult weather conditions, and by overcautious practices in general, to maintain a statistically satisfactory record of operations. This is not the case; the operational objectives must be met in the national interest, and all restrictions imposed to increase safety in flight must be carefully examined to ensure that they do not have an adverse effect upon operational capabilities.

While restrictions and regulations pertaining to flying operations can and do serve a useful purpose in preventing accidents, they also have drawbacks. Over-regulation at any level can discourage initiative in thought and action and thus an educational program must supplement and, where possible, replace regulatory action. The reasoned avoidance by trained personnel of inefficient or hazardous actions and methods will eliminate more potential accident causes than will blind adherence to regulations. This professional attitude can be developed by continuous educational programs emphasizing safe practices and the awareness of flight safety problems.

The Flight Safety Officers of Air Defence Command play a major part in organizing and carrying our programs of this nature among the personnel concerned with the operation of aircraft.

Squadron pilots designated as Flight Safety Officers are attached to each Flight of All-Weather Squadrons. Through their efforts, the group is kept abreast daily of the latest technical developments, and of changes in environment or other circumstances which may effect operations. During the squadron's weekly ground training periods, these pilots arrange suitable lectures and drills to provide refresher-training to the aircrew, and to ensure also that new developments or procedural changes are explained in detail.

Station Flight Safety Officers, who are selected for their mechanical aptitudes and interest in the work, have a somewhat different function. These specially-trained pilots, who have completed a tour with a squadron and who have received the RCAF Flight Safety Officers' Course, are uniquely placed to influence the education of aircrew and technical personnel

This is the type of publication stand found in the corner of many AW squadron crew rooms. The flight safety publication display rack is eye-catching and practical and serves the purpose of keeping publications neat and readily available.

ADC alert crews may be called to operate in weather or under conditions which would call a halt to normal flying operations. These officers take advantage of the ice on one of our airfields.

alike.

By virtue of being employed as test pilots for aircraft on completion of maintenance work, they are able to maintain close contact with the latest technical developments. In addition to ensuring that information is disseminated to all concerned, and to initiating training programs, they are responsible for assisting as necessary in the investigation of accidents and incidents, and for ensuring that appropriate reporting action is taken.

As specialist advisers to Commanding Officers on Flight Safety, the Station Flight Safety Officers have the responsibility of actively seeking out and eliminating potentially hazardous situations in all phases of air and ground operations. They are supported in this respect by Station Flight Safety Committees which are chaired by the Commanding Officers, and which meet monthly.

The minutes of these meetings are sent to the Command HQ where they receive the appropriate circulation and consideration. Flight Safety Officers also encourage the submission of Near Miss Reports and Operational Hazard Reports, and handle their processing at unit level.

The Command Flight Safety Officer and his staff maintain close contact with the unit specialists, and ensure the rapid transmission of information between the stations and Air Defence Command Headquarters. Their assistance or advice is available on request to the units at any time, and through them, the facilities of the Directorate of Flight Safety are available when needed.

The Flight Safety organization described, by enlisting the support of aircrew and ground personnel in the interests of accident prevention, has contributed toward a progressive decrease in flying accident rates within Air Defence Command over the years since its formation.

There can be, however, no relaxation of effort if reverses in the trend are to be avoided. There is no doubt that the introduction of new aircraft to the inventory will create major problems in accident prevention. These problems can and must be solved if waste of resources is to be avoided.

Air Defence Command must succeed in meeting its objective. To this end, sustained success in minimizing flying accidents must be achieved. When success or failure in these matters can influence the strength of continental air defences, there can be no excuse for failure to adopt the professional approach.

LOOSE RIVETS ON SABRE WINGS

Reports from the field indicate that some doubt exists as to what constitutes a "loose rivet". The following information has been compiled to assist servicing personnel to determine whether a rivet is loose. Note, however, that this information is general, and doubtful conditions should be referred to a competent authority.

The flexibility of a wing is desirable and, since the rivets are working in the wing, a slight seepage can be expected in the presence of fluids or other foreign matter. Consequently, a trace of oil, fuel, water or graphite on the skin surface adjacent to a rivet head is no indication that the rivet is loose. Experience has also shown that cracked paint around the head of a rivet is not a positive indication either.

If the heads of a row of rivets seem to have tipped, and chipped paint is observed around the heads, you may assume that the wing has been subjected to excessive loads, and these rivets should be considered loose. (Figure 1.) If there is any doubt, one or more of the rivets should be removed carefully, to preserve the rivet shank for inspection. If excessive loading has been applied, the shank may have become joggled and/or the rivet holes misaligned. Yet, single rivets with tipped heads may also be the result of faulty workmanship.

In brief, rivets on Sabre wings should not be considered loose unless they can be moved or pried loose, or over-stressing verified by inspection.

The following remedial action may be taken for loose rivets on Sabre wings:

(1) Loose explosive rivets may be replaced by oversize Cherry rivets with no limitation on the number that may be replaced. Where the hole is beyond tolerance, the next larger shank diameter of the nominal shank size Cherry rivet may be used.

(2) Loose AD (A17S-T4) rivets may be rebucked.

(3) Loose DD (24S-T4) rivets may be rebucked. If the rivets are in the hardened condition, extreme care should be taken when rebucking them to avoid cracking. A short and steady burst of the rivet gun is recommended. To determine the serviceability of cracked rivets, see Figure 2. Refer also to 6 and 7 following.

(4) Loose rivets are not permissible in the front and rear spars. They must be replaced by the original type of rivet. Cherry rivets are not permissible as substitutes in these areas.

(5) The maximum allowable number of loose rivets in a wing is one rivet in five.

(6) If not more than two adjacent solid rivets in a row of rivets are loose, oversize Cherry rivets may be used, with the exception of the front and rear spar areas.

(7) If more than two adjacent solid rivets are loose, they must be replaced with solid rivets, unless authorized otherwise.

(8) Loose high-shear rivets on the wing are not permissible. Loose high-shear rivets may be replaced by similar size AN bolts (AN3 to AN20 series with ultimate tensile strength of 125,000 to 145,000 psi), provided that no spot-facing is required. Flush high-shear rivets may be replaced by a special screw made from a standard AN509 (Figure 3), provided that the original hole and countersink are not oversize.

CANADAIR SERVICE NEWS

FIGURE 1
TYPICAL ROW OF TILTED RIVETS

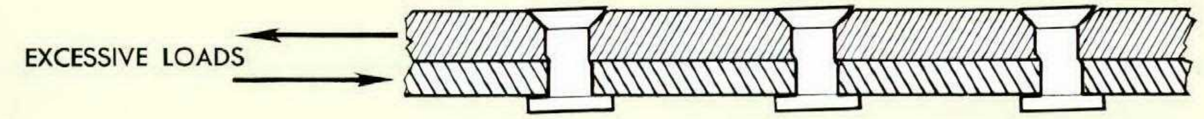
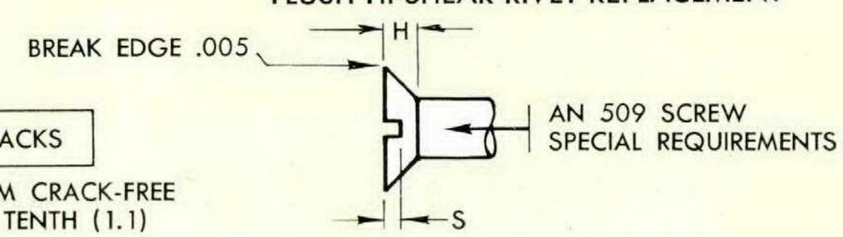


FIGURE 3
FLUSH HI-SHEAR RIVET REPLACEMENT



SIZE	MAKE FROM	H	S (MAX)
3/16	AN509-10	.047-.045	.036
1/4	AN509-416	.061-.059	.036
5/16	AN509-516	.068-.066	.045
3/8	AN509-616	.078-.076	.045

1. STAMP HEAD "SPL"
2. SUFFICIENT CLEARANCE AND FLAT SEAT REQUIRED FOR NUT
3. AFTER MACHINING RE-PLATE (CADMIUM)

OPEN AND SUPERFICIAL INTERSECTING CRACKS

THE UPSET RIVET HEAD SHALL HAVE A MINIMUM CRACK-FREE SURFACE DIAMETER EQUAL TO ONE AND ONE TENTH (1.1) TIMES THE RIVET SHANK DIAMETER

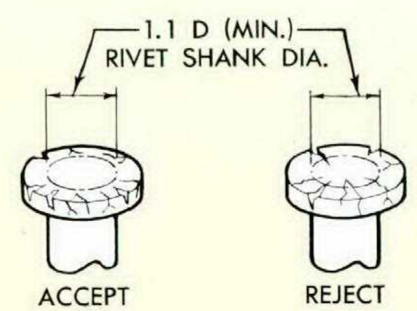
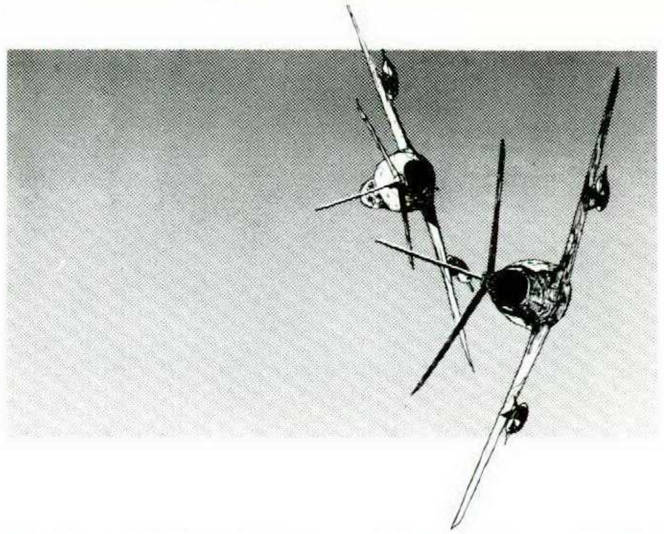


FIGURE 2
TYPICAL CRACKED RIVET HEADS

CHIP ON MY SHOULDER



How often, when you were a boy, did you get into a situation which ended with either you or another fellow reaching down dramatically, selecting a suitable chip, placing it on the shoulder, and hurling the challenge; "Go ahead, knock it off, I dare you!"

It took some nerve to knock it off. It took more nerve to leave it there to exhibit self-discipline, and endure the taunts of the others.

Now we are men, working at a profession which requires a great deal of self-discipline. Professional military pilots must exercise it perhaps as much, or more, than any other vocation.

Here we may examine for a moment the paradox in the selection and training of military pilots. We want men who are sober, conscientious, trustworthy, responsible individuals, who will train for a relatively dangerous job (check the insurance rates!), be aggressive, self-confident, and ready to risk combat prepared to win, knowing full well the price of losing. In short, we want men who fill all the requirements of bank clerks to behave a good deal like prize-fighters.

Now there's nothing wrong with bank clerks or prize-fighters. It's just that, in civilian life, we don't usually find one man with the traits of both. The RCAF faces a unique problem, because civilian flying doesn't entail the aggressive, complete-the-mission outlook required of military pilots. Aircrew recruits join the RCAF to fly; it must be assumed that they have in mind the combat role of the air force, as opposed to the passenger or cargo-carrying role of civilian companies. RCAF pilots therefore must be aggressive individuals, ready to accept challenges and their attendant risks.

As our aircrew trainees progress, the discipline of the service and the example of older, experienced and respected pilots begins to influence them. The young pilot realizes that the day of the white scarf is past, and that accepting unnecessary risks for "kicks" is frowned upon—indeed, taboo.

After his graduation from FTS, the RCAF pilot is channeled to Transport, Maritime, all-weather or day-fighter operations. (The latter will soon change to the tactical strike role upon the introduction of the CF104 into Air Division).

Because of the nature of the aircraft he will fly in ATC and MAC, and the long hours spent under training in the right-hand seat, and with the example of the highly-qualified captains he will associate with, the young pilot makes adjustments, and his mental attitude soon encompasses self-discipline. But the problem of the pilot trained for all-weather operations, and particularly the Air Division role, is different than his counterpart in the two Commands operating large aircraft.

The fighter pilot is trained to be aggressive, to have dash, high morale, and readiness to "tangle" when required. He is trained by men who, in many instances, have won personal distinction, and who have brought credit to the RCAF by displaying these qualities. Most of these officers have retained these virtues, and it is natural for the young fighter-pilot trainee to emulate them. The difficulty is that he must, at the same time, exercise the great self-discipline necessary to direct his actions properly when flying alone, or without direct supervision.

How does all this philosophizing fit into our flight safety program? Here's how: The RCAF has had some fatal accidents because pilots flying day or all-weather fighter aircraft exhibited aggressive spirit, and, at the same time, a lack of self-discipline. Take these three examples; in each, regulations were contravened:

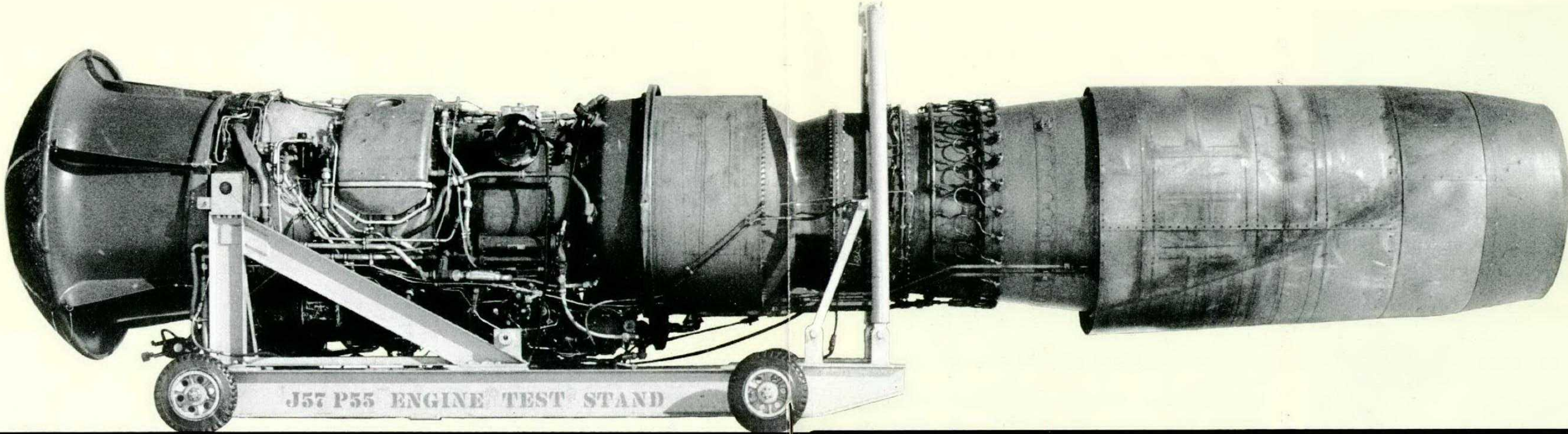
(a) the mid-air collision, where the young, or not-so-young pilot, attempts to demonstrate to the occupants of the other aircraft how he can really "bounce" them through his superior skill;

(b) tail-chases where excessive "G" is pulled, or manoeuvres are carried out near the ground where there is no margin for error; or

(c) disregard for the weather, where prudence and common sense indicate a diversion, but fear of friendly teasing overrides discretion.

When you consider them, these situations are just another kind of the old "knock that chip off my shoulder" game. If we, as fighter pilots, become mature enough to exercise self-discipline and say No! we can take the friendly teasing of our fellows, and thus show that we are professionals, not amateurs.

THIS OBJECT CAN WRECK A JET



FOD MUST GO

Jet engines are giant vacuum cleaners; the larger and more powerful they become, the more effective their ability to ingest foreign objects—bolts, nails, wire, stones, tools, parachutes, clothing, humans, and so on.

Larger and more powerful engines are installed in the new aircraft coming into RCAF operational service. It follows, then that foreign object damage is becoming an ever-increasing menace, and must be wiped out.

Everything entering a jet engine except fuel, air, and water in the proper proportions is a hazard, and is almost certain to cause damage attributable directly to a human failing, whether by a top supervisor or an inexperienced technician.

Despite many flight safety programs, there are still a number of problem areas which, with some concerted effort, could be eliminated.

We all know the old truism about an ounce of prevention being worth a pound of cure. To prevent financial drains and the loss of life, the time to eradicate FOD is now.

CAUSES

Jet engines have been damaged by foreign objects at every stage of their life histories, both on the ground and in the air. Examples of the latter are bird strikes and ricochets from air-to-ground or air-to-air firing in combat.

It is on the ground that FOD is almost always unacceptable, because carelessness or negligence is usually the culprit.

Negligent maintenance personnel and poor airfield housekeeping are not the only cause of FOD on the ground. Pilots, too can be at fault. One aircraft was damaged seriously when the engine was fired with the pilot's parachute resting in the intake. Another pilot started an aircraft and took off without removing the nose plug.

Maintenance and housekeeping laxity can lead to malfunctions during run-up, or partial or complete failures in the air. Result: an unscheduled engine removal; and those responsible are rarely found. Much of the damage comes from aircraft and engine fasteners like nuts, bolts, nails, washers, or safety wires, ingested from the tarmac, as well as from objects such as pebbles, earth, sand, pieces of concrete, cinders, wood, or ice. Good housekeeping could practically eliminate occurrences of this kind.

Careless maintenance can result in wrenches, pliers, caps, and even technicians, ending up in the engine intakes. As a matter of grisly fact, a technician was recently ingested into a Sabre—the first instance of such an accident in over eight years. Fortunately examples like that are not too prevalent.

Every time an engine has to be repaired, money must be spent on fixing the engine (in the field or at the factory), on freight costs to and from the place of repair, on miscellaneous handling costs, on increases in the support procurement of new engines and spare parts, on increased maintenance and supply workloads at each echelon; and it all results in decreases in general preparedness.

REMEDIES

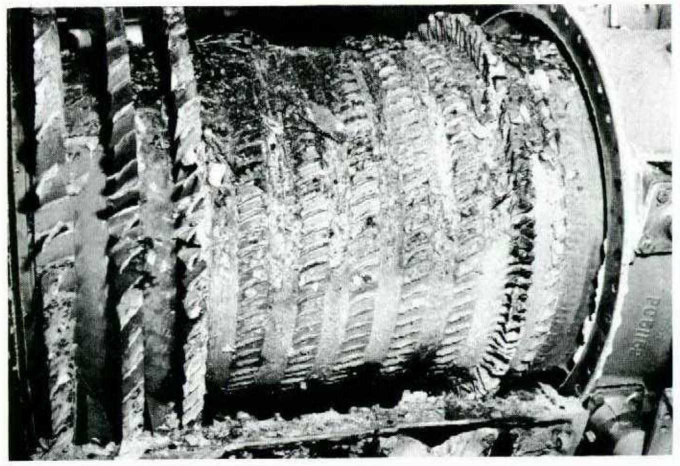
It isn't possible to pinpoint the causes of FOD and attach responsibility to one trade or unit. What is needed is the co-operation of all ranks, from commanding officers to new technicians. Supervisors at all levels have an important part to play.

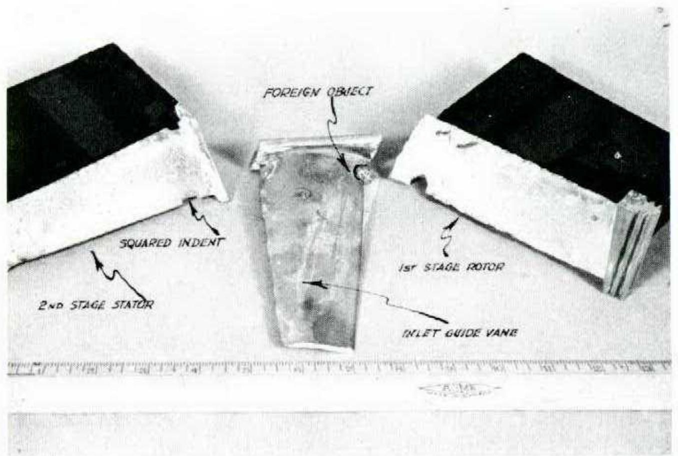
The new anti-FOD program should stress both maintenance and servicing techniques, and airfield housekeeping.

HOUSEKEEPING

Good housekeeping means keeping the entire airfield clean—not just the ramp areas, but the overrun, taxiways, and runway shoulders too.

On the ramp, hazards range from a small piece of wire to a towing vehicle or bulldozer. Neglected taxiways or runways are often covered with engine-destroying rocks, pieces of concrete, and ordinary trash. This





is definitely the fault of inadequate inspection. Now inspection isn't just a cursory look-around, but a good habit requiring continuing and exhaustive effort. And, most important of all, inspection is useless unless followed—promptly—by corrective action.

How about it? Are YOUR cleaning methods and equipment adequate? Can YOU recommend an improvement? Is all non-essential traffic on aprons, taxiways, and runway prohibited?

Moreover, are your perimeter roads adequate? Do you have a planned aerodrome cleaning schedule? Is your current manpower able to provide the necessary supervision, and is it in a position to take corrective action to eliminate hazards?

The unit commander ought to be able to answer all these questions with a definite YES. If he can't, it's his responsibility to correct deficiencies himself, or to bring them to the attention of his Command Headquarters.

Foreign Object Damage has to go. There's no room for it in the RCAF. With the co-operation and vigilance of all personnel, it can be stamped out. Are you doing YOUR share?

LITTLE THINGS MEAN A LOT

DID YOU KNOW that

One micron = $\frac{1}{25400}$ of an inch = .001 millimetres?

You can just see a 40-micron particle with your naked eye?

A 100-mesh sieve will pass particles of up to 150 microns?

A human hair is about 100 microns in diameter?

One gramme = .035 ox., and 1 milligram (mg) = .00035 oz?

One litre = 1.76 pints = .22 Imperial gals?

Clean dry fuel should contain:

(a) less than 2 mg of solid contaminant, with particle size of a maximum of 5 microns, per litre of fuel; and
(b) no free or entrained water?

Jet fuels are of higher specific gravity and more viscous than gasoline type fuels?

Jet fuels have a great affinity for water?

Jet fuels act as cleaning agents, dislodging rust, etc?

Jet fuels retain particles longer than lighter fuels; for instance, a 5-micron particle settles 4 inches per hour in JP4 fuel, but as much as 18 inches per hour in Avgas?

Fuel may contain water in dissolved, entrained (suspended) or slug (free) form?

1,000 gallons of JP4 may, on cooling by 90°F, release 1 pint of dissolved water?

A separator (or stripper) removes water by use of the principle of interfacial tension (coalescing method)?

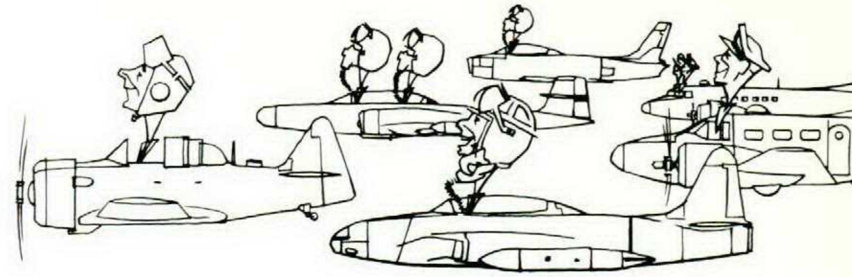
A good separator will remove entrained, but not dissolved, water?

The settling process will readily remove free water?

Additives such as corrosion inhibitors reduce water/fuel interfacial tension, and thus impair separator capabilities?

The most effective means of removing particles and water is by prolonged settling?

FUEL IS AN AIRCRAFT'S LIFEBLOOD
KEEP IT CLEAN.



HEADS-UP FLYING

WIRED FOR TROUBLE

F/O R.J. Saulnier took off in a T-bird from Calgary on an IFR clearance to Comox via Enderby, at flight level 320. The climb was in cloud from 6,000 to 27,000 feet. About 27 minutes after takeoff, the generator warning light flicked on and off for approximately 10 seconds before staying on. The loadmeter indicated zero.

F/O Saulnier immediately turned 180° and headed back to Calgary: After two attempts at reaching Calgary approach, on 119.3 mcs, he tried to switch to 121.5 and squawk MAYDAY, but the VHF failed to switch channels, and went dead.

All electrics (except fuselage tank and radio compass) were turned off. After F/O Saulnier received station passage, he let down in cloud from 27,000 feet in the northeast quadrant, and broke cloud at 10,000 feet indicated.

He re-homed the beacon; the generator blinked on and off for about 10 seconds again, before the light stayed out, and the loadmeter indicated a charge. F/O Saulnier contacted approach control on 121.5 and landed without further incident. The weather at the time was partially obscure, with visibility one mile in snow.

The intermittent power loss was caused by a loose screw in the generator switch in the rear cockpit, and wires PP302A20 and PP300A20 were also loose, making intermittent contact. Use of a split lock washer rather than a star washer could have started the chain of events. This area isn't readily accessible, and the connection is rarely broken. It was felt that this failure was an isolated case.

F/O Saulnier used good common sense and proper procedures, and refused to panic. This was heads-up professional flying in a situation which might have been even stickier if the batteries had been low.

ALERT

Mr. R. Gaudreau, a civilian test pilot employed by Aircraft Industries of Canada, carried out a run-up on a Dakota and found no malfunctions.

After the pre-takeoff cockpit check, the takeoff run began. The Dakota left the runway at 80 kts., using 44" MP. At this point Mr. Gaudreau noticed that the port engine rpm at nearly 2800.

He pulled the control back to decrease the rpm; at nearly the same instant an abnormal increase in noise and an unsynchronized engine condition accompanied another sudden surge in rpm. The starboard engine tachometer was indicating 3400 to 3500 rpm. Mr. Gaudreau cut power immediately and landed the aircraft straight ahead.

Quick brake application indicated that it would be impossible to stop because of poor braking action and lack of runway. The pilot swung the Dakota into the snow on the port side of the runway, and cut the switches. The aircraft stopped within the field boundaries, without airframe damage.

The constant speed unit had a sheared drive, which was caused by seizure of the component. This caused a runaway propeller and engine overspeed.

The CSU had been installed for only 78 hrs. 20 min. It was returned, together with the engine and propeller, to the overhaul contractor for further investigation.

Mr. Gaudreau's alert action in this sticky situation undoubtedly prevented further damage. He was flying an RCAF aircraft, and Flight Comment congratulates him on a heads-up performance. It's nice to know that our aircraft are in capable hands while flying at the contractor's.

HOT-WEATHER TAKE-OFF

Comes the hot weather, our takeoff accident rate goes up. Why? The answer is simple: of all aircraft performance characteristics, takeoff performance is the one most profoundly affected by outside air temperature (OAT).

As the temperature rises, takeoff performance goes down, but the same takeoff weights are needed for training or operations. We must, therefore, operate close to takeoff performance limitations during hot weather, when there is less tolerance for error.

To err is human, but unfortunately, the mistake in judgment which will cause a few bad moments during a non-critical takeoff, will "buy the farm" when the conditions are such that the tolerance for error is small.

While it is true that materiel failure could cause an accident on a critical takeoff (it might not if the takeoff wasn't critical), we'll look here at only those factors over which the pilot should have control.

Each aircraft type has different performance characteristics, but all are affected more or less. The heavy jet transport is susceptible to the most performance losses, but the jet fighter is affected too.

From a review of the records, it would seem that the RCAF has had more aborted TOs involving aircraft with a surplus of power, than with types which are marginal at all-up weight. Could it be that the pilots with "power to burn" get a bit burned by overconfidence?

If you don't want to end up slithering off the runway some fine hot day, you'd better read on—no matter which type you're flying.

PLANNING

Planning is the beginning of any successful operation. The more critical the takeoff, the more accurately and completely all related factors should be considered. The takeoff data in the AOIs show accurately the effects of temperature on performance. Effort has been made to show all possible variations.

In spite of this, pilots have been guilty of incomplete planning and a lack of appreciation for the effects of high temperature. For some, this was their last mistake. Remember that an error committed in planning a critical takeoff can easily nullify any emergency action taken during the takeoff—no matter how proper.

TEMPERATURE EFFECT

The pilot should understand why temperature is such a potent factor. This may be "old hat" for some, but it won't hurt to review it. High outside air temperature increases takeoff distance for two reasons, both stemming from the lower density of the air at high temperatures.

First, engine thrust is decreased; second, the ground speed required to achieve takeoff airspeed is increased.

The thrust output of an airbreathing engine is directly proportional to the weight of air passing through the engine. Since only a fixed volume of air can pass through the engine at a given throttle setting and airspeed, the weight of air passing through the engine depends entirely on air density. Since air density decreases as temperature increases, the thrust output of the engine decreases. Lower thrust, of course, means longer takeoff distance.

Some newer jet aircraft are equipped with "flat-rated" engines, so-called because, by throttle movement beyond the normal maximum setting for takeoff, the same thrust available at 60°F. is maintained up to 100°F. This feature reduces the effect of temperature, but does not eliminate it, because the groundspeed required for takeoff is increased by temperature. This, and the high takeoff gross weights at which these aircraft will be operated, means that takeoffs will still be critical in hot weather.

EFFECT ON AIRFRAME

The indicated airspeed required for takeoff at a given gross weight is independent of air density. Ground speed, however, required to attain this indicated airspeed varies inversely with air density. Since air density decreases as temperature increases, the ground speed required to attain a given indicated airspeed increases. Because it is proportional to ground speed, takeoff distance increases with outside air temperature.

TO GO OR NOT TO GO

A critical takeoff should have a definite influence on a pilot's decision in the event of an engine failure during the takeoff roll. To appreciate what influence it should have, and why, we must understand takeoff limitations and our method of monitoring takeoffs.

The present limitation for peacetime operation is that critical field length must not exceed the runway available. This means that the aircraft can usually be handled safely if an engine fails at any time during the takeoff roll. There are, however, some points in this roll where this becomes serious, and sometimes a moment's indecision, an improper procedure, or a malfunction will result in the loss of the airplane. Let's look at this situation.

V1 speed is a calculated airspeed below which a takeoff must be aborted if an engine is lost, because not enough thrust is available to permit a takeoff from the remaining runway. In the most critical situation, critical field length equals runway available.

If an engine fails before reaching the V1 speed, the aircraft cannot continue the takeoff; there is not sufficient thrust available to become airborne before running out of runway. The takeoff must then be refused, and a successful stop can usually be made on the runway. But if a tire blows, or hits a wet spot, the aircraft cannot be stopped on the runway.

If, however, the engine fails after V1 speed, the takeoff can be continued on the reduced thrust—in fact, it must be continued because there isn't sufficient runway remaining to stop the aircraft, even if brakes and all work perfectly.

It is apparent that the V1 speed is the meaningful point on a critical takeoff. Because it is the earliest point in the takeoff roll at which the aircraft could suffer an engine failure (or similar loss of thrust) and still continue safely, the pilot should obviously decide to abort if an engine fails prior to reaching the V1 speed.

If an engine fails, or any other emergency occurs after passing the V1 speed, the pilot should always continue the takeoff aggressively. There are obvious exceptions to this last statement, for instance, if the pilot was to lose control of the aircraft.

WORD OF ADVICE

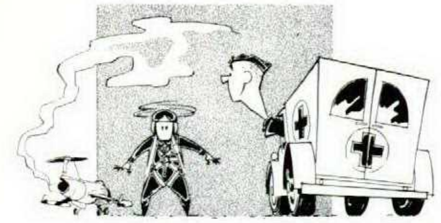
One further word of advice concerning the V1 speed, and any emergency other than an engine failure which might occur after passing this speed.

It is extremely difficult to guarantee accurate and representative aborted-takeoff data. Time required for pilots to recognize and react to emergencies will vary with every pilot and type of emergency. Tire-to-runway friction coefficient, which is the primary factor in braking performance, varies with every runway surface condition. Because of this, the capability of aborting safely becomes more marginal and less reliable as the aircraft progresses beyond the V1 speed.

Even on a critical takeoff, then, if an emergency other than an engine failure (or loss of control) occurs beyond the V1 speed, the pilot should stick with his decision to go, which he made at the V1 point.

In summary, be aware of the effects of high temperatures on takeoff performance, and understand takeoff monitoring procedure, so that you can take the right course when the lives of you and your crew depend on it. Always consult your AOIs—and don't let a hot-weather takeoff be your last.

Adapted from a Flight Safety Foundation article



NEAR MISS

WRENCHED

External and internal checks on the Expeditor were completed normally, and nothing ontoward was noticed until takeoff. Just as the aircraft became airborne, a 12" crescent wrench slid across the nose section, and came to rest just at the base of the windscreen. It was impossible to abort because of the short length of the runway, so the airspeed was kept low and an immediate circuit commenced.

The pilot intended to land; the open jaws of the wrench had caught on the hub of the windshield wiper stopping its movement. As the circuit was begun, however, the wrench started to rotate around the hub, "and it seemed probable that it might dislodge from under the wiper and cause unknown damage to the aircraft or personnel or property in a built-up area below."

The wrench was now within reach, so the pilot turned control over to the co-pilot and recovered the wrench through the clear vision panel. The rest of the trip was uneventful.

The wrench had been left in such a position that it could not have possibly been seen from the ground before takeoff, and because of the dull, dark finish it did not stand out from the dark background, and was not noticed from inside the aircraft until it moved.

The wrench could have caused a great deal of grief if it had fallen off the aircraft into the built-up area just beyond the end of the runway. An investigation was carried out and the mechanic responsible was disciplined.

THE NOT-SO-ETERNAL TRIANGLE

The article in the November - December 1961 issue of Flight Comment on distress-pattern flying has been overtaken by our new, faster aircraft—and it contained some discrepancies anyway. (See Letters to the Editor on page 24 of this issue.)

Recommended airspeeds for the distress-pattern triangle are as follows:

Aircraft	Kts. IAS
T33	200
F86	240
CF100	240
CF104	260
CF101B	280

Don't forget to fly where radar coverage is available, and at the best height. Review the article, and use your head to make a triangle.

SURE SET-UP

Aircraft operating in the area of an accident are in a deadly set-up for a mid-air collision. With no planned "pattern" existing, you'll find aircraft with widely varying speeds, including helicopters, orbiting a crash site, often in opposite directions. With much attention concentrated on the crashed aircraft, the hazard of another accident in the same vicinity is increased tremendously. Pilots orbiting an accident site for a useful purpose should maintain an extremely vigilant lookout, and pilots who have no more than spectator interest should leave the area, for their own safety and that of others.

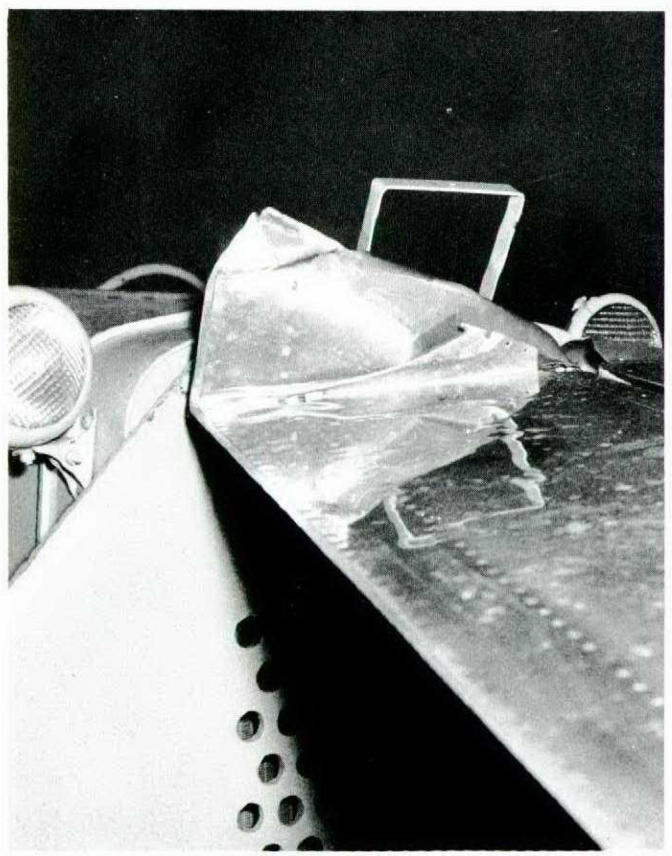
USN: Approach

ARRIVALS and DEPARTURES

VOLUNTEER

The airman volunteered to get an energizer parked four feet from the starboard wing tip of a Sabre. He assumed he had enough room to turn the mule, and back it up to the energizer, but he misjudged the distance, and the front of the mule collided with the port wing tip of the aircraft.

The weather conditions were good; the tractor on examination was found to be in good working order, with steering and brakes fully serviceable. Instead of turning the energizer tow bar, the airman tried to manoeuvre the mule too close to the aircraft—and damaged an aileron beyond repair, and a wing tip less seriously. Excessive speed was not a factor. The airman's error in judgment cost him $25.00.

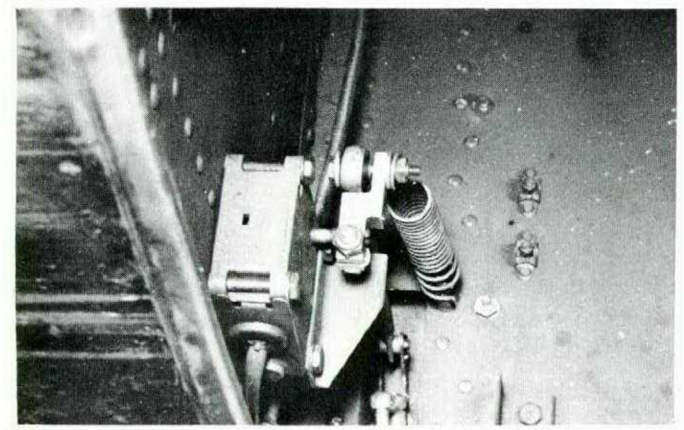


MURPHY AGAIN

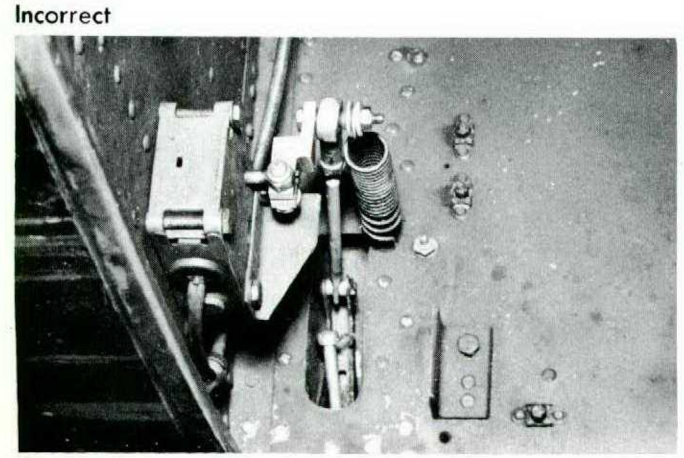
During an overshoot, a Sabre pilot selected undercarriage "up" at 150 knots. The main gear retracted normally, but the nose gear didn't; it was found by the number two to be in contact with the "D" door. The pilot selected gear "down" and made a safe, straight-in approach.

Detective work disclosed that a technician had positioned an actuating rod incorrectly. (See EO 05-5E-2, page 201, figure 2-53, detail "E"). It was old Murphy's Law again—"If an aircraft part can be installed incorrectly, someone will install it that way." The point here is that all Sabres on that particular wing were checked, and three more instances of improperly positioned actuating rods were found. The moral is obvious: HELP STAMP OUT MURPHYS!!

Correct



Incorrect



LOOSE

A Neptune was on a Maritime exercise when the No. 1 hydraulic pressure gauge began to fluctuate. Five minutes later, while the flight engineer was investigating, the main hydraulic gauge fluctuated and began to fall. The main hydraulic system was bypassed and the reservoir was subsequently found to be empty. The crew declared an emergency and headed for base.

A complete check of the hydraulic lines in the aircraft showed no breaks or leaks; on reaching base the main hydraulic reservoir was filled with all available liquids on board in the hope of gaining toe brakes, flaps and nose wheel steering. The liquids didn't help; a GCA approach and flapless landing were carried out successfully.

Why this failure? A loose pressure line from the port engine-driven hydraulic pump to the firewall quick-disconnect. The line had been disconnected to rectify a hydraulic leak prior to flight, and had not been tightened sufficiently when re-installed. Vibration during flight caused the loose fitting to back off and allowed the hydraulic fluid to escape.

The incident, assessed as Maintenance, resulted in disciplinary action against the two AETechs responsible for the loose fitting.

UP SIDE DOWN

There was a thud during inverted flight at 2,000 feet and the engine failed. As he was unable to relight, the pilot ejected. He had not inserted the safety clip in the quick release box prior to takeoff and either during ejection or separation from the seat the parachute harness was released and the pilot hung upside down, held only by the friction between the left thigh strap and leg loop. Seeing he was going to land in the River Weser, he grasped a strap with one hand and inflated his Mae West before hitting the water head first.

RNZAF Flying Safety

KID STUFF IS FATAL

Two CF100 aircraft took off on an interception exercise. After one intercept they were instructed to return to base, and the section changed R/T frequency.

During the let-down, an unauthorized tail-chase began; it turned into a simulated dog-fight at low level. The lead aircraft struck the ground, and both occupants were killed.

The investigating board found that the incident was caused by the pilot's disobedience of flying orders. Further, it appeared that both pilots were determined not to "lose" the dog-fight. Instead, the crew of one aircraft lost their lives—a high price to pay for a lack of self-discipline.

FAULTY HOIST

An APU hoist (Ref. 4G/1730-21-800-0903, serial #6) was being used to install a new APU in the nosewheel well of a Yukon. When the APU was about six inches from its mounting position, the lifting was stopped for a moment to allow for the "manhandling" necessary to juggle the unit into position for the final lift.

At this point, one of the cables on the hoist broke, and the full weight of the unit broke the other cable. The APU fell four feet, wedging the wheel well doors, and damaging both the APU and the well. If the unit had not jammed in the doors, an airman standing underneath might well have been seriously injured.

Extra precautions were being taken at the time to prevent abnormal strain to the cables during the lifting operation, because there had been several previous failures of this type—in fact, this was the second such occurrence on this particular aircraft. Both of these were on APU hoists being used for the first time; moreover, the manufacturer had modified both hoists, using a cable-tensioning device designed to prevent the cable from "piling" on the cable drum, thus eliminating such breakages. Three UCRs had been submitted.

The manufacturer, at the time, was working on a hoist which dispensed with the cable-and-drum arrangement, substituting chains and sprockets with a vernier adjustment to allow for minute positioning on final alignment. This hoist is now in service; in the interim, the unit borrowed the manufacturer's production-line cable. The accident was assessed Materiel—faulty design.

GEAR BOX BEARING FAILURE

The H34A was engaged in firefighting operations; it evacuated 10 passengers, dropped them off, and became airborne for another trip. Just after takeoff, at a height of about 150 feet, a severe vibration was heard and felt.

The aircraft started to rotate in a steep nose-down attitude, and crashed out of control. Although the co-pilot sustained major injuries, it was fortunate that nobody was killed.

The crash was caused by a bearing seizure in the input side of the intermediate gear box, which resulted in the breaking of the tail rotor drive-shaft.

A modification leaflet had been issued previously, requiring installation of a new type of input and output bearing to intermediate gear boxes in service. The modification to spares in stock was annotated "non-applicable".

This aircraft had been fitted with an unmodified gear box from spares in stock during a normal maintenance function.

All intermediate gear boxes—in service and in spares—have now been modified. This ought to eliminate trouble of this kind. We all learn from experience.

BOXCAR CIRCUIT-BREAKERS

The Boxcar captain found all temperatures and pressures within takeoff limits during his pre-takeoff check. During climbout, however, the oil temperatures for both engines rose to 105°C., and were not reduced by a manual toggling of oil control switches. After levelling out, oil temperatures stayed at 102° C. for the starboard engine and 108° C. for the port. The aircraft was flown back to base without further incident.

An unserviceable circuit-breaker, part #AE 3161-P10, left the circuit open, regardless of the position of the reset button. Both oil-cooler exit-flap actuators were thus inoperative, no matter which switch was selected. Further opening of the flaps (and a resulting increase in air flow to compensate for potential increases in oil temperature), was therefore prevented. (Refer to EO 05-90A-2, part 11, figures 11-17, item 17).

It was the second such incident in two years on that aircraft, and a UCR recommending installation of a circuit-breaker for each actuator was submitted. The recommendation would ensure that such an incident could not again happen to both engines at once.

Letters to and from the Editor are not official RCAF correspondence, and need not be directed through official channels. Unless otherwise stated, statements in letters and replies should not be construed as regulations, orders or directives.

Dear Sir: The article "Flying the Distress Pattern" in the November - December issue of Flight Comment has some merit in allowing for the effect of wind on the shape of the triangle, but the speed suggested for a jet would create a hazardous condition.

The article recommends that a jet be flown at 35,000 ft. or 1,000 on top at a TAS of 240 kts., which is in the order of 130 kts. IAS at 35,000 ft. or 120 kts. IAS at 40,000 ft. These speeds are dangerously close to the stall, depending on fuel load. They do not permit retention of altitude in the turns, nor is it practicable to follow them from a fuel-consumption standpoint.

I would suggest that a minimum of 200 kts. IAS is an acceptable speed for flying the distress pattern in either a T33 or an F86.

F.D. Kaye, F/L

(F/L Kaye's remarks are completely valid. The speed recommended in our article was decided upon in an attempt to make the triangle flown by jet and piston aircraft similar in size. This has been proved to be impracticable; revised airspeed for various aircraft are listed on page 19 of this issue.—Ed.)

FAMOUS LAST WORDS

SOME LIKE IT HOT

(The following account is taken verbatim from a D14. Only the names of the Dakota's crewmen have been withheld to "protect the innocent"—the incident was assessed Materiel.—Ed.)

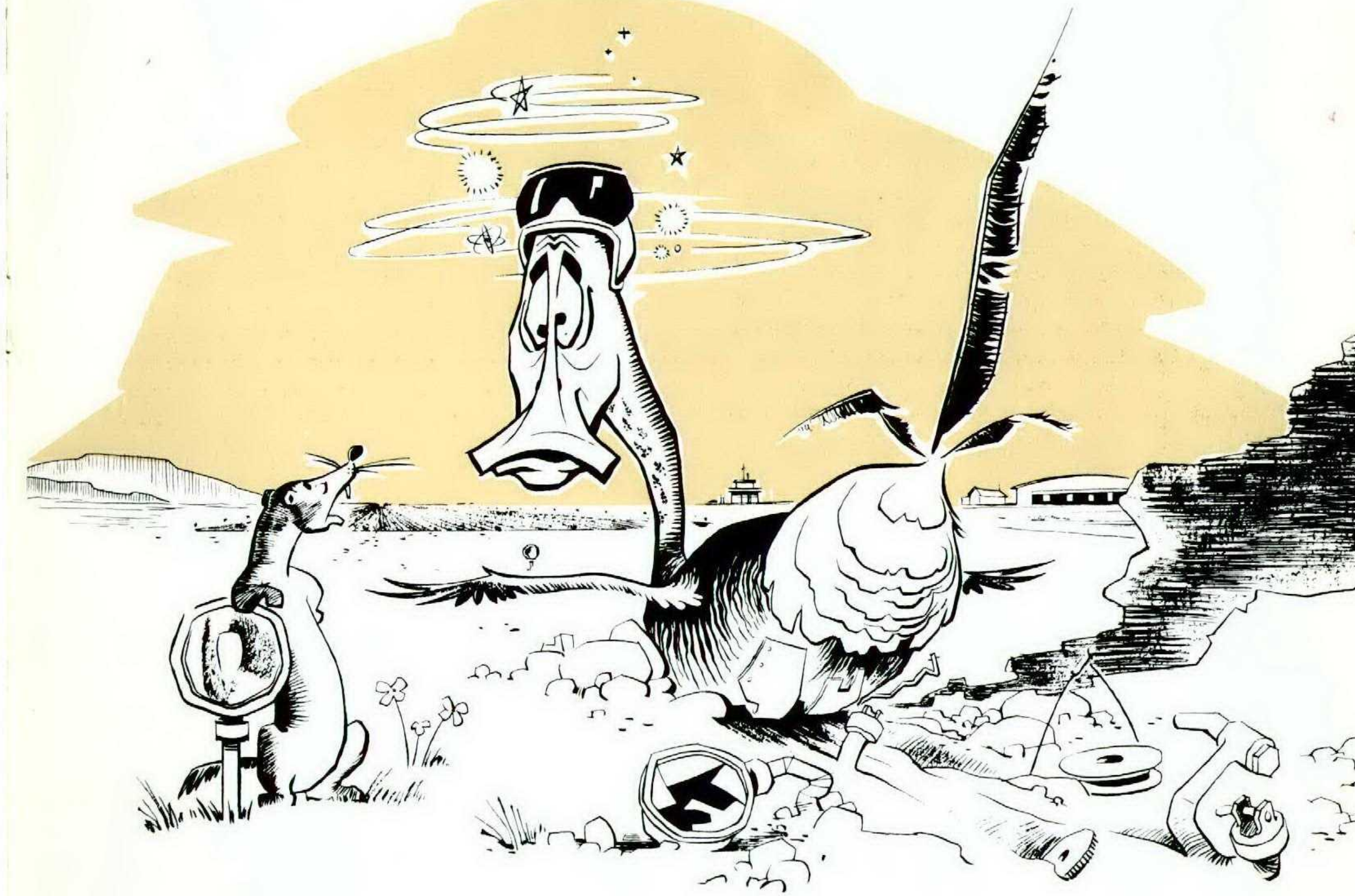
"During ground run-up prior to takeoff the crewman...noticed smoke coming forward from the galley compartment. (The galley door was closed and the steward was in the passenger compartment.) The captain was notified, and investigated immediately. The source of the smoke could not be determined immediately.

"The galley master switch was turned off and the hot-cup electrical leads removed. The fire truck was requested from the tower. The pilot windows were opened and the smoke cleared from the galley and pilot compartments.

"One hot-cup wiring was found to be smouldering, and was extinguished. No further indication of overheating could be found, hence the request for the fire truck was cancelled, and the operation was continued—using the remaining hot-cup."

(Many parts of an aircraft need attention and maintenance. This incident could have caused a serious fire in some circumstances—or the crew could have lost its remaining hot-cup!—Ed.)

BIRD WATCHER'S CORNER

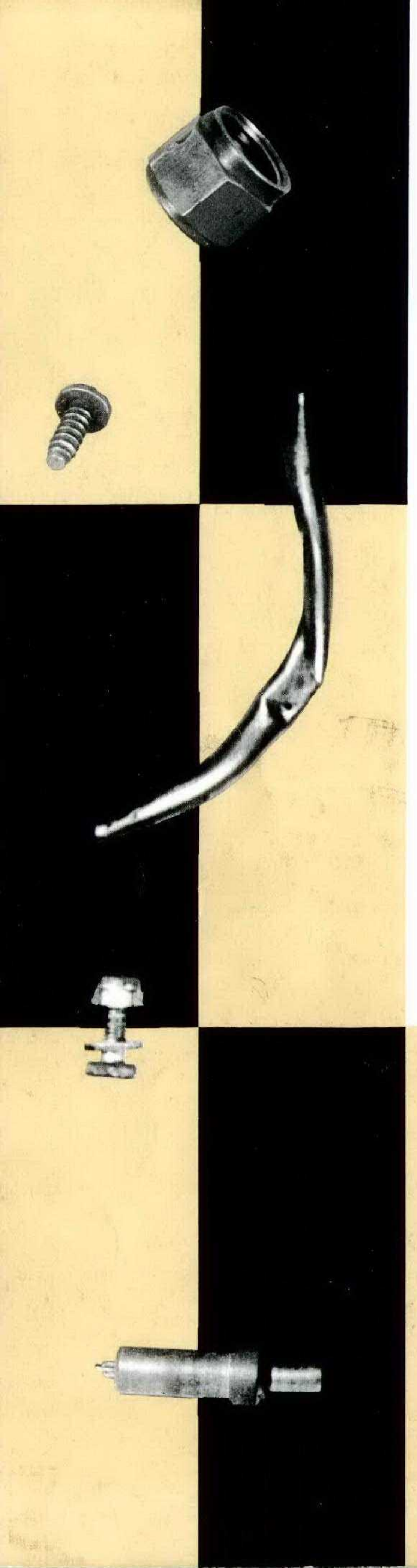


SPADE-BILLED TOOLEY-SQUATTER

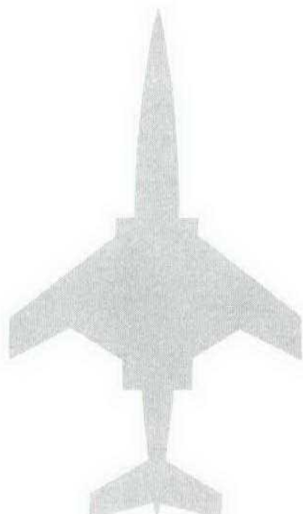
Alights unexpectedly in the "toolies" short of the desired perching site, frequently clobbering such items as approach lights in the process of damaging itself. Fatalities have also resulted. This bird seems not to understand why small wings, high loadings or marginal speed should produce such a high rate of sink. Apparently thinks that the term "back side of the power curve" has reference to egg-laying.

Call: THOUGHTIHADITMADETHOUGHTIHADITMADETHOUGHTIHADITMADE

Roger Duhamel, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1962



FOD* BIGGEST ACCIDENT CAUSE?



YES!—UNLESS you remember that jet engines are giant vacuum cleaners, and will ingest anything from runway or tarmac with disastrous results. Pick up EVERY foreign object and toss it in a refuse can. Remember too that good housekeeping is just half the battle—the other half is sound maintenance. DON'T drop tools or anything from your pockets. Help stamp out F.O.D.—save an engine, perhaps a life.

*Foreign Object Damage