FLIGHT COMMENT

MARCH • APRIL 1966

Maintenance Issue

Comments

■ Breathes there a man with fighter blood in his veins who hasn't thrilled to a well-executed pitch-out? For those whose specialty precludes the need to pull G it may seem just a showy way to get an airplane into the circuit and onto the ground, but in its day the overhead break made sense. The fighter pitch had its heyday back in the fifties in Air Div when the Sabres were given a fling at low-level formation sorties. This enabled the boys to pitch over the button in arrowhead following a run-in from initial at 100 feet or so. Spectacular it was, and (dare we say it?) – a real thrill.

The fighter pitch has acquired the respectability of old age but as the years roll on it strikes us as an increasingly anachronistic manoeuvre with little operational purpose. Rapid recovery of large flocks of birds in VFR just isn't a requirement any more. To those who have long been pitching out on the judder, on the G-meter, or on the horn, it may sound like heresy to propose "let's pitch out the pitch".

For the experienced and current jet jock the fighter break may be a ho-hum thing, but we see it as a continuing hazard – a temptation to the inexperienced, and for the remainder of us an opportunity for the occasional misjudgement. And the perennial "What if I should flame out in the circuit?" now has an unconvincing ring; isn't it time to bury the old veteran with full military honours?

■ Nowadays, there can be no argument with the groundcrew/aircrew "team" concept in military aviation. A remark such as "What a fine chap – too bad he isn't a pilot", now is used only in jest but it wasn't always that way. Some vestiges of other days remain, and quite candidly Flight Comment is one. Our name (yes, we have thought of changing it) implies "Flight – therefore flyers", and often the sparsity of groundcrew items makes the contents at least consistent with the title. The majority of our readers, that is the groundcrew, deserve something better – and so, this issue.

The magazine is fatter this time to contain in one issue a good cross-section of items gathered by G/C Hoye and S/L Hendrickson of the Directorate Maintenance Policy (Air). The reader will notice that the contents imparts a remarkable perspective. The past, present, and future; the contending viewpoints; the unending detective work; human ingenuity versus the almost stupefying complexities of keeping a modern aircraft serviceable and safe – all these and more are discussed.

We wish to thank the contributors whose efforts on your behalf made this issue a real pleasure to publish.

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ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1966

THE TOTAL SITUATION

A significant trend in the assessment of accidents has been recognition that although the actions of an individual pilot may lead to an accident it does not necessarily follow that the fault therefore lies solely or even mainly with that pilot. Rather, when the actions are a reasonable result of the circumstances and the available information, the blame and preventive action must encompass the total situation, not just the last link in the chain.

Accidents attributed to "Maintenance" require a similar approach. Many of you will have had the profoundly disturbing experience of being confronted with the results of an investigation in which a tradesman with an outstanding reputation for skill and integrity has contributed to an accident. In these circumstances it is not enough to determine which maintenance job was left undone, or improperly done, it is also necessary to determine what pressures caused a highly skilled and well motivated individual to make the mistake. Too often the pressures are found to result from an atmosphere of frustration and bickering where there is a lack of mutual understanding and co-operation between maintenance and operations.

Maintenance exists to support flying operations but maintenance cannot provide effective support in the absence of clearly defined reasonable objectives arrived at by agreement between operational and maintenance staffs in an atmosphere of mutual understanding. Where there is mutual understanding, problems can be resolved without producing the frustrations and pressures that so often lie behind poor maintenance practices.

Don't let an accident happen because your interest in flight safety stops short of the total Operations-Maintenance situation.

Group Captain WN Hoye
Director of Maintenance Policy(Air)

Working Together for Safety

Group Captain WN Hoye, born in Vancouver, served in the RCAF Auxiliary for a year before joining the regular force in November 1935 as an airframe mechanic. Commissioned in 1942 he served until 1944 as trade test officer at Eastern Air Command HQ, Halifax, (now Maritime Command), and in 1944 was posted to the Sub Repair Depot, Sea Island as OC general engineering. In 1945 he joined an RCAF heavy bomber squadron in England as technical officer and remained in England until 1946.

In 1947, after brief terms on staff at Western Air Command HQ, Vancouver, and Chief Technical Officer for RCAF Stn Patricia Bay, he went to the Winter Experimental Establishment, Edmonton. His brief stay (on Vampire tests) was followed the same year by a posting to RCAF Stn Trenton, preparing Vampire maintenance schedules and instructions. After serving a year as Chief Technical Officer at 9420 Unit, London, Ont, he was named in 1948, Officer Commanding repair section, Stn Trenton.

From 1950 until 1952 G/C Hoye served on staff at Air Materiel Command HQ, Rockcliffe; following this he was posted to 1 Air Div HQ at Metz, France, as staff officer maintenance.

In 1954 he was named OC of the technical trade school at Aylmer, Ont, then chief Technical Officer at Stn Cold Lake, from 1958 to 1960. He was transferred to Air Materiel Command HQ and later appointed in 1964 to CFHQ as Director of Maintenance Policy.

This issue of Flight Comment contains a number of articles dealing with various maintenance activities which contribute to flight safety. In this article, I intend to link these maintenance activities to the activities of operational commanders and aircrew by presenting our concept of the way Maintenance and Operations can work together to maintain the quality of maintenance operations, and therefore ultimately, flight safety.

Our large, complex, and very expensive aircraft maintenance system is designed and operated with one basic aim:

- to provide aircraft and installed equipment which will function satisfactorily so that the unit can fulfil its mission.

When this aim is achieved, not only are flying tasks completed on schedule – they are also completed safely. Unfortunately, in spite of the effort devoted to this aim there may be accidents or incidents in which maintanance actions are a primary or contributing factor. The most disturbing aspect of a maintenance error is not only that it occurs in spite of the many precautions to prevent it happening, but an error frequently involves a man who is highly trained and motivated and who has a good reputation as a tradesman.

Maintenance techniques derive from a comprehensive investigation of the requirement, training to provide the skills, provision of specialist tools and test equipment, and supervision of the operation by skilled and competent NCOs. When an error is made under these circumstances there is a tendency to assume that the cause was an individual's carelessness or neglect. The problem may not be that simple.

Maintenance error, as with pilot error, requires objective investigation in considerable depth to determine whether there are environmental stresses acting on the individual, negating the benefits of carefully planned techniques, procedures, tools, and supervision. For example, a tradesman required to troubleshoot an engine or a complex piece of avionics equipment knows that accurate analysis depends upon carefully and thoroughly following each step of the procedure. However, there is a limit to his ability to resist continual pressure to meet deadlines. When the pressure is unreasonable he is particularly susceptible to leaping to a conclusion that an apparent symptom identifies the malfunction. In many cases he may be right but in some he may be wrong, with the result that an aircraft is exposed to a hazard because of the lack of correct maintenance action or because an incorrect action was taken. Since such actions derive initially from a well-intentioned attempt to further the unit's flying program it should not be construed as carelessness or neglect.

What is the real cause of the problem, and what can be done about it? A peaceful, serene environment with ideal working conditions under completely programmed work scheduling would undoubtedly eliminate the problem. Tradesmen and supervisors could ensure that every maintenance action was carried out to perfection. But inherent in flying operations and the supporting maintenance tasks are problems, difficulties, frustration, and unexpected complications. The maintenance organization must continue to function under these conditions. That maintanance people have done so well in the past may lead to an over-estimation of their ability to respond. The more complex and demanding the maintenance task the sooner the limit is reached; that there is a limit is demonstrated by our accidents.

We need a means of discriminating between the normal pressures inherent in aircraft maintenance, and excessive pressures which can be resolved before they lead to accidents.

It is generally accepted that the efficiency of any group depends to a marked degree on each man understanding the aims of the organization, and the degree of acceptance of those aims. A maintenance technician, like any other skilled person, has his perceptions highly developed as a result of selection and training to ensure that he is capable of observing, analyzing, and logically determining courses of action. These qualities are not confined to his work as a tradesman; they can also be applied to his work environment. Careful definition of the overall aim of the organization, and in particular the part to be played by the group to fulfil this aim, is essential to achieve harmonious participation by people of this calibre.

Such philosophies may be as indisputable as "truth" or "justice" but to have worth they must be applied to the daily realities. General objectives of most units are quite clear. Aircraft are to be flown at a monthly flying rate to fulfil the unit's role, but what is the *specific* maintenance task for today? Tomorrow? Next week? Next month? Is it to be something vague like "produce as many serviceable aircraft as possible", or "produce a percentage of aircraft serviceable", only to have these aircraft poorly utilized, wasting much of the maintenance effort? Waste of one's effort is always difficult to accept but when followed later by unreasonable demands for increased effort to make up for the waste, these additions to the normal pressures will set up conditions conducive to an accident.

Obviously, the solution to this problem involves a compromise. A plan which produces optimum working conditions for maintenance but which seriously interferes with the flying program is unacceptable. Similarly, an apparently ideal flying schedule which produces intolerable stresses in maintenance or support organizations is also unacceptable. The flying operation, which is the key to the operation of all supporting functions on a station, must therefore be a compromise among the capabilities of the aircraft operators, flying control, servicing crews, aerodrome maintenance, base maintenance, shops, and so forth. Such a plan can be developed only by the CO, in consultation with command, division, or sector operation staffs. This mutually acceptable plan must satisfy the operational objectives of the unit, and be capable of meeting the day-to-day variations of changing circumstances. The plan must be thoroughly understood and accepted by all. Once the basic plan is established each section can subdivide its tasks; crews and technicians will know exactly what is expected of them and can plan their work so that it is done most efficiently and safely.

In spite of the wisdom of these programs, people will make errors if the relationship between operations and maintenance results in unacceptable environmental stresses. There are plenty of clues to indicate these conditions – here are some of them:

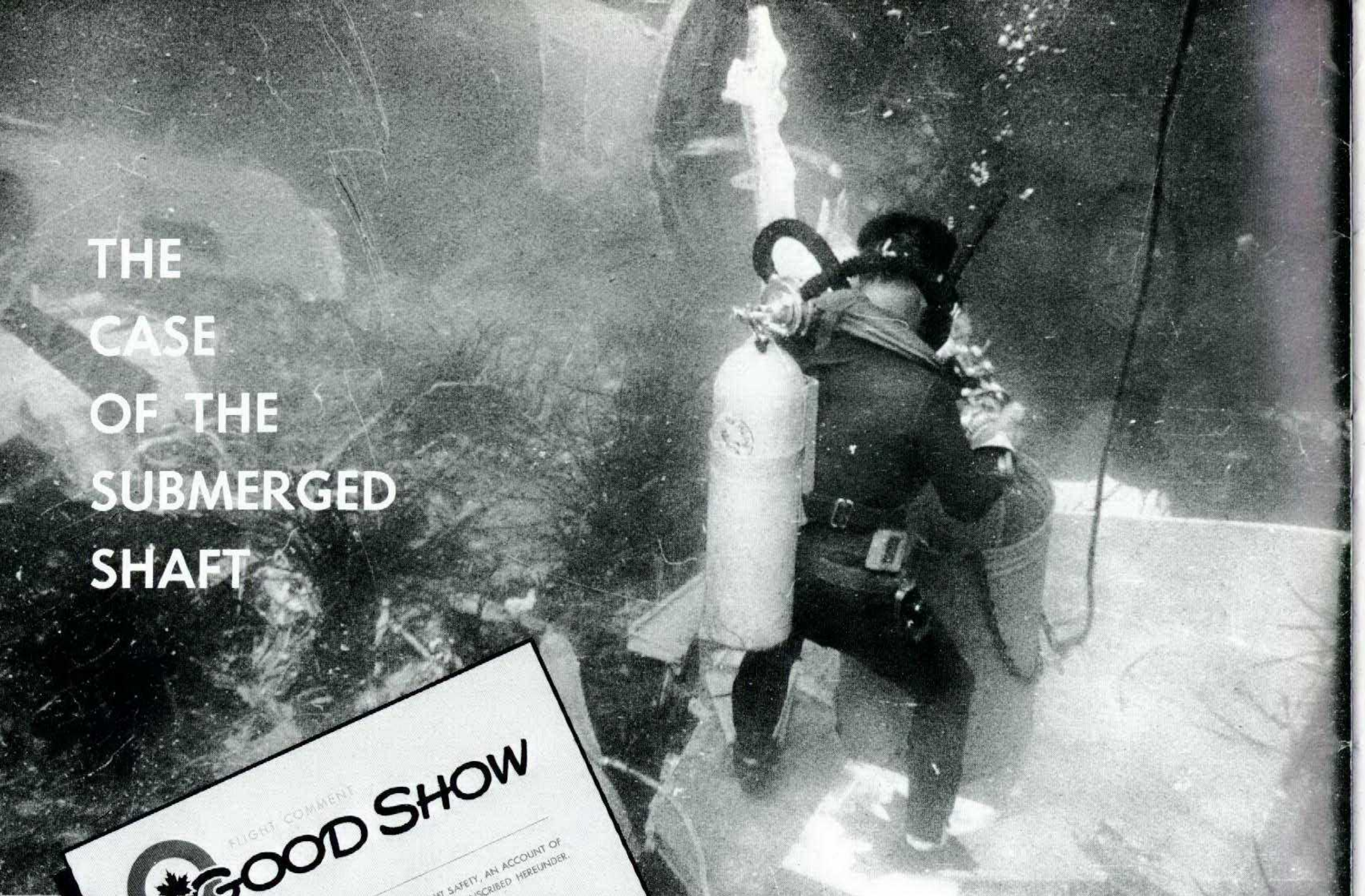
- ***Incomplete liaison between operations and maintenance***
- ***Frequent crash programs to catch up with planned flying rates***
- ***Repetitive unserviceabilities that have not been properly fixed***
- ***Poor utilization of available flying time***
- ***Lack of reserves to meet special commitments***
- ***Inexplicable accidents and incidents.***

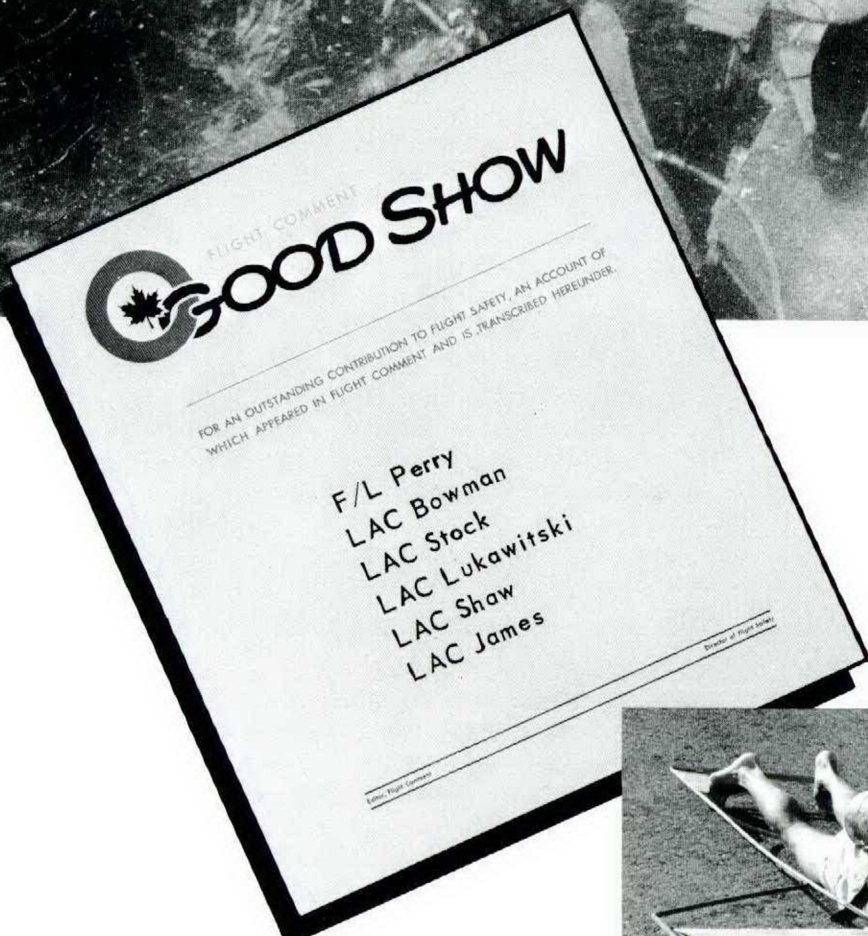
When some or most of these conditions exist at a unit to any significant extent it is time for action. A superficial assessment may be that more aircraft and/or more people would solve the problem. Unless aircraft utilization is higher than the planned rate it would indicate that fewer aircraft better managed will more likely contribute to a solution. Similarly, more people will not resolve the problem unless conditions already exist that ensure optimum use of the present staff under conditions which encourage them to contribute their utmost.

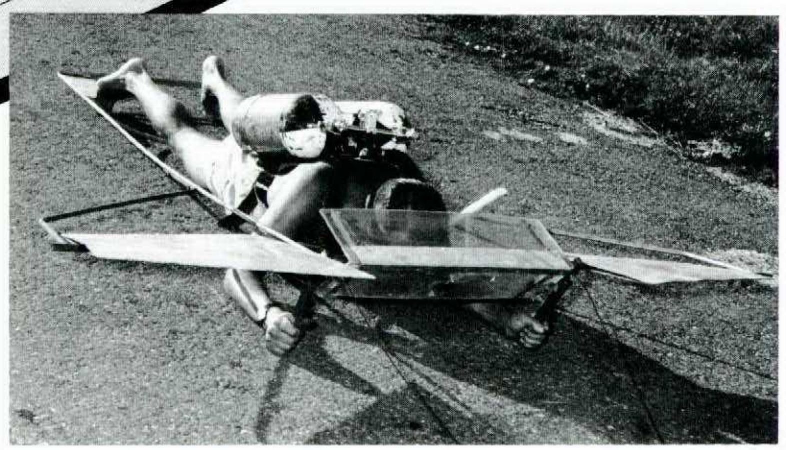
A vital contribution to flight safety can therefore be made by all concerned, but particularly by commanding officers, chief operations officers, squadron commanders and flight commanders who have direct responsibility for flight safety. Such responsibility entails constant alertness for the indicators listed above, and compliance to up-to-date, comprehensive, detailed agreements developed mutually between the operators and supporting sections. Finally, the plan needs distributing in meaningful terms to that last vital link in the chain of safety – the tradesman who actually does the job.

Only in this way can we be sure that the unit is operating with optimum effectiveness and therefore – maximum safety.

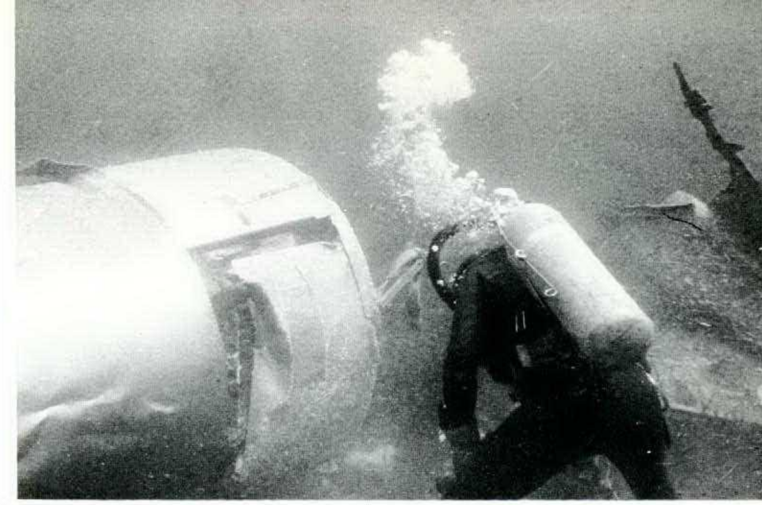
THE CASE OF THE SUBMERGED SHAFT







In search position, a diver "flies", using hand-operated wings.



Somewhere in 12 fathoms of salty Mediterranean water about two miles off the Sardinian coast lay the broken remains of CF104 817.

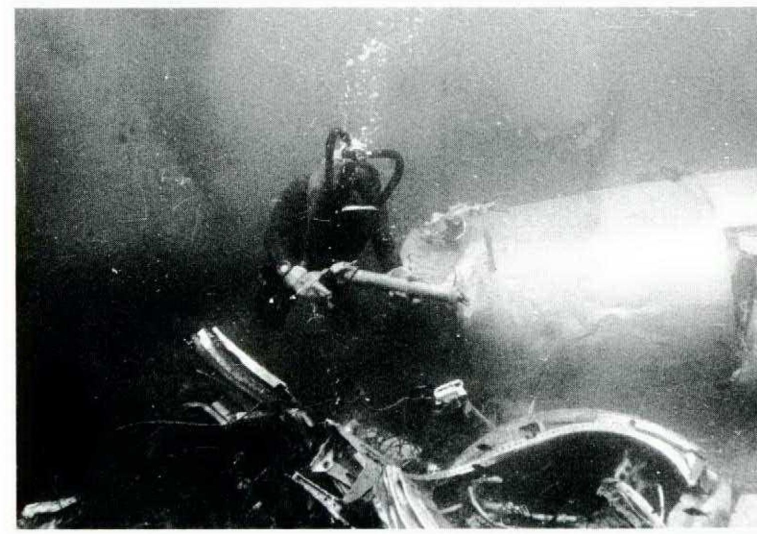
The pilot had successfully ejected after his flamed-out engine refused to relight. The aircraft had disappeared without a trace; however, the conditions for an underwater search were encouraging. The water was clear, the depth not excessive; indeed, a local fisherman, Armando Poma, had seen the aircraft plunge into the sea. He had raced out in his fishing boat to rescue the pilot only to have an Italian Air Force helicopter arrive there first.

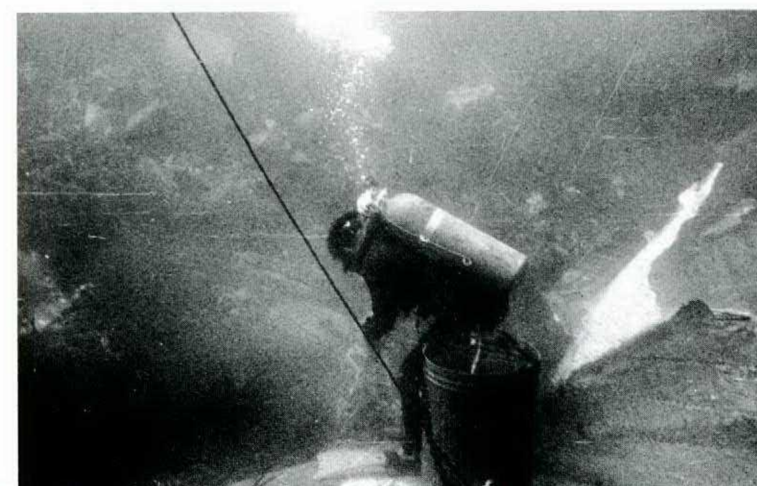
It was imperative to recover the aircraft components to determine the cause of the engine flameout. The whole setup had a real Mike Nelson flavour to it and proved to be a once-in-a-lifetime opportunity for the SCUBA boys of Stn Decimomannu and 1 Wing, Marville.

F/L Perry the station armament officer, and another member of the Deci SCUBA club were airlifted to the scene the afternoon of the crash (5 July) but heavy seas, a condition that persisted for two more days, made an air search futile. Meanwhile, from two eye witnesses in the little village of Tumnaria nearby, the salvage crew under Lt Col Fatagati of the Italian Air Force, were able to establish a rough location of the crash. Later, in a calmer sea, F/L Perry, LAC James and LAC Lukawitski carried out 30-minute exploratory dives down to about 100 feet but they saw nothing.

A lull in the operations due to rough weather gave the SCUBA boys an opportunity to build an underwater sled. The sled when towed enables a diver to "fly" through the water conserving the energy normally used to propel himself. In this manner, far greater search areas could be covered. The first sled, a wooden affair, turned out to be a "complete washout" as it was difficult to control. Another sled, this time made of metal and built according to plans found in a skin diving magazine, proved a complete success. A short training run brought a diver to full competence as an underwater "pilot".

Twelve days after the crash the fisherman who had earlier attempted to rescue the pilot caught some aircraft wreckage in his nets. This led to the recovery of the





engine. Signor Poma received a reward of fifty thousand lire ($80.00) for locating this wreckage.

Recovery of this part of the aircraft unfortunately yielded no meaningful evidence. The clues needed to solve the engine flameout mystery were still at the bottom of the Mediterranean; what had been a rewarding experience for fisherman Poma had been a net gain for the Canadians of little more than confirmation that the wreckage was still out there. Search operations continued. Each diver in turn surfaced with the same news – no sightings. The AWU SCUBA team were now supplemented by LACs Shaw, Stock, and Bowman from the 1 Wing SCUBA Club. During this phase the search seemed to offer little hope of locating the wreckage.

On Aug 11, over five weeks after the search had begun, the RCAF hired a small 14-foot boat with motor, to tow the underwater sled. This proved to be a better combination. All five divers carried out searches down to 100 feet; this time, the canopy and seat pack were sighted and recovered. It was now possible, using the position of the ejected canopy and seat, to compute the crash point. Two days later, while employing Signor Poma's fishing boat as tow vessel the aircraft wreckage was discovered on a flat reef in about 75 feet of water. The wreckage was marked with buoys.

Several days later, when the search was resumed, the buoys had disappeared – either blown away or stolen. The search was recommenced; this time the wreckage was located without difficulty. The six divers took two dives each and recovered the fuel system components required for AIB investigation.

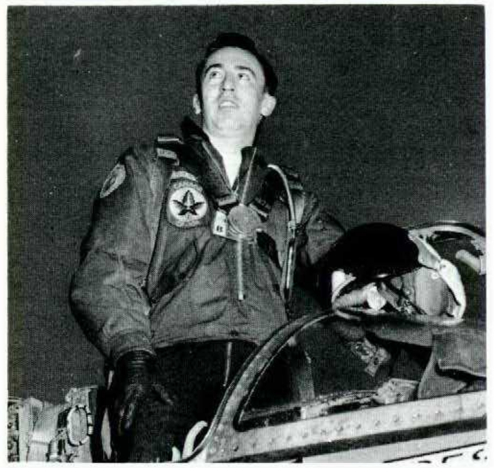
By examining the salvaged components, investigators readily spotted the failed part. The small shaft in the photograph was the vital evidence investigators needed to pinpoint the cause of flameout. (The account of that investigation appears in the previous issue's "From AIB Files".)

The excellent job done by our volunteer SCUBA divers meant another accident cause eliminated – the manufacturer is now pushing out parts to replace the kind that has cost us one Starfighter and endangered several more.

The SCUBA divers logged these underwater times; an effort worthy indeed of a Good Show all round.

F/L Perry	*3 hrs 23 mins*
LAC Bowman	*5 hrs 29 mins*
LAC Stock	*3 hrs 47 mins*
LAC Lukawitski	*4 hrs 02 mins*
LAC Shaw	*5 hrs 29 mins*
LAC James	*52 mins*

GOOD SHOW



F/O LK GERNACK

While on a low-level navigation training flight out of 3 Wing in a CF104, F/O Gernack felt and heard a bang. Suspecting a bird strike he pulled up in a climb, checking the engine instruments which revealed no malfunction. About 20 minutes later while advancing the throttle through 2-3% the engine temperature became abnormally high, accompanied by a loud rumble. At this point, F/O Gernack stopcocked the engine. The rumble ceased and the temperature decreased rapidly. The throttle was therefore advanced into military power on an engine relight. The return to base and landing were normal. Very extensive inspection of the engine revealed no reasons for the compressor stall.

F/O Gernack's quick response to this emergency rectified the engine compressor stall before any engine damage could occur. This aircraft demands a quick and precise reaction to in-flight emergencies; F/O Gernack's correct assessment and proper sequence of actions saved a valuable airplane.

LT RL ROGERS

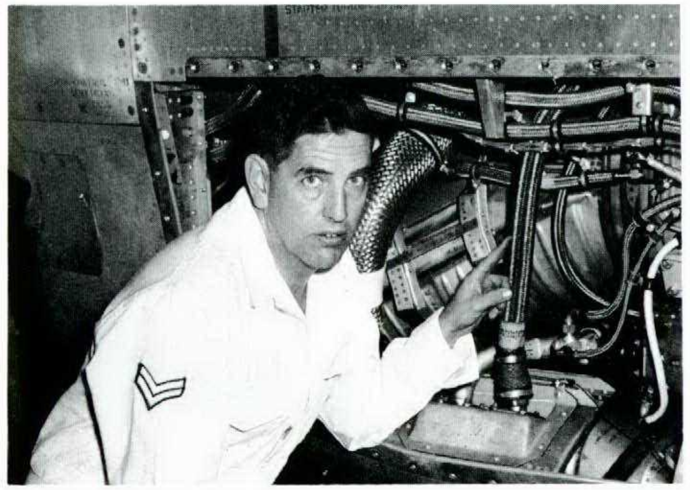
During the first leg of an instrument flight in a CHSS-2 helicopter, the crewman reported a fuel leak from overhead in the sonar operator's position. Lt Rogers returned to base and commenced a precautionary landing on GCA. After about 15 seconds on final descent it became difficult to maintain heading. A quick scan of the instruments, and a glance at the pilot's vertical gyro indicator (Lt Rogers was flying from the co-pilot's position, the left seat) confirmed that the VGI had failed. Failure of this gyro eventually results in dangerous aircraft attitude changes because the stabilization system attempts to follow the gyro as it runs down.

Lt Roger's quick and accurate assessment of the gyro failure helped him to combat a potentially dangerous situation. This pilot, faced with a hazardous fuel leak, and on a limited instrument GCA final in IFR conditions, skilfully flew his aircraft to a safe landing – a commendable example of good judgement and airmanship in response to two serious in-flight emergencies.

CPL JF CAMPBELL

Cpl JF Campbell was inspecting an Allison engine prior to its installation in a Hercules. He visually checked the lines and extended his inspection by feeling the lines hidden or shielded from view. As a result of this thorough search Cpl Campbell discovered an oil return line severely chafed. Further investigation revealed that lines on other engines were in the same unsafe condition. Cpl Campbell checked the EOs and found that a clamp and clip had been left off a flex line during manufacture allowing this line to rub against the metal elbow of the oil line.

A less conscientious airman could have missed this chafing by carrying out a visual check only. Cpl Campbell's initiative, technical competence and thoroughness, averted what could have developed into a serious flight hazard.



GOOD SHOW

LAC BR KENNINGTON

LAC BR Kennington, an airframe tech, discovered a bullet hole in a Chipmunk aircraft. His alertness prevented an aircraft from flying in a possible dangerous condition. Civilian police were notified to search for the irresponsible person who fired the shot.

The position of the hole was such that only a thorough inspection under the tail section would reveal the entry hole. The bullet punctured the upper surface through the black portion of the letter F in "RCAF", making it nearly invisible except under close inspection.

LAC Kennington is to be commended for his thoroughness during a very routine inspection.

FS JJG PETIT

There was heavy storm activity in the Bagotville area that night; several jet aircraft had diverted. During the height of the storm the quadradar scope became extremely cluttered with spurious returns from precipitation. The wind was gusting from 40 to 55 mph at an angle of 40° to the runway.

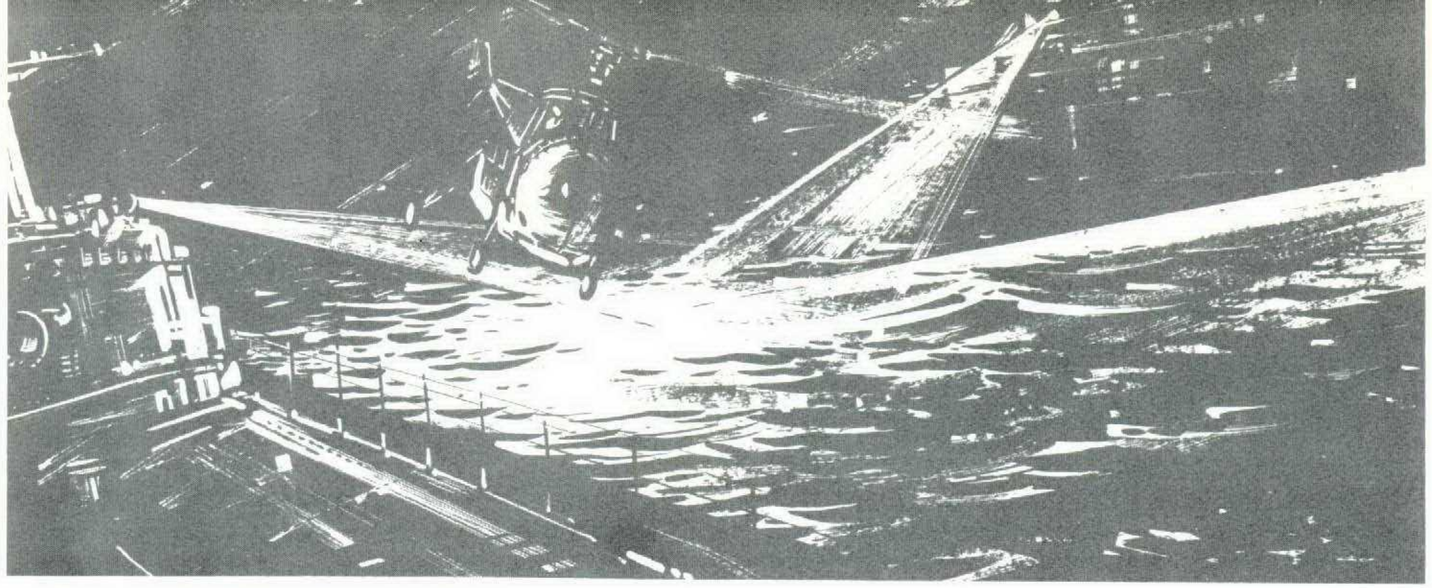
The pilot of Air Canada 448 reported a faulty radio compass to Bagotville RATCON and requested a GCA approach. He was cleared for the approach, and was passed to GCA and FS JJG (Pete) Petit. The radar target was identified at 15 miles and FS Petit proceeded to vector the aircraft around the heavy build-ups, using an almost saturated radar scope. After switching to precision mode for the final approach FS Petit advised the pilot he had lost radar contact and asked if he wished to divert. The pilot requested that the approach be continued as long as possible. FS Petit, on approval from the terminal controller (who was monitoring), continued the approach. During the period of lost contact (6 to 8 miles) no descent instructions were given. At five miles the aircraft reappeared on the scope and although off track FS Petit faultlessly guided the aircraft to a position from where a normal landing was carried out. Later, the pilot expressed his appreciation for an excellent approach.

FS Petit's skill, quick thinking and resourcefulness resulted in the safe recovery of an aircraft during very marginal flying conditions.

LAC RS HARVEY

On a T33 start-up, while the two pilots were strapping into the aircraft, LAC RS Harvey observed scorch marks around a small panel on the upper starboard plenum area. He immediately removed this panel and discovered that a bolt associated with a flame tube assembly, was missing. The trip was aborted.

LAC Harvey's alertness and initiative is another fine example of how flight safety is achieved.



LT PA BLANCHARD, LT JW McDERMOTT LEADING SEAMAN KF BOWEN

At about 2045 on 18 Oct 65 Lt PA Blanchard was called to the flying control position and informed that the Bonaventure was to evacuate casualties from an explosion and fire on HMCS Nipigon. Weather conditions were a 1500 foot overcast, visibility 5 miles reducing to 2 in rainshowers, wind at 17 to 19 knots, and a sea of about 3 feet.

Half an hour later, his HO4S-3 rescue helicopter was ready to go. Nipigon was on a parallel course about 200 yards port of the Bonaventure, both ships steaming into wind. The ships were floodlit, their signal lamps lighting the water between the ships; two Sea Kings were hovering, their lights trained on the water. HMCS Kootenay was also providing light from a position astern of the force. The flights could not have been accomplished without the lighting and positioning of the ships. The signal lamps playing on the water produced a well-defined handling area enabling the crew to provide height and ground speed information to the pilot in control.

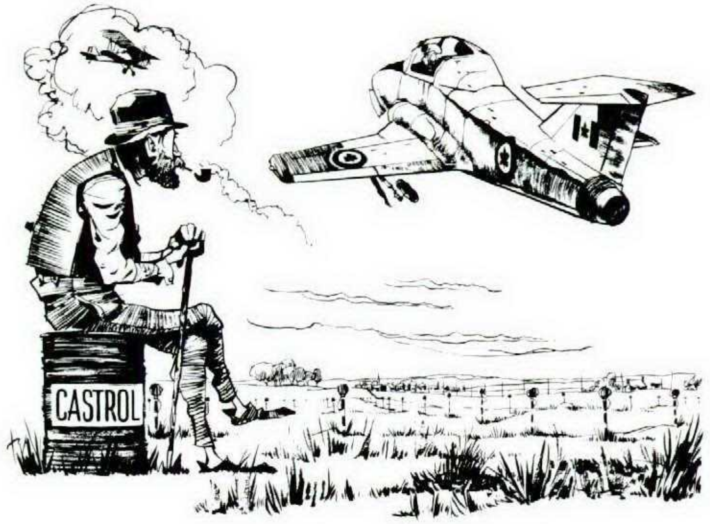
The first trip carried Bonaventure's Principal Medical Officer, Wing Commander LA Gazely, one medical assistant, and approximately 100 pounds of Chemox canisters. The first transfer was flown by Lt Blanchard with the co-pilot and crewman providing height information and lookout. The next flight carried two injured men on stretchers to the Bonaventure, followed by a return with a load of bandages to Nipigon. The second transfer from Nipigon consisted of four ambulatory casualties. The final sortie evacuated one stretcher case, one ambulatory patient and Bonaventure's medical assistant.

The co-pilot, Lt McDermott, flew the helicopter from Bonaventure to Nipigon and Lt Blanchard flew from Nipigon to Bonaventure since rain obscured forward vision making it necessary to crab sideways between the ships. The main problems were height control due to lack of visual reference in the poor visibility in the rain, and difficulty in judging the roll of Nipigon's deck. These problems were overcome with the outstanding work of Leading Seaman Bowen, who, on his own initiative, provided guidance and assistance to the pilots during landings.

The entire detachment performed well on this mission. On a dark gusty night, the maintenance crew spread and pre-flighted the aircraft in record time. Throughout the whole operation, we heartily agree with Lt Blanchard's comment that there was a high level of teamwork and co-operation within the crew which contributed to the success of a most challenging mission.

W/C LA GAZELY, LT PA BLANCHARD, LT JW McDERMOTT and LEADING SEAMAN KF BOWEN

From Baling Wire to Computers



F/L DI Shade

F/O DI Shade's family has been associated with the engineering and maintenance of aircraft in the RAF and RCAF for many years. All male members of the family have or are currently serving as technical officers in the RCAF. F/O Shade served briefly during the war as an aircrew trainee and returned to the RCAF in 1946. After taking the then lengthy aero engine technician course in the first post-war entry, he was transferred to 426(T) Sqn in time to witness the acceptance of the first North Star aircraft into service. While with the Thunderbird Sqn, and later with maritime reconnaissance, he saw duty on detached operations in many parts of the world.

F/O Shade has been engaged in instructing, quality control and most aspects of aircraft maintenance. Commissioned from the ranks in 1963 he was transferred to Materiel Command HQ. For two years he was assigned as technical specialist on aircraft undercarriages until recently when he took over the duties of Aircraft Project Officer for the Tutor aircraft.

A few years ago as I was leaving the maintenance hangar of a large station in eastern Canada, I spied a book stuffed in the top of an overfull garbage can. Having always been a bit of a bibliophile I seldom throw away a book and am always on the lookout for something new to acquire. Normally, this does not extend to garbage cans but on this occasion as no one was looking I managed to surreptitiously salvage the book. It was a real find – an 855-page volume of 1927 vintage, titled Modern Aircraft, by a Major Victor W Pagé of the then US Army Air Corps.

The book contains useful information such as how to uncrate and assemble a Curtiss JN4, and an entertaining survey of the performance and flying characteristics of aircraft of the day. The constant references to "pre-war" aircraft are intriguing because the author, of course, is referring not to the second world war but to the first. One can read with the advantage of hindsight, for example, that aircraft engines are unlikely to exceed 1000 horsepower because of the limitations of aircraft propellers, and that we can look forward to speeds of 300 mph with planes specially adapted to fly in the rarefied air at extremely high altitudes of 30,000 to 60,000 feet. I suspect no one would be happier than Major Pagé to know by how much his predictions have been exceeded!

The book also provides an interesting background of the decade in which the RCAF itself was just starting. It is surprising that 38 years ago 700,000 air passengers were being carried each year by commercial operators. Such seemingly modern mechanical devices as reversible propellers and Roots blowers like those used for cabin pressurization today, were well known; the latter were used for supercharging the Liberty engine.

In his descriptions of aircraft maintenance Major Pagé is most fascinating. The book indicates how little the basic responsibilities of the aircraft technician have changed through the years. In 1927 he stated: "It is important that all parts of an aircraft should be inspected thoroughly before the machine is allowed to leave the ground and this inspection must be carried on periodically while the machine is in service. The inspection should follow a certain well devised and logical sequence of events and should not be done in a haphazard manner". Who could argue with that statement today?

No longer is it possible for one or two technicians to keep an aircraft flying with a few rudimentary hand tools, pinking shears, fabric, a pail of dope, and a roll of baling wire. In an age of specialization modern aircraft are seldom tended by technicians having a broad overall knowledge of an aircraft. Instead, the technician has intimate knowledge of only a portion of the machine and is a specialist in some particular maintenance field, although, it wasn't always that way.

My own connection with aviation goes back only 23 years and before that my father was in the aircraft business as far back as I can remember. His stories of the Royal Flying Corps during World War I were often supplemented during my childhood by the yarns of my *grandfather* who also served in the RFC. Through all their stories, whether of flying or aircraft maintenance, the same theme seemed to tie them together. It was always the man himself that counted and everything that happened to the machine was a result of man's endeavours or lack of them. The experts in aircraft maintenance continually reiterate the same theme.

In Colvin's Aircraft Handbook of 1942 appears: "The building and maintenance of the modern aircraft require a knowledge of many things. The most vital need is absolute reliability on the part of the designers, the technician and the pilot. Aside from the needed skill is the need for dependability in all that pertains to the plane. Any mistake or doubt as to the quality of the material or of the workmanship should immediately be reported to those in charge of work. For the airplane is a machine for which nothing but the best is good enough".

Brimm and Bogges first published some three years earlier (and familiar to all wartime technicians), wrote: "It is impossible to overemphasize the importance of a thorough knowledge of the duties, requirements and responsibilities of a mechanic... The most important characteristic is a feeling of responsibility. This will mean a refusal to do slipshod work, a refusal to cover up mistakes and a refusal to take anything for granted as to the condition of an aircraft in his care".

Unfortunately not all entrants to the RCAF possess these desirable attributes to the same degree. I recall one airman who asked for an interview with the CO to request that he be granted leave without pay so that he could earn enough money to purchase his discharge because he couldn't stand aircraft! Then there was the trainee technician who was reprimanded by the instructor for driving wood screws home with a hammer. In reply to the query, "Don't you know what a screwdriver is for?" he answered "Yes Sarge, that's to take them out with".

Despite the fact that the basic responsibility of the technician has changed but little through the years, there have however, been many changes in the ways of doing things. The aim of aircraft maintenance is still the same – keeping equipment in one's care in the best possible condition. Throughout the forces modern management techniques are being applied to this task to make sure that no resource is wasted. Planned inspection and repair schedules are in general use.

Colonel Van Sickle of the USAF in his excellent text, Modern Airmanship, puts the case for planned maintenance in these words: "Planning and the scheduling of inspection and repair have paid tremendous dividends. It affords planned utilization of manpower, early determination of repair work required, and more accurate planning for the accomplishment of the required repair work. The result is reduced elapsed time, higher maintenance quality, better training, development of more efficient work habits, and lower cost. Thus, maintenance management is a highly professional and vital field of maintenance".

Planned inspection is a little different from the scheme that my father swears was used to check the rigging of Stranraers during the last war. According to his account at the end of each inspection a pet pigeon was let loose amongst the wing bracing wires. If the bird found its way out there had to be a wire missing somewhere and the rigging was rechecked!

Aircraft maintenance in the RCAF is gradually adopting procedures made possible by electronic data processing. This will give us a rapid analysis of equipment failures, early identification of trends, and the highlighting of components with an unacceptable failure rate.

Space does not permit going into detail about the improvements over the years that have been made in technical publications, aircraft record keeping, ground handling equipment, and in the other paraphernalia that make up the world of the aircraft maintenance technician. For someone with the perspective which comes from being in this aircraft business a couple of decades or more, the changes seem large indeed. Take for example integration. A few months ago I heard a crewman on a transport aircraft carrying a high-ranking naval officer, shout an irreverent "Cast-Off" when he wanted the wheel chocks removed!

Although there may today be slightly different ways of carrying out the familiar maintenance functions of servicing, lubrication, inspection, trouble shooting, repair, modification and overhaul there is one thing that has not changed and is unlikely to do so. That is the requirement for dedicated technicians; men who can feel a surge of elation as they watch a Sabre doing a series of rolls above an airfield, an Argus doing a short field takeoff or even in listening to the ground-shaking roar as a modern fighter aircraft cuts in the afterburner. It is men such as these who have taken in their stride the change from wood and fabric aircraft to all-metal aircraft, then to gas turbine propulsion followed closely by swept wings, pressurized cabins, powered controls and other equipment that spells TODAY in aviation. The nostalgic odours of burning Castrol oil have long since drifted into the blue to be replaced by the smell of JP4. Today's breed of technicians are worthy successors to the wartime erk and the pre-war mechanic. Shatterproof would have been proud of you.

Those Non-Tricycle Aircraft

The collective response of two experienced pilots to combat a swing on landing produced the results shown in the photograph. Perhaps we have become incautious by the good direction-holding performance of the tricycle undercarriage, but as long as we have the old style tail-down variety of aerodyne they'll have to be treated with the quick reactions they demand.

For the sake of argument..

The Right Approach

F/L TW Murray,
F/L EMW Robinson
ADC, St Hubert

A small note about VASIS in the "Comments" of the Nov/Dec issue prompted this article. We hope it may shed some light on the problems involved in an area which is obviously much misunderstood.

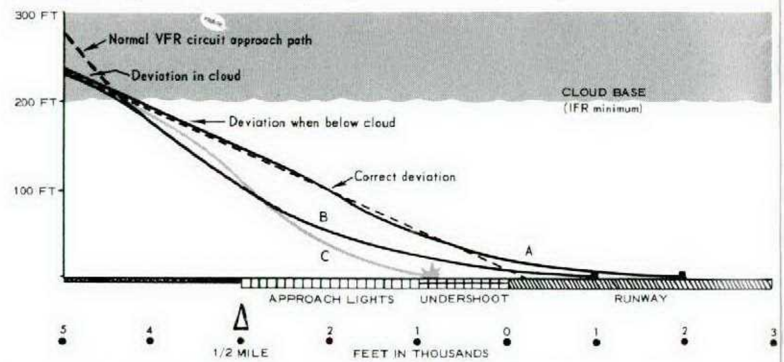
By and large, airfields, approach aids, approach lighting, etc, have not kept pace with the developments in aircraft technology and performance. Indeed, we are now at the stage when the advantages of our ultra-sophisticated weapons systems are in many ways negated by our not being able to employ them when we may very well need them most – in marginal weather.

The mission itself is basically the same as it was in the days of the CF100 or F86, although the CF101 and CF104 are many times more efficient in mission accomplishment. Yet, is breaking 200 ft and ½ mile weather minima in a Voodoo at 185 kts IAS, as simple as doing the same thing in a CF100 at 140? It is neither as easy nor is it as safe. One or two new undercarriage struts and wings attest to the trickiness of this manoeuvre.

The problem lies in the approach – at ½ mile to be exact. On a normal correct VFR approach, studies show that century series aircraft ½ mile from threshold should be at 100 ft, to make a good touchdown at 1000 feet down the runway. This touchdown point can be achieved with a 2½° glideslope intercepting the ground in the underrun 800 ft short of the button, or with a 2° glideslope intercepting the runway 200 ft down. With ADC GCA glideslopes at 2½° intercepting the runway at 200 ft from the threshold, the aircraft is at 140 ft, ½ mile back. This gives the pilot 10 seconds in which to do a "deke" to lose an extra 40 feet before he crosses the threshold. That is, if the pilot reacts *immediately* on spotting the runway; every second increases the error. Perform this manoeuvre in a high wing-loading aircraft with only a little lift to spare before the onset of high sink rate or pitch-up!

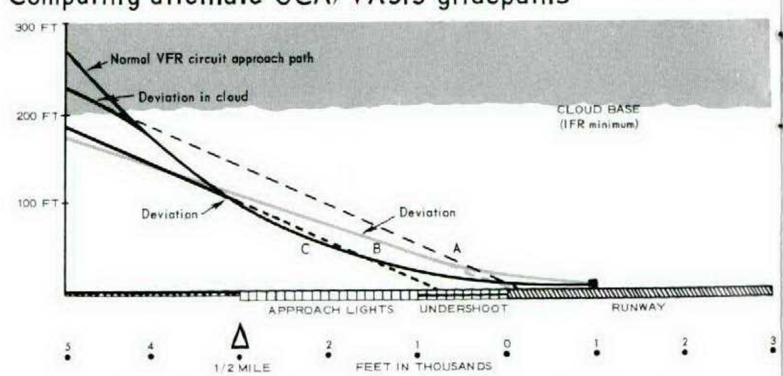
Obviously, the pilot should be positioned on an IFR approach in the same place as he would be on a VFR approach so that when he breaks out of cloud the approach

Comparing alternate flight paths of interceptor



Dotted line indicates GCA glidepath at 2½° intercepting runway at 200 ft.
A Path of interceptor doing GCA "Properly" – giving 2000 ft (+) touchdown.
B Path of interceptor trying to achieve VFR touchdown point (note when he must leave glidepath).
C Misjudgment of excess lift available at approach speeds tc stop rate of descent.

Comparing alternate GCA/VASIS glidepaths



Solid lines represent interceptor approach paths to achieve VFR touchdown point.
A 2½° glidepath intercepting runway 200 ft after threshold.
B 2° glidepath intercepting runway 200 ft after threshold.
C 2½° glidepath intercepting undershoot 800 ft before threshold.

appears normal. He should not be positioned where some wild stick handling will be necessary to avert landing halfway down the runway.

It is interesting to note that the same holds true for the T33 and CF100, although to a lesser extent. Admit it, can you properly land a T33 off a GCA 1000 feet down the runway, breaking the rate of descent for touchdown, retarding the throttle for airspeed control, and *not* going below the glidepath – even a little bit? Think about it. How was GCA designed to work? Is it supposed to stop at 200 feet in the air, or be capable of guiding aircraft closer in bad weather? How close? 50 feet?

VASIS has been installed at several airfields. This system might be called a "visual GCA" designed to prevent sink rate and fix a good approach path for the pilot VFR. It should be positioned around the GCA glideslope intercept point and be set at the same angle, but the same problem arises.

The immediate alternatives are either to raise the landing limits for interceptors with a resultant degradation in operational capability or ignore the hazards involved and accept the risks. Surely, the obvious answer is to bring our airfield layout and approach equipment to the same state of sophistication as the aircraft now flying. Neither flight safety nor operational efficiency should, or need be, compromised. Flight Safety is a method of conserving combat resources, hence it should serve to promote operational efficiency.

A complete re-appraisal of current equipment is needed, together with a thoughtful evaluation of new concepts or inventions. To put it simply "Can we get an increase in bad weather capability without an attendant increase in risk?"

Innovations and pieces of equipment have been tried, glideslope intercept points have been moved closer to the button, VASIS has been installed, runway impression fences have been tried and strobe approach lights have been requested. Each new aircraft incorporates new instrument presentations and approach aids. We now have almost all the ingredients necessary for all-weather capability. As pilot of a century-bird, imagine having:

- an accurate, coupled ILS
- cockpit instruments giving easy reference to altitude, azimuth, height, etc
- strobe approach lights which would at least double the effective cloud base
- one constant descent angle until flareout
- easy reference to make the change from instruments to visual without any radical change in aircraft attitude
- adequate warning for any equipment malfunction
- something to warn you if you were indeed about to land short.

If you think the preceding is unduly fanciful, consider the items again:

- Coupled ILS is wonderful but we have arrived at the state where both pilots and operators in the RCAF can accomplish a smoothly-flown GCA which is just as accurate
- Our high-speed aircraft do have excellent instrument presentations.
- Strobe approach lights have been requested. Strobes can be seen through 200 ft of cloud and at 1½ times the reported visibility by day, and at four times by night. The complete system also permits azimuth and roll guidance to permit lining up with the runway even before it is acquired visually thus decreasing the effective weather.
- One constant descent angle is available at most airfields. If GCA glideslope intercept point is close to the button of the runway at 2°, you would be in the same position on an IFR approach as you would be at that same range on a VFR approach.
- Easy reference to make the change from instruments to visual at one mile or more is available if VASIS is co-located with the GCA glideslope intercept point. Also, the fact that you see the normal VFR picture up ahead, makes you less susceptible to hauling off the power, diving for the undershoot area, etc.
- Adequate warning is now provided for aircraft malfunctions; however, the pilot will always have to cross-check the approximate position or heights when he could expect to pick up strobes or ground visually, etc.
- A simple proven aid to prevent anyone finally landing short by day is provided by a runway impression fence.

All the above systems, of course, complement each other, and maximum advantage would be derived from using them; they can be supplemented by such things as heads-up instrument displays, automatic throttle retardation, etc. However, we do at this time have control over some of them, and by spending a comparatively small amount of money, we can get others. The price of one CF101 or CF104 would go a long way toward providing sequenced strobe lighting, for example. Lower glideslope angles would put aircraft at present minimums farther back; therefore, on occasion "visual acquisition" will, in fact, be "approach lighting acquisition". Sequence strobe lighting to at least ½ mile range is then essential for a pilot to fly the approach smoothly. Until such a time as strobes arrive, a pilot will have to level off at 200 feet and fly azimuth only until he sees the approach lights. If he does see the approach lights beyond half a mile, he is of course, much better off. He is less likely to make a radical change in attitude which could result in a miscalculation or an accident.

This analysis has ignored the rationale behind putting VASIS and glideslope intercept points some way down the runway. This expedient may, to an extent, solve some approach problems, but it does so at the expense of blown tires, aircraft leaving the runway, barrier engagement, etc. RCAF runways were extended to meet aircraft requirements and on occasion these aircraft require the complete length of runway available. The same conditions which result in an approach to minimums also normally demand more fuel and higher approach speeds, with wet runways. Therefore, we must do everything possible to make sure that century-series aircraft are programmed to do a long low flat approach down to IFR minimums, make the transition to "visual" easily, and still touch down reasonably close to the threshold. Only then will we have cleared up all the problems involved. Only then will we be in truth, "all weather".

As an epilogue, let's look at the future. The present trend is toward the automated or "blind" landing in zero-zero weather for which new equipment will be required.

- A radio altimeter in the aircraft and ILS or its equivalent coupled to the autopilot, for automatic positioning of the aircraft on the approach.
- "Heads-up" displays of pertinent information on the windshield so that the pilot will not have to shift his eyes off the runway for landing.
- New integrated instruments incorporating command signals, such as the Collins situation display.
- A "3-D" artificial horizon which displays information from the ILS and radio altimeter interpreted into pitch and bank commands which will enable the pilot to execute a perfect approach and touchdown on instruments. Put this display on the windshield, perhaps couple it to an autopilot, put lights into the runway in the touchdown area, and landing will be possible – and safe – in visibilities down to 800 feet! As aircraft become more complex and expensive, airfield and aircraft equipment must keep up to ensure maximum freedom from weather limitations. Maximum safety in the approach and landing phase, acknowledged to be the greatest accident potential area, will be a by-product.

The right approach is the thing.

Clues and Curiosity

Ever think of yourself as an accident investigator?
You are – every time you work on an aircraft or aircraft component.

Yes – find the clues, identify them properly, REPORT THEM and prevent an accident.

This little maxim is aimed right at you, particularly those of you who maintain and service aircraft.

Because accident prevention starts right in your area, you probably have by far the greatest opportunity to observe things that are technically wrong. This means you're in a good position to do something about it.

You don't have to be a Sherlock Holmes, although one of his qualities we'd like you to develop – that normally inquisitive nature of yours. Surely, we are curious about the things around us; we ask you to apply this inquisitiveness in a positive and productive manner. This means searching out incident and accident causes, or *potential* causes, so that remedial action can be taken. Naturally, most opportunities for this sleuthing occur at the flying unit or station. It is here that the flying, servicing and maintenance teams combine to produce the missions required by the commander. And here also is where *little* incidents occur – those warnings of bigger things to come. Unless an alert and conscientious technician spots these warnings and sounds the alarm we're in for trouble.

Can you be satisfied, or think you've done your job when you've found an obvious incident cause? Seldom in the aviation environment is there one lone cause factor. What may appear at first as simply a nut or screw improperly installed may, on further investigation, reveal a cracked component, a loose fitting, or any combination of "small" things which together set the stage for an accident. There are any number of these cases on file – ever since that day when "For want of a nail the shoe was lost. . ."

When you're called upon to rectify that minor or examine a faulty component, give the job the long, searching appraisal that so often pays big dividends. Consider the recent Good Shows awarded to several technicians of Stns Summerside and Greenwood (Flight Comment Nov-Dec 65). By discovering loose bolts in the Argus horizontal stabilizers, cracked stabilizer brackets were also revealed. This condition was a serious flight hazard; a special inspection of the Argus fleet uncovered other similar failures. A possible accident prevented – because someone was curious and diligent enough to treat a clue as a suspected trouble source. This type of performance is hard to beat.

There is another way in which you can help determine incident causes: by preserving with care, any foreign substance or object you may find during your examination of a malfunction or failure. Better still, when you do find anything of this nature *stop right there* and bring your supervisor into the picture. He'll know what to do about preserving this type of evidence, and relating it to the occurrence. A fine metallic particle or a spoonful of fluid is often the vital evidence needed to identify a malfunction or potential failure. A microscopic sample could be a telling clue under spectrographic analysis.

Okay – the ball's in your park; much of our success in accident prevention must depend on the way you play the game. The next time you're called upon to help in the investigation of an aircraft incident, minor accident or component failure, do some real digging – you might be surprised at what you'll find.

Good Hunting!

W/C JT Mullen
DFS/AIB

Maintenance Research and Flight Safety

"A CF104 crashed today in northern Canada. RCAF officials state that the pilot successfully ejected and the wreck has been located. An official inquiry has been started to find the cause. . ."

To the civilian population it's another news release and another crash. In messes, smoke rooms, and the "wets" it is a topic of conversation for a few minutes. For others it means standing by in the bush for dreary nights and days guarding the wreckage. An AIB investigator shows up; the digging, and picking up the bits and pieces, begins. Later, in a corner of a hangar these are catalogued and placed on the floor in a sprawling grotesque jig-saw puzzle.

In this spectacular crash the public, the services, and particularly those on the station are aware of it, but if an aircraft goes skidding down the runway into the boondocks, only those on the station are usually aware of it. And what of the day-to-day run-of-the-mill accidents and incidents? Beyond the station flight safety officer, a technical officer, some airmen on the flight line, and the NCO and crew detailed to find the cause, few realize the amount of investigation and reporting involved. However, this sleuthing for faults often prevents the big ones which make news.

Most units hand the job of "carrying out CF210 action" to a technical officer, WO or Sr NCO attached to the CTSO's office. He in turn asks for facts and figures, calls upon anyone with experience of past occurrences. Many units now have a section to gather statistics, process technical failure reports, unsatisfactory condition reports, technical inspection reports and maintain the Master EO Library. This section has those facts and figures that often help investigations and other flight safety work.

The section, whether it is known as Maintenance Research, Technical Research, or some fancier title, and whether it is only a small corner in "Log Control" or completely organized under an officer or NCO, is a proven tool in promoting flight safety.

Aircraft Technical Research
& Investigations Section
Cold Lake

"Flash-Back"

Unfortunately the ambulance arrived before the crash...

SPOT THE SAFETY DEVICE

A good aircraft technician is skilled
in recognizing safety features. . .

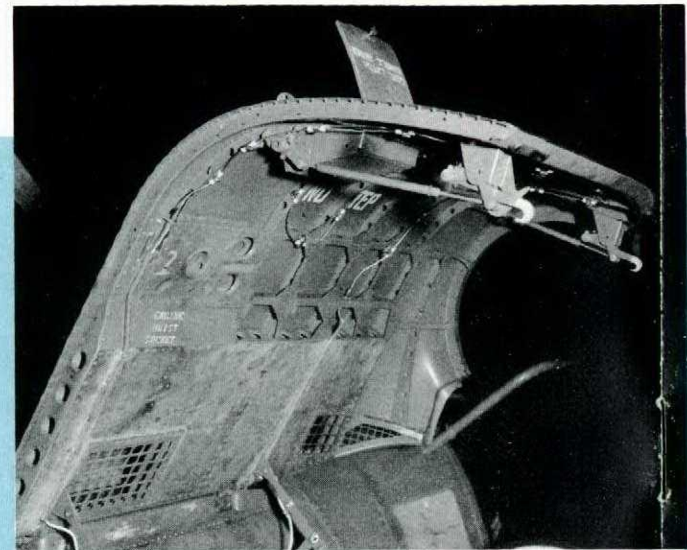
By design or modification during service, many features are incorporated in aircraft to ensure safe operation and ease of "double checking". Each photograph contains a safety feature which has been emphasized in Navy operated aircraft in the past year and at least one safety feature which has been in service for years.

WRITE IN THE SAFETY FEATURES AND TEST YOUR SKILL.

A ______

B ______

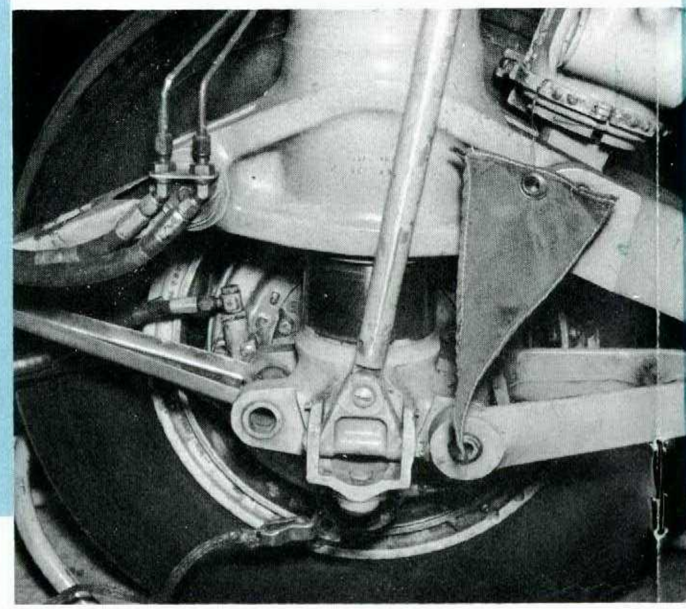
A The blade tip paint scheme of the Tracker was changed from a 4-inch wide dayglo red band to 3 – 4 – 3 inches dayglo red-white-red scheme to improve propeller blade conspicuity. The propeller hazard is high on the cramped flight deck.
B Wheel chocks, wing and torpedo bay jury struts, undercarriage locks, nose gear position mirror (polished nose ring spinning) and safety markings have all been in service for years. Their proper use and upkeep is vital.



A ______

B ______

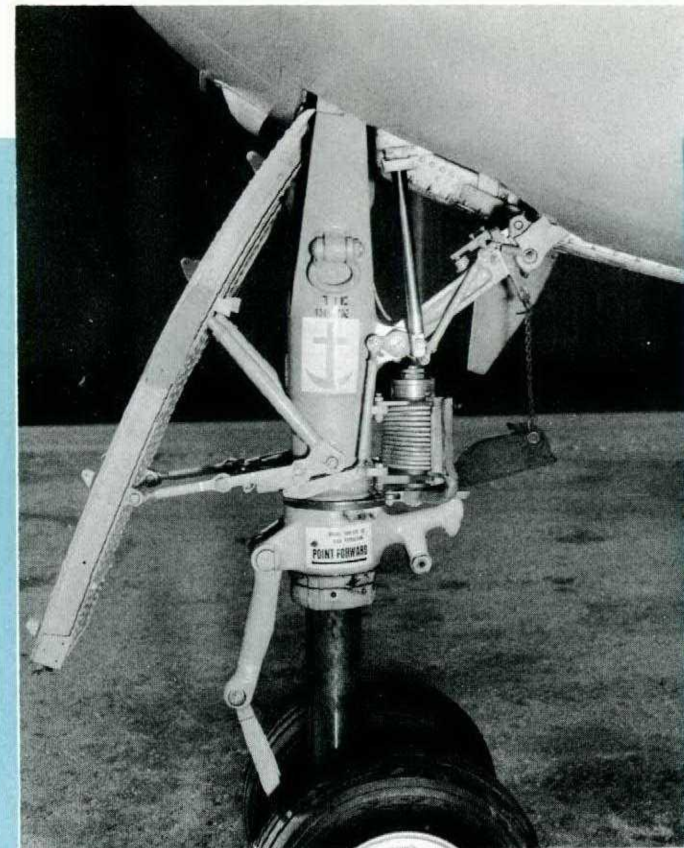
A The Sea King engine cowl latch "J" hook is painted conspicuously for inspecting the correct positioning of the hooks. The built-in safety features were not reliable in this case.
B The engine cowl (servicing platform) latch mechanism has two safety features:
(a) The cowl latch handle panel cannot be closed when the handle is in the unlock position.
(b) The cowl latch "J" hook is prevented from moving to the locked position until the retaining hook has released the latch bellcrank.



A ______

B ______

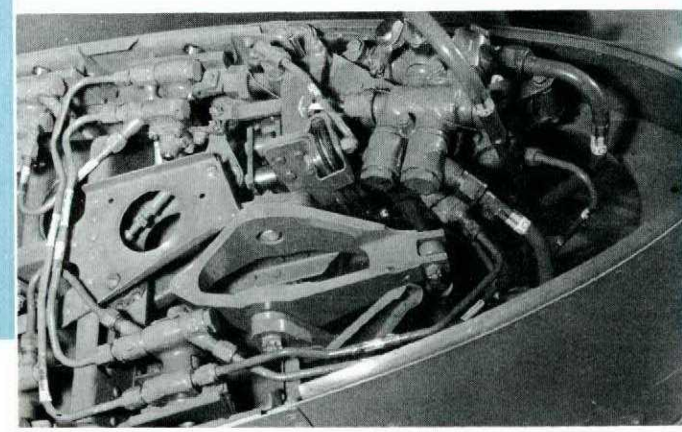
A Tracker operators will remember the brake problems when the brake shuttle valve bolts backed off. To prevent this the brake shuttle valve bolt safety wire locking was introduced.
B Besides the safety features which can also be seen in other photographs, a brake pad automatic adjuster pin will be spotted by a keen eye.



A ______

B ______

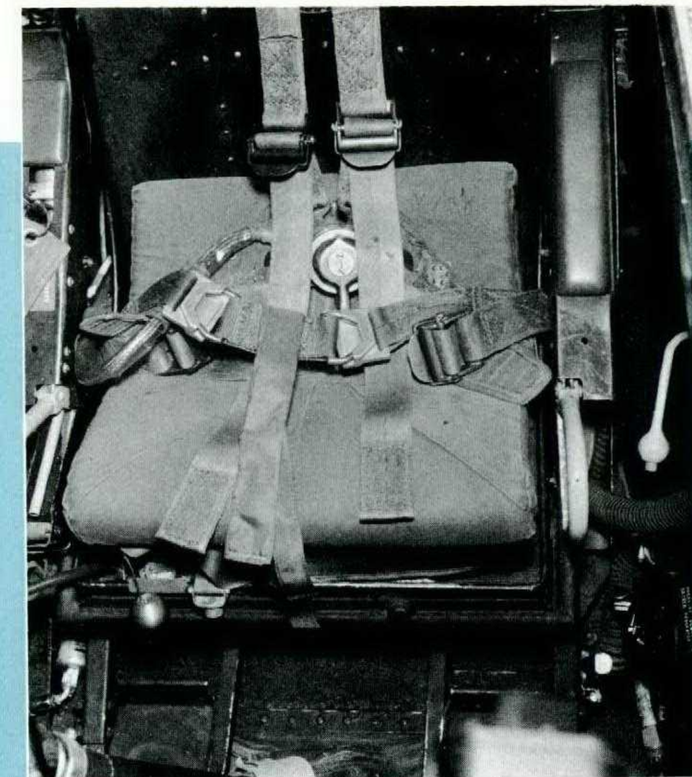
A Point forward decal on the Tracker is a reminder that the shimmy damper will function only if it is properly engaged.
B The nose gear lock and flag illustrate the use of ground locks and knowing when and where required.



A ______

B ______

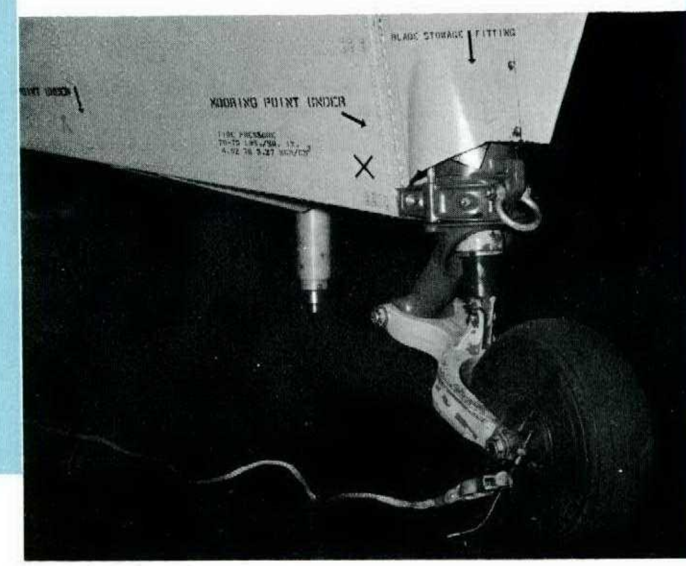
A Painting the Tracker wing fold/spread sequence valve knob and lever mechanism has simplified ensuring that the sequencing mechanism is correctly positioned on the pre-start up check.
B Marking of fluid lines and safety wire locking are recognized features for all types of aircraft. The wing lock cylinder pins protruding to the surface of the wing when in the locked position is a feature which eases checking for correct locking of the wing.



A ______

B ______

A The solo rigging strap for the T-bird back seat is a simple, effective device for securing the seat gear.
B The safety pins must be in position at all times.



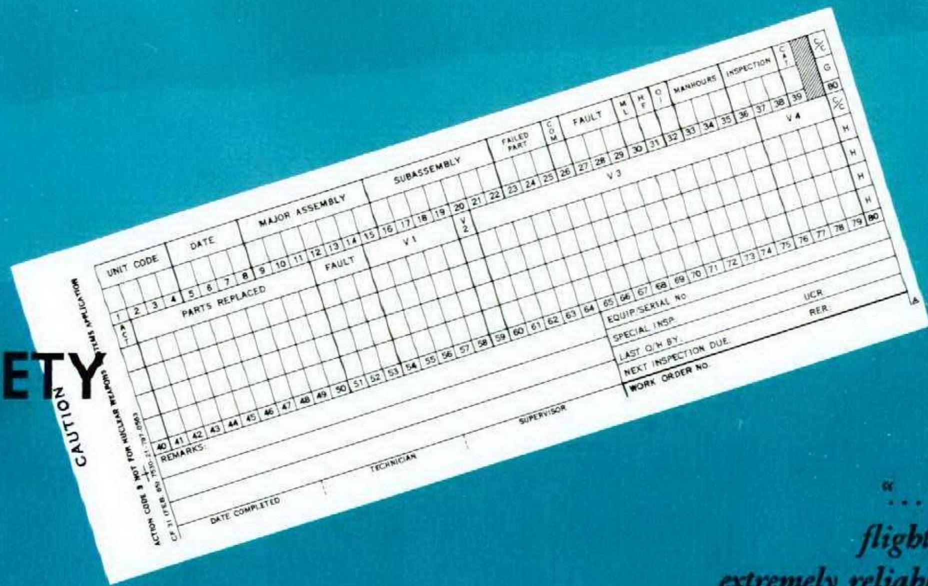
A ______

B ______

A The CAUTION reminds us that the first step in towing a Sea King helicopter (CHSS-2) is to ensure that the tailwheel is free to rotate. The lock pin is painted two colors for ease of checking that it is retracted; the stencilled caution is an additional reminder.
B Other safety features are the bonding wire, mooring point, and correct pressure markings.

TFR* AND FLIGHT SAFETY

*Technical Failure Report



"... the keys to flight safety are extremely reliable materiel and highly effective preventive maintenance..."

W/C JC Olson
MCHQ

Aircraft accidents are usually comprised of two distinct and consecutive events. The first is the developing emergency and the second is the action to correct the emergency condition. Prompt and correct action in an emergency may prevent an accident but it is still axiomatic that the best preventative is to not have the emergency arise in the first place. The best emergency equipment and procedures must always be available, hopefully, never to be used since the emergency should never be allowed to happen. If one occurs the accident prevention program has failed to some degree.

The vast majority of emergencies arise either from aircrew causes or from aircraft unserviceabilities due to technical failures. Much effort has been expended on aircrew causes with encouraging results. Similarly, emergencies caused by technical failures require our attention. Our concern is based on the growing importance of this aspect of flight safety and the present lack of a comprehensive method of combating technical failures.

W/C JC Olson of Regina, was a pilot on operations in Canada and the UK during World War II. In 1950 he received a BSc in Chemical Engineering from the University of Saskatchewan. After two years at AMCHQ W/C Olson was transferred to an RCAF Detachment, Culver City, California, and following this was chief project officer at the CEPE Detachment, Cold Lake. After two years study at the Massachusetts Institute of Technology, W/C Olson received a Master of Science degree in Aeronautics and Astronautics. Previous to his present position at Materiel Command HQ he was at CFHQ.

One Emergency Procedure – ESCAPE

As aircraft become more complex there is more and more equipment which can affect flight safety; dampers, stick shakers and automatic pitch controls are a few examples. Furthermore, the maintenance of newer aircraft is more difficult requiring more sophisticated test equipment and higher skill levels. To maintain a reliable, airworthy aircraft is becoming more difficult; at the same time, modern aircraft design and performance reduces the capability of aircrew to combat in-flight emergencies. It is not inconceivable, therefore, that in the future there will be one universal emergency procedure: ESCAPE! The obvious conclusion is that the keys to flight safety are extremely reliable materiel, and highly effective preventive maintenance.

How are materiel reliability and maintenance effectiveness to be improved? Generally, the process may be considered to consist of five aspects:

- we must know the materiel and maintenance problems
- we must know how well we are preventing the problems from developing into accidents or incidents
- we must decide which problems should be solved first
- we must find timely and adequate solutions to the problems
- there must be evidence that the solutions were indeed timely and adequate to remove the problem.

These aspects involve reporting, management decisions and engineering effort. Together, they form a technical failure reporting system more conveniently known as TFR. Properly used, a good TFR system can enhance flight safety.

A Good TFR System

The first requirement of a TFR system is that the materiel and maintenance problems be known. Operating units will report all failures since the TFR system has functions other than flight safety. Those failures which affected or could have affected flight safety must be annotated, as well as when they were detected, ie, during operations, unscheduled maintenance, or scheduled maintenance. These reports define the problems to be analyzed and resolved.

The prime objective of maintenance is to prevent technical failures during operations; the measure of its success is the ratio of failures found during operations, to those found during unscheduled and scheduled maintenance. We will probably never achieve 100% effective maintenance; however, every failure found during operations is an instance wherein maintenance failed in its prime objective. Every failure found during unscheduled maintenance represents an instance wherein maintenance was lucky to achieve its prime objective. Thus:

- a majority of failures during operations indicates that maintenance is doing badly
- a majority during unscheduled maintenance constitutes a warning signal
- a majority during scheduled maintenance indicates that the maintenance procedures are effective in preventing failures during operations.

The latter condition does not mean that action to correct the overall situation is not necessary; there will always be room for improvement. The requirement for action and the priority of that action must be established by further analysis.

The Priority Problem

The primary aim is to prevent technical failures from causing even one accident or incident. Therefore, the basic principle in determining priorities is that those failures most likely to cause accidents must be resolved first. Absolute rules cannot be established for applying this principle since the situation continually varies and decisions must be relevant to the overall pattern of failures. Normally, failures which have actually caused an accident/incident should be considered first, to establish the probability of recurrence. The failures discovered during unscheduled maintenance should be considered next, to determine the probability of their not being discovered until they occur during operations as an accident/incident. Finally, the failures discovered during scheduled maintenance must be considered to determine if trends are developing. In some cases, only those failures discovered during operations will warrant immediate attention. In other cases, failures discovered during scheduled or unscheduled maintenance will warrant immediate attention if the accident/incident rate is not to rise. The aim is not to remove the cause of past accidents but to employ our resources to achieve the minimum accident/incident rate in the future. Having determined which failures must be eliminated, a plan of action can then proceed.

Solutions to the technical problems affecting flight safety must be adequate and timely. Generally, modifications are expensive and, what is more significant to flight safety, time consuming. For this reason interim solutions are often necessary. These might be special inspections, revised maintenance procedures, more frequent replacement intervals, etc. Theoretically, these are only stop-gaps. In practice, many stop-gaps become final solutions since the alternative is a major redesign of an aircraft system, prohibitively expensive in time and money. The criterion for success of both the final solution and the interim solution is that the problem is removed or at least does not show up during operations. Future reports from operating units enable continuous monitoring of how effective the action has been. The final proof is a decrease in the accident/incident rate from maintenance and materiel causes.

A TFR Experiment

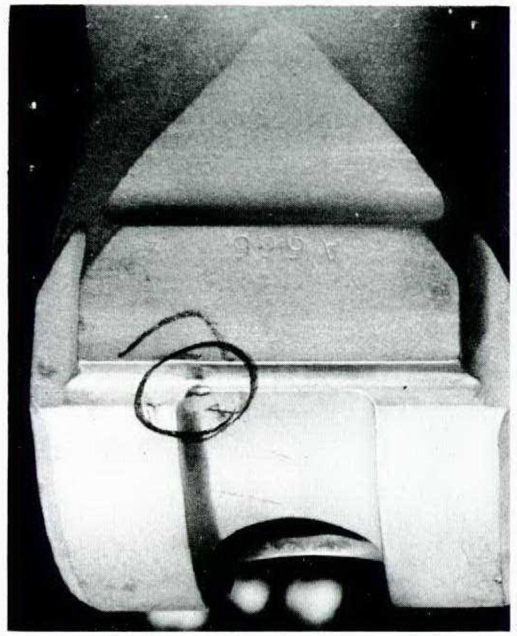
I have outlined how technical failure reporting improves flight safety. Although I expressed concern that the RCAF does not employ such a system, one known as the CF31 TFR system has been developed. This system requires technicians at units to record on a coded card all technical failures. These cards will be processed at Materiel Command HQ to present the technical specialists with data including immediate identification of flight safety failures which occurred during operations, and a monthly summary of all flight safety failures segregated into those found during operations, unscheduled maintenance, and scheduled maintenance. The technical managers can analyze the problem areas using these reports and their knowledge of the aircraft. Although this data may reveal some causes such as local conditions by comparing units, in general the technical specialist will have to do a further detailed investigation to determine the correct solution.

A trial of the CF31 TFR system is underway at RCAF Stns Comox and Chatham, with the CF101 Voodoo as the guinea pig aircraft. Concurrently MATCOM HQ is assessing the concept and procedures for analyzing the data. Since the trial extends only until March 1966 there probably will have been insufficient time to affect the accident/incident rate at these units. However, it will be possible to assess how effective the system is up to the point where solutions to problems must be found. Whether these solutions are good or bad depends more on the quality of the technical effort which evolved them, than on the efficiency of the TFR system. At the conclusion of the trial, any corrections to the CF31 system will be evolved. Hopefully, the system will prove effective and be approved for adoption by the Canadian Forces.

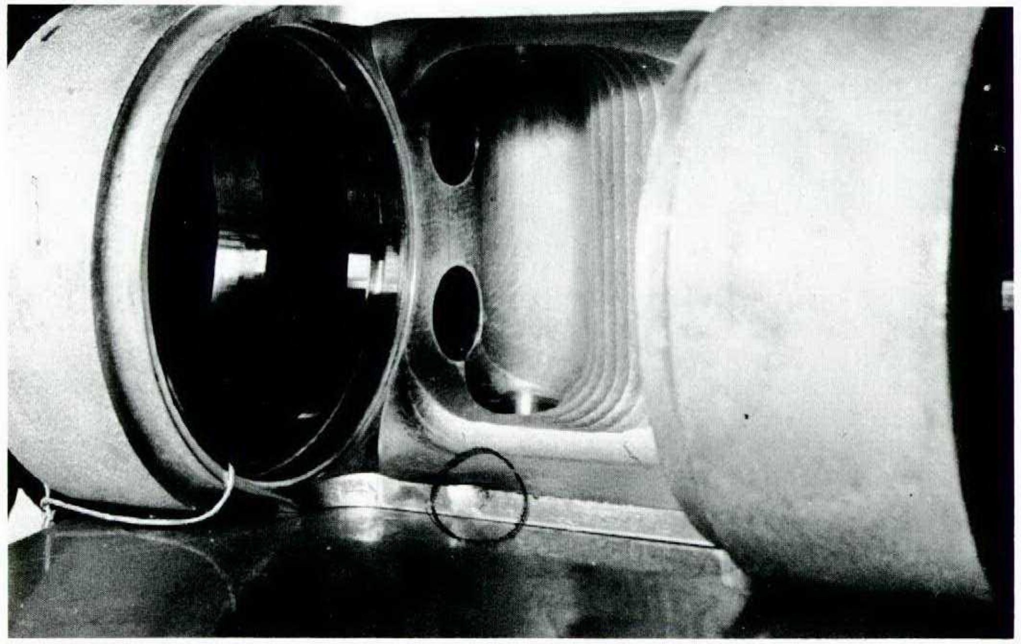
A word of caution is necessary. In common with all TFR systems the CF31 will not promote flight safety merely by its being adopted. In simplest terms it is a tool which can be used for this purpose and like all tools must be used properly. Aircrew must describe unserviceabilities accurately; likewise, technicians must fill in the failure cards conscientiously including every pertinent detail. The technical managers at MATCOM HQ must analyze the situation with the flight-line and operations always in mind. Finally, the technical specialists must be meticulous in finding the best solution to the problems defined.

The manpower cost to do all this must be accepted if we are to recognize early the technical problems which could affect flight safety and if we solve these problems intelligently an improvement to flight safety is inevitable.

HEL'FOD



The badly-bruised flapping hinge mechanism in the photograph is from a CH113 fodicopter - helifodter - helicopter. Seems some FOD dropped in the top of the hinge and slipped down the back. Next time the egg-beater flew, the FO dropped in between the droop stops which then got D (damaged). The pilot complained of fodstop – DROOPSTOP pounding.



Slow Down... You're on the Ground!!!

F/O CB Lockett
Stn Bagotville

F/O CB Lockett is a member of the Flight Safety Committee at Bagotville, where he is the T33 Maintenance Officer. He joined the forces in 1944 and after a brief stay in the army, returned to the RCAF in 1945. In 1947 he was trained as a safety equipment tech; during the next three years he served with 412, 413 and 408 Sqns. In 1948, F/O Lockett was a crew member aboard the Lancaster photo flight which discovered two uncharted islands in Fox Basin in the Arctic. Following parachute training he served for one year as a para rescue team member at Trenton, Ont. From 1951 to 1958 he was an SE tech at Saskatoon and Chatham, then SE supervisor and maintenance officer at North Bay until 1963. His next posting was to Bagotville as aircraft servicing officer for the CF101 Voodoo.

*The story you are about to read is true!
Only the names and places
have been changed to protect the writer!*

You're a maintenance officer. You've been assigned to do a survey for a feature article on "The Significance of Maintenance to Flight Safety".

"But there's not enough darn material on this whole %$fi£% station for an article like that!" you mutter as you leave the Skew-L's office.

"It'll take fourteen months to compile enough bumph to make any sort of reading at all, and he gives me 'til the twenty second! Ratz-a-phatz!"

On your way back to the office, (where you intend to take immediate steps to get yourself off this hook)... "Le'me see, who's the lucky candidate that I can refer this nasty little item to?" You walk by the Visiting Flight line and a T-bird taxiing into his slot sends your hat rolling across the grass into an open FOD control container. Picking it out of the debris and jamming it on your head, you decide to fulfil your life's ambition and beat the hell out of this guy. So you head with solid determination toward your intended victim, who is now bouncing and screeching to a stop on one of the maze of yellow lines...

As you are about to step forward and extract this jockey bodily from his perch, you STOP!

"Now just a darn minute" you say to yourself, "I wanna write about flight safety... an' this guy's been flying... He's a visitor, so he'll be going again ... maybe I should... just... back... off..."

As the ground locks come clanking to the ground from somewhere above, narrowly missing the technician who has chocked the bird and is just about to hook the ladder over the sill, a slim young form disengages itself from the tangle of harnesses and descends to ground level.

"Where bound, sir?" the airman asks.

"ChatBay! and I'da made it if that damned TACAN hadn't packed up and the flap motor quit... Oh! an' wou'ja take a peek at that port tip... it isn't feeding too well... Hey! You guys havin' an exercise or something? Your line sure is full... Boy! Haven't seen an old Clunk for a long time. An' look at those B57s... Say! You guys look pretty busy... just fix up this bird an' gimme some fuel an' I'll be out of your hair in an hour, after I eat."

It's a bewildered airman you hear muttering to himself as the pilot strides toward Servicing.

"Of all the damned nerve! An hour he said... Great Ceasar, where do I start...? Fuel first and call telecom? And who can I get to work on that flap? An hour! Boy!"

For one fleeting moment you stand and sympathize with this airman and wish sincerely that you had followed through with your original intention. But wait! Isn't this a beautiful example of what you're looking for? Think of the implications here. The picture forms — the recipe is clear – ALL the ingredients are there:

1 supersonic air type
1 very unserviceable aircraft
1 slightly upset technician
8 visitors of various types
1 limited servicing crew

Separate the air type and send him off to eat. Mix the 9 aircraft together and blend in 1 upset technician and the limited servicing crew, and bring quickly to a boil. If the mixture thickens too quickly, add 43 gallons of JP4 to each leading edge tank. Drop this mixture in lumps on an engineering officer, preheated to 375 degrees.

Could this situation affect flight safety? Need one say more? Too much work for too small a crew. Something is bound to be overlooked in the rush.

THIS IS TOO MUCH! Just 10 minutes ago you were in a real quandry... a story but no material and here you were with enough to keep your pen in action for an hour.

"Boy!" you say, "just let me get to my desk and get this little scene into words and maybe by the time that pilot gets back from lunch I can talk to him and take some of the pressure off that line crew."

As you head thoughtfully toward the servicing office, your emotions a mixture of anger and delight, you bump headlong into a body laden with flying gear, flight bag, maps and a travelling L14.

"'Scuse me, Mac...a-ah Sir!" you stammer as you back away from the three bands on his shoulder. You hope that's a good-natured smile you see as he lunges for his maps and L14 which are now fair game from the brisk breeze. Your embarrassment is only exceeded by the speed with which you recover his paper.

"Guess I wasn't quite with it, sir...Couple of things happened out there that had me thinking..."

"Well, matter of fact I was a bit guilty myself," he assures you. "Sort of absent-mindedly trying to figure out where else I'd received this sort of servicing. Somebody ought to be pretty happy with his crews; I've been trying to find their boss to let him know how pleased I am but he's not in...hoped I'd run into him before I left."

"You just did, sir." You hope he appreciates the pun, which he greets with a mild grin, and continues, "Those lads really appeared to enjoy what they were doing – maybe they thought I was getting a bit impatient or nosey because I stood around and watched...but not so. Just interested in your procedures here. Your reputation is pretty widely known, you know."

"No, I didn't, and thank you," you beam.

"My thanks to you and your men. Keep it up." He waves his maps as he moves toward the aircraft on the line. "Good trip!" you call over the din of a taxiing Voodoo and step into the line office.

"Have a look at this, sir" says the desk corporal, handing you an L92.

You grasp the Transient Aircraft Servicing Form and think, "Oh gad! what now?"

The comments on the bottom of the form read 'Fastest snag recovery and turn-around in the East! Many thanx.'

"Nice to see", you say as you flip over the sheet to see who did the work.

Just at that moment the crew in question burst into the office, the corporal is beaming. "What a nice guy!" he offers.

"Gee, thanks." you accept.

"Well...I suppose," he grins "but I mean that Winco who just left. People like that you don't mind busting your backside for. He explained the whole snag so darned well an' even said he'd wait over if we were too rushed...I went out and got Joe from repair and we got everything back to normal in jigtime. He was some pleased too, an' didn't mind saying so."

"Me too, and neither do I!" you say with gratitude.

"He told me what a good job you did and wrote a screed on the L92. Have a peek and I'll go thank Joe."

This last little event you are about to shrug off as routine, when again, for the second time since you picked up your assignment, you STOP!

"Maintenance! Flight...! Say! That little episode could end up being a very important example in your story...Happy aircrew, quick to size up our problems...no pressure to rush things...good explanation of snag symptoms...encouragement and praise where due...resulting enthusiasm and quick, thorough snag rectification...both parties pleased...Yes, my boy! There is a key to flight safety if there ever was one!"

Your day has gone too well! Twice you've been confronted with glowing situations and you think, "by gosh, maybe every visiting 'turnaround' isn't just the routine chore you believed it to be...surely some of them have to be normal...but two out of two? And are all the examples right here in servicing? Well, it's a good start, so just sit tight and keep your eyes open..."

So you do just that, while in between there's the jottings for your story, the inevitable stack of paper in your IN basket, the queries from the OR staff, the daily review of Repair Progress...Repair Progress... What about that? Have you built up your repair section with too many personnel and is servicing suffering because of it? Could you afford to ease a man or two out of this area to strengthen servicing? But darn it man, they always seem to be pretty busy, the aircraft are staggered into inspections at regular intervals, the controller sees to that! You've never seen them without a job and they've done their share of overtime...and when you think about it, isn't the repair section basically where the maintenance input for flight safety really begins? Where systems, controls, regulators, indicators and the like get their functional checks to ensure that the aircraft are in good condition? Of course it is! You can't possibly afford to jeopardize this, the most basically important contribution to flight safety: to provide faster service on the line.

Your common sense says "Let it lie, boy!" you know the men will do their best. Just keep the reminders coming that undue rushing can only lead to disaster. So somebody's not on time for lunch in Summerville... a courteous explanation will take the heat off. The aircrew guys listen with the best of 'em...and ten to one these travellers have seen the same situation on many a flying station."

Your thoughts are suddenly interrupted by a rap on your door.

"You'll probably be hearing about this, sir" your Flight i/c Servicing begins, "So I'd like to put you in the picture right now...young Schmedlap was on the line starting a visitor and let loose with some pretty unsavoury remarks while the pilot was doing his walkaround. The exchange was getting pretty hot when I got there. The aircrew guy was damned mad and I don't blame him. Guess this fellow needs a lesson about courtesy to visitors and everybody else. The aircraft roared away and nearly blew us both over!... You wanna see him, sir?"

"You bet your boots I do!" You jump at this one because now you are more aware than ever of the effects one's temperament can have on how he does his job. If that job is flying then the pilot being angry when he rolls away from the line could certainly have quite a bearing on his safety.

You are suddenly amazed at yourself and how every aspect of your job is so obviously connected with this project you are now so involved with.

"Just never thought of it quite this way before", you think as you head down the hall to see what the boys in log control have to offer.

Explaining your assignment to the corporal in charge, you ask if he has anything to contribute.

"I sure have!" His quick reply startles you.

"Something happened to a bug-smasher that could be quite pertinent. They rolled it out on the line after inspection the other day", he continues,"an' everything looked pretty normal for the test flight, but 45 minutes from takeoff the repair crew was parking this beast again and the pilot didn't look the least bit happy. I learned later that his pink-sheet entry read U/C RED UP-LITE OUT, TESTS OK...Well, after a successful retraction check, the repair crew cleared the snag like this: U/C CHECKS SERV AS PER MOD 05-45B-6A/207 (CARRIED OUT DURING 4 CHECK). Log control goofed here because we overlooked providing a form, showing details of 'Effects on Cockpit Configuration and Operation of Aircraft'. We realize the importance of letting the aircrew in on any mod changes; it isn't likely we'll overlook it again!...Especially now, since you have the story!" he adds grinning.

"That's good, I'll use it! Even the 'paper section' contributes to this flight safety bit. Thanks Sil".

You're eager to get this 'Goodie' on paper and try to tie things up to meet the deadline...but you have one more call to make.

There's a man in your organization who has been here for some time. He's been rotated through servicing, snag and repair, and is now NCO i/c engine bay. He writes articles for the station paper and you're sure he'll have something for you. You're not wrong.

"Joe, you've been through the circuit here, you know the operation...just how does our maintenance contribute to safety of flight?"

"Well, the way I see it," he drawls, "Too many organizations develop a miserable attitude toward others. We feel if we can't do things first class we don't want to do them at all. In other words, we put a bit of effort into our work. Anyone can be miserable; added effort produces a real stinker!" Dragging on his pipe he continues. "We maintain a state of co-operation between our repair and servicing. Our left hand is kept in-the-know with the right. Stressing a high quality of maintenance during inspection and on snags produces a higher state of serviceability and less time lost on snags once the aircraft is returned to flying...That's about it, I guess."

"Joe, you're a gem." The perfect wrap-up...now, if I can sort this all out and get that typewriter of mine to translate it..."

Later...much later, that evening, after you have erased and retyped the last line of your story (on a typewriter that just won't ever learn to spell), you lie in bed anxiously waiting for your good wife to complete her proofreading of your missive and voice her opinions.

She turns to you and says: "Honey, your typing is terrible, your spelling is atrocious, and all I can get out of this article is THAT MAINTENANCE IS FLIGHT SAFETY".

For just that statement alone, you love her dearly!

The SFSO and the Maintenance Organization

...the old slogan about safety being everyone's business, made him sick...

Particularly important to effective flight safety is the relationship between maintenance staffs and the Station Flight Safety Officer (SFSO). One of the major tasks of the SFSO is to advise the commanding officer in assessing incidents and accidents. In the majority of these occasions this assessment is no simple matter and requires much information and co-operation from maintenance personnel. In fact, with most incidents or accidents the bulk of investigation falls upon the maintenance organization. It should become quite obvious then, why it is most important for the SFSO and the maintenance staff to work together. This co-operation exists in the day-to-day exchange of paper work, and through direct personal communication.

A flight safety officer should feel free to visit any servicing maintenance section on the station. Not only should he feel free to do so – he must do so! In these visits flight safety and maintenance are drawn closer together, for in reality these two functions are one.

Often, the SFSO is a communications link between aircrew and maintenance or servicing personnel. If this relationship permits a two-way interchange of ideas, much can be accomplished in the interests of Flight Safety. Obviously, the SFSO must have the confidence of the groundcrew for this vital exchange of information to begin and continue.

We in the maintenance side of this business welcome a hard-driving incumbent in the station Flight Safety position. We look to his office to "nip in the bud" the all too familiar game of "finger pointing": maintenance error – pilot error. His tenacity in ferreting out the *real* cause of accidents/incidents within a united organization, means that the basic cause is made known and hence, the proper correction made.

At a recent civilian safety conference, the keynote address was presented by a very frank senior executive. This speaker made the blunt statement that the old slogan about safety being everyone's business, made him sick. Safety, he stated, was the business of management, and it is time that all management awake and put a stop to the extensive loss of resources attributable to needless accidents. Since this conference we have retired the old slogan to pension.

RCAF Stn Summerside

Truths from Super Sleuths

F/L J Corbett
Air Div HQ

If the people involved hadn't realized the potential hazards in each of the situations below the tales might have had different endings. There are many more instances where in the course of his work the maintenance man makes a contribution to flight safety. Most of these things are done almost automatically by the good maintenance man; it is almost a reflex action for him to consider the flight safety implications of all his actions. . .

Case of the Perambulating Pin

It was only a small pin less than two inches long which should have been safe and sound tucked up in the crowded wheelwell of a CF104. Its job: to ensure that the emergency undercarriage release cable stayed in place around the emergency release system pulley. This particular pin for some unknown reason had lost its spring locking feature and started to work out of the pulley bracket.

The AFTech doing a check in this area could have missed this small technical discrepancy – but he did not. Having discovered the one faulty pin he could have replaced it with a serviceable item and forgotten about it – but he did not.

What did happen goes something like this. The technician who discovered the fault reported it to his supervisor. A check of other aircraft revealed that several had pins which had lost their spring locking feature.

The condition was reported, and the unit:

- raised a Wing special inspection to check all CF104s for defective pins.
- sent a message to Air Division info other Air Div units and Materiel Command reporting what had occurred and the action taken.
- submitted a UCR on the pin.

Air Division in turn, issued instructions to all units to check the serviceability of the pin. Air Division also requested that Materiel Command issue a Special Inspection to cover the condition and attempt a fix.

Materiel Command promptly issued Special Inspection, EO 05-165A-5/113 to check the condition of the pin on all CF104s. Later, after further investigation, Materiel Command issued modification EO 05-165A-6A/247. The modification replaced the spring locked pin with one which was retained by a cotter pin.

It was only a small item but the airman who discovered the initial case acted properly. By so doing he initiated actions which culminated in giving the 104 pilot a more reliable emergency undercarriage extension system.

Case of the Corporal's Cure

Over a period of time there had been several instances of unselected lowerings of all or part of the CF104 main undercarriage. The consequences of this occurring at high speed are destructive and could very well be disastrous.

One of the reasons for the inadvertent lowerings was the design of the undercarriage control circuitry on the CF104. The circuit was such that if either of the rear main undercarriage door switches operated from the up to the not-up position both forward main undercarriage doors would immediately be powered to the open position regardless of the position of the pilot's undercarriage control handle.

Once the forward doors were open they were usually torn off or severely damaged. With forward doors open or missing the air blast on the rear doors and main gear would sometimes be enough to force the main gear out of the up-locks and into a partial down position. This usually meant further damage to the rear doors. Fortunately, the main gear has been rugged enough to withstand this rough treatment. However, undercarriage components being ripped off and striking other parts of the aircraft have a rather unhealthy effect on the overall aircraft structure. Usually, some hydraulic components came adrift releasing hydraulic fluid and with it, the loss of some of the hydraulically-actuated services. Fortunately, the emergency undercarriage lowering system is pretty dependable. The aircraft involved in these occurrences have always been able to make a wheels-down landing.

The circuitry was clearly a hazard and a cause for concern among the maintenance people. A corporal ETechA in Air Div worked out a solution involving a change in the aircraft wiring. His proposal meant that before the undercarriage doors could actuate from the up position a down selection had to be made.

The corporal showed his idea to a visiting officer from Materiel Command, who asked for a copy of the proposed wiring changes, suggesting that it also be submitted as an original suggestion. On his return the officer took the proposed wiring changes to Canadair and requested they check the feasibility of the proposal. Canadair felt that with very minor changes, incorporation of the proposal would be feasible and definitely desirable.

As a result, modification EO 05-165A-6A/251 was issued and the circuitry changes embodied in all CF104s. Constructive thinking instead of just moaning about the inadequacies of the system meant that the chances of major aircraft damage and possible loss of an aircraft due to inadvertent undercarriage extension have been greatly reduced.

Case of the NCO vs FOD

A J79 engine had been returned from the contractor after repairs. The engine was being built up for a test run, then installation in a CF104.

A corporal AETech detected an unfamiliar tinkling noise as the engine was being rotated on the roll-over stand. Not content to assume that an engine from the contractor was serviceable, the NCO and his crew started to dismantle and inspect the engine. The cause of the strange noise turned out to be a small bolt approximately one-half inch long rolling around loose inside the outer combustion liner.

Had the bolt remained it is difficult to determine exactly what the result would have been. The bolt may have bounced around harmlessly for a period, but at any time it could have been pulled or bounced into the engine proper. Then if we were lucky it would end up as a damaged engine that no one could explain. If we were unlucky it could have been an aircraft crash. In effect, it was similar to a loaded gun waiting for someone to pull the trigger.

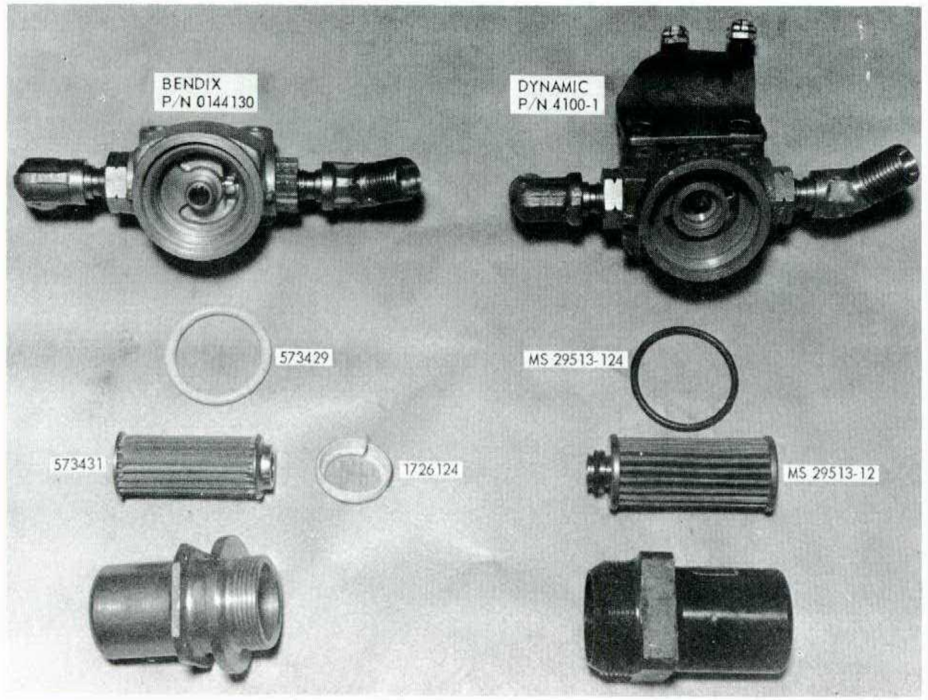
Here, a technician who knew his equipment well enough to detect a strange sound and was thorough enough to take nothing at face value, averted a possible major accident.

Another Murphy

The pilots of a CHSS-2 noted a strong smell of fuel in the cockpit 15 minutes after takeoff, obliging them to abort the mission. Fuel was found leaking from the static fuel filter – the wrong O ring had been installed.

The manufacturer of the T58 engine has seen fit to sub-contract for static fuel filters to two suppliers. While the two units are readily identifiable (see photo) a distinct hazard exists from inadvertently interchanging components. The O rings are NOT interchangeable, neither are the filters.

This sort of thing makes the already formidable job of aircraft maintenance unnecessarily complicated. But there it is – we'll have to live with it.



INSPECTIONS

What's New?

New methods no matter how much better than the old, usually meet with resistance. Pride in the old way, suspicion of the new and just plain stubbornness can ruin our best efforts.

A "New Look" has recently been introduced in Aircraft Inspections. Perhaps the following overheard in a typical repair section may clear some of the suspicion and shift the pride to the new system – it may even melt a little stubbornness.

"Say, have you heard of the New Look in inspections?"

"New Look – what's that?"

"Well, officially it's called the Aircraft Planned Inspection Card System. It's in EO 00-15-10B."

"So what's new about planning inspections? We've always had to do that."

"Yes, we planned – like the time we ended up with five in a Sabre cockpit and someone reconnected the battery."

"Well, those things happen, but usually once the crew got organized we turned out a pretty good aircraft and on time."

"Yes, except when we were held up for parts or had to wait two hours for someone to come down from the shop, or when we found a big snag on the last day and had to AOG, and work overtime to catch up, and then someone forgot a lockwire."

"Sure, but I don't see how some fancy system dreamt up in headquarters is going to get parts. I say: put more people in the shop, and stop those snags."

"Well, the system wasn't just dreamt up. It's really a group of ideas developed over the past years put together in a standard system. And secondly, although the basic system was put together at Materiel Command the actual Planned Inspection for our aircraft was worked out at one of our units. Not only that – when we use it we can control the sequence. Naturally, we have to do everything that is called up, but now we can get changes made quickly rather than waiting a whole year."

"That still doesn't get us the parts."

"Not directly, but the card system makes it possible for our people to see what's going on before, during, and after an inspection."

"Before?"

"Yes. Remember that last inspection? We checked out the hydraulics then they put in a mod and we had to check it all over again. The card system ensures a complete coverage BEFORE an inspection; parts, modifications, special inspections, extra help – these are thought about before the inspection not just as they occur."

"How about during the inspections – are we going back to those flow charts that showed five minutes for a two-hour job and vice versa?"

"Yes and no. Yes, we'll use flow charts; and no, to the wrong times. When we start to use the system we'll have flow charts developed by a unit with the same aircraft as ours. They'll have listed all the jobs in the order they did them along with the time it actually took to do each job."

"Their times and sequence may not suit us."

"Perhaps, but as we're doing the same job we'll be pretty close. After we've done a few inspections we can adjust the sequence and times to suit our operation."

"How do we know what adjustments to make?"

"Well, the card system employs a man called a Recorder. He hands out cards and records their return. He also monitors the progress of the inspection, noting where the holdups are. He marks on the flow chart the actual time taken for each job. A review of what went on, points to where the troubles are. The flow chart can be adjusted if necessary."

"The recorder must be kept busy."

"Yes, his work takes a load of paperwork off the crew chief, who can now concentrate on making sure the inspection is done right – gives him more time to supervise the crew and to check the aircraft."

"These cards – why are they used?"

"Several reasons. First, the cards which the tradesman takes to the job give him a job sequence showing what has to be checked and how. The controller can easily keep track of what's done. Also, with an inspection broken down into cards the scheduling can be changed quite easily right at the unit."

"What you say all sounds fine – but doesn't the Planned Inspection Card System use more people?"

"You could say one more man – the controller. But when the system is properly used, inspections get done faster and usually with a smaller crew. Actually you save on aircraft down-time, and people. Most important though, with planned inspections it's easier to make sure things get done on time and properly; you avoid the last-minute panics that cause accidents."

"I think I'll take a look at the EO."

"Good idea – it's in 00-15-10B."

On The Dials

Clearance Limits and Lost Communications

A jet aircraft loses communications before receiving clearance to maintain a suitable altitude and is forced to fly to destination at the last assigned altitude, or the minimum enroute altitude. The increased fuel consumption at lower altitudes makes this trip impossible.

Problems of this nature prompted the introduction of a new procedure about two years ago.

If unable to give an operationally suitable altitude in the initial clearance, ATC will assign a lower altitude to a point short of the destination. If communications loss occurs the pilot proceeds at the last assigned altitude for ten minutes past the clearance limit, then climbs to flight plan altitude and proceeds to destination. Very good so far – but here's the rub:

- What is an operationally suitable altitude?
- How far from the departure point can a clearance limit short of destination, be?
- What is the minimum altitude that can be accepted to such point?

Who shall answer these questions? You, old buddy – that's who.

Most controllers consider that the trusty T-bird can be given 25,000 as an operationally suitable altitude with a promise of higher later on. But if the usually reliable UHF talking machine ceases to function prior to your receiving a higher altitude you are now committed to maintain FL250 all the way.

Let's consider a T33 flight planned from Winnipeg to St Hubert. Most days FL370 is needed to meet the fuel requirements; some days FL330 will do nicely. But it's on a rare day you can make it at FL250. If FL250 was given with the clearance limit at St Hubert, you're in real trouble if you have a communications failure. About the only out is to make an uncleared climb. This is not only ungentlemanly and unofficer-like conduct – it's downright dangerous. Had the clearance limit been Kenora at FL250 you could proceed ten minutes past Kenora at FL250 and climb to flight-planned altitude and press on, certain of your separation. Your separation is thus assured and would probably not leave you with a fuel shortage.

The communications failure procedure is quite acceptable as such; however, a problem arises in its application. The controller is in no position to judge:

- whether a flight-planned altitude is vital to that flight
- if the flight can be made at lower level
- how long a lower level can be maintained before fuel problems are encountered.

Therefore, we find unacceptable clearances being issued, and worse yet – accepted by a driver, airframe.

The fellow who plans the trip knows best what is acceptable; he alone must make the decision. He can reject a clearance in which communications failure would jeopardize the flight. A revision can be requested so that an initial clearance limit is within your capability should you sustain a loss of radios.

Also, you can request in the remarks on the flight plan, a minimum acceptable flight level; this clues the controller on your requirements.

In closing, we must admit to this being a continuing problem. We have observed numerous occasions in which pilots accept clearance limits which preclude their reaching destination. They assume the requested altitude will arrive after takeoff, but busted radios don't talk – and they do go bust once in a while.

Also it happens, though rarely, that the initial altitude is the only one available; even the best communications won't help in this case. This is a problem easily overcome by landing short of destination. The main thing is painfully obvious:

– don't get sucked into accepting a clearance limit which will run you out of fuel before you get there.

Training Command Maintenance Award

The Commander, Training Command has recently introduced a system of maintenance awards . . .

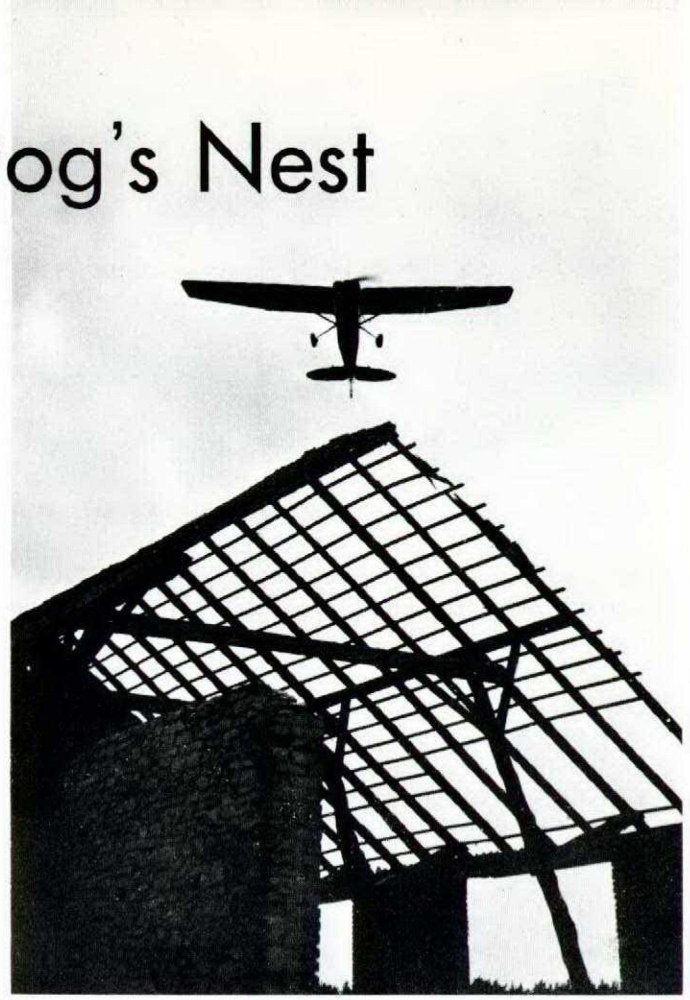
The individual award, a Training Command Certificate, recognizes an outstanding contribution to operational safety. A plaque is awarded to any major flying unit which for twelve months is free of air or ground accidents attributable to maintenance. Each subsequent twelve months accident-free merits that unit a bar to the plaque. Similarly, a unit which has three months of accident-free maintenance operations will display a distinctive flag.

These awards will serve to honour the technicians contributing to the sucess of their maintenance team. Since there are many diverse factors in the roles of Training Command flying units, these awards are not in any way intended to be competitive between stations.

This program aims, like the ZERO DEFECTS program of civilian industry, to emphasize to each technician that *his* efforts are vitally important.

Tending the Bird Dog's Nest

CAPTAIN RI ADAMS



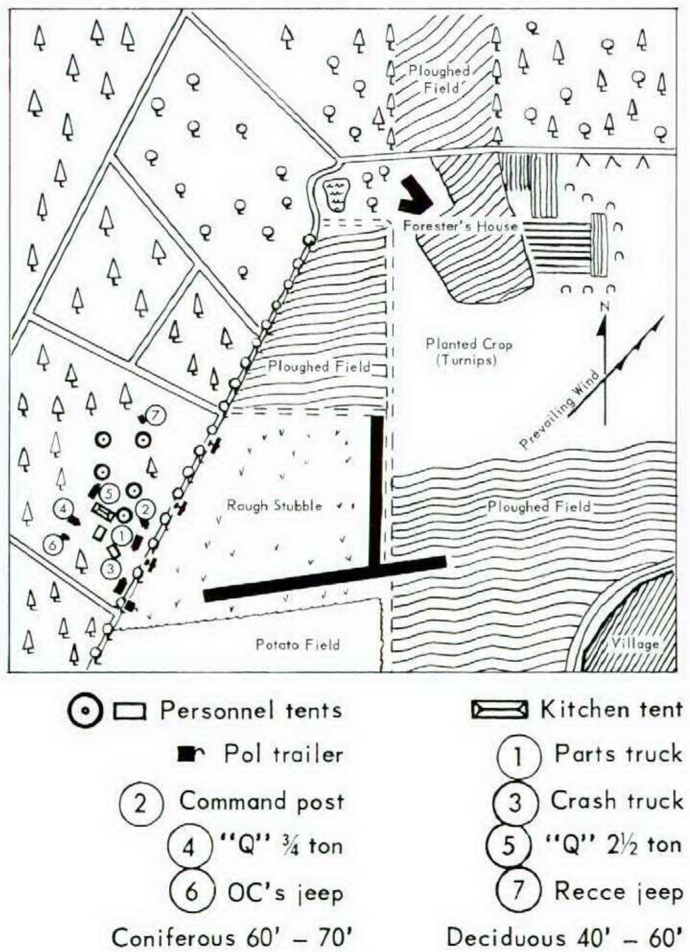
At the maintenance end of the artillery regiment's Air Observation Post Troop in 4 CIBG, Germany, flight safety is a challenging aspect of supporting a flying program.

The AOP Troop in Germany consists of four pilots, seven Royal Canadian Electrical and Mechanical Engineers (RCEME) aircraft maintenance men, four Royal Canadian Horse Artillery (RCHA) gunners to man the ground radios, several vehicles, and of course, L19 Bird Dog aircraft.

Some of the troop's time is spent operating out of the airfield at Hemer where the regiment is in garrison but for the equivalent of three months in a year the "field" beckons. During one three-week training exercise the troop operated around the clock entirely out of tactical airstrips in farmers' fields, and put in nearly 200 hours among four aircraft. The winter weather in Germany precludes much steady flying but activity reaches a fever pitch as the continuation (proficiency) pilots in the brigade descend on us to beat the deadline for their requirement!

The crewmen in the troop spend a reasonably large amount of time airborne; for their own safety should "something happen", they are taught basic airmanship and the handling of the aircraft radios. With this requirement, one can see that the maintenance personnel of the troop are not spectators to the flying operation.

The nature of field operations imposes some unique hazards to flying. In spite of the relatively uncomplicated nature of the machine, FOD is a constant threat. The maintenance crews are alert to the dangers; "FOD collector" areas of the aircraft are carefully checked. Marshalling is another important item of flight safety for the groundcrew. We have the normal hazards of taxiing aircraft on ramps and near hangars when we are at the home strip except that not having a bowser, the aircraft must be taxied to the pump. To get from the strip to the ramp, an aircraft must be taxied through a gate in a fence, an operation that requires some caution. However, the problems in marshalling change abruptly when the aircraft join units in the field. Here, the strip is a bit of stubble field and the hangar is the most convenient stand of tall timber. The uneven ground, the undergrowth, small trees, gopher- and pot-holes, overhanging branches, and small ditches are run-of-the-mill hazards. It is desirable to get the aircraft quickly under cover. Ground handling over an uneven surface and around trees with the small staff makes this phase somewhat challenging. "Interrupted procedures" are dangerous and should be avoided but with small numbers of men, work on a BFI or PI may be halted when another aircraft is being dispatched or received. Our men are alert to this danger, and it is a credit to their vigilance that no incidents or accidents have been attributed to maintenance error.



S/Sgt JH Siefert, maintenance supervisor, checks the installation of a para-bundle being prepared by the Air OP Troop for airborne delivery in the field.

The ever-present FOD hazard requires careful inspection of control surfaces.

Refuelling from the POL trailer must be done quickly so the aircraft can get under cover as soon as possible.

When on an exercise, groundcrew have other tasks such as sentry duty , ground recce, vehicle maintenance on exercises. These extra duties can rob a man of proper rest and meals. Fatigue must not be permitted to a degree that a man's quality of work jeopardizes men and equipment.

Another aspect of field operations is that of goodwill ambassador. In Germany, work on and around the aircraft proceeds without the security of a protective airfield fence. Maintenance personnel therefore are exposed to the close scrutiny of the local people. They arrive by foot, car, and horseback from the moment the first recce vehicle appears, swell to crowds (especially on weekends) when the aircraft begin to arrive and are there waving a fond farewell when the last element departs, seemingly indifferent to the time of day or weather. The danger of having people wandering about in an area of spinning props, rotor-wash, vehicles, taxiing aircraft, and fuel is serious. Crewmen at all times must use the utmost diplomacy when abruptly ordering the family of the local Bergermeister away from an aircraft that is starting up, or perhaps firmly pointing out to the Waldmeister in whose woods you are living, that it is positively "verboten" to puff on his pipe while leaning on the AVGAS drum! The spectator problem complicates the "scramble" response to a call for a mission, and the aircrew rely on the groundcrew to quickly clear the area.

Worthy of mention is the maintenance of ground equipment such as runway markers, night beacons, taxi flags, and windsock – a task of primary importance to flight safety. The equipment is portable and often moved, adding to the servicing factor. Also portability is a prime requirement for the souvenir hunter who might find one of these items highly attractive.

Thus, for an AOP troop, flight safety is a challenge with unique features, when one realizes that the aircraft often fly in an environment not conducive to safe flight as we normally think of it. AOP flying means being low enough to use trees, low hills, and the like, as ground cover from observation and hostile fire; it means flying fast enough not to be "sitting ducks" – this in nearly all the kinds of weather in which the army must necessarily fight. The pilot must have "heads up" for wire, fences, poles, vehicles and other obstructions while map-reading, observing, taking evasive action, calling targets or describing enemy formations.

The pilot, moment by moment puts his faith entirely in the reliability of his aircraft which in the hands of the maintenance personnel makes his occupation as safe as they know how.

Captain RI Adams, born in Brantford, Ont, was in the RCAF from 1953 to 1959, serving in 430(F) Sqn at 2(F) Wing, AMCHQ, and in 6RD Trenton. On joining the army, Capt Adams took his basic artillery training at Camp Shilo, Manitoba in 1960. While with the 2nd Regiment Royal Canadian Horse Artillery in Winnipeg he took a conversion course to army flying at CJATC Rivers in 1962. He rotated with the regiment to Germany in 1964 and joined the Air Op Troop in 1965. Capt Adams is presently a section commander in the troop.

A Simple Job ?

LCDR CP TISDALL
VU33 RCN

LCDR CP Tisdall began his naval career in 1952 as a student at the Canadian Services College, Royal Roads. In 1957 he graduated as an aeronautical engineer from the Royal Naval Engineering College, Plymouth, England. He then returned to the navy and served at Shearwater and on the Bonaventure. Prior to his present position as engineering officer, VU33 Sqn, Pat Bay, he was on the staff of the Canadian Naval Technical Liaison Officer with United Aircraft, Montreal.

Yes, a simple job – hydraulic fluid leaking from the Tracker's tail section. A rudder trimmer concentric slide valve needs replacing. Ignoring the mechanics of the actual replacement let's explore the publications and orders that are involved in this job.

The air technician begins by looking in MICN* 3.35.01 for instructions on the valve and discovers without difficulty, Part 2, Section 4, describing removal and installation of the part. He removes the part and the supervisor hands him the replacement item.

At first, the installation appears as simple as the removal (discounting the endless panel attaching screws and the cramped working space). The bolts that secure the valve are in bad shape – so, over to the hangar issue centre for new ones. The man is asked "What kind of bolts?". He knows the size but this is not enough so he returns to the 3.35.01 but they are not identified. After some thought he looks in MICN 3.35.09 and eventually finds them listed.

Armed with the new mounting bolts he returns to the aircraft and picks up the valve to install it. Then a thought strikes him; "what about lubrication?". Nothing is mentioned in the 3.35.01, Part 2, but now cautious after his experience with the bolts he checks further. The 3.35.01, Part 1, does not specify lubrication; he is about to fit it when the supervisor tells him to wipe the exposed portion of the actuating rod with hydraulic fluid. He then installs the valve as per 3.35.01.

Before tightening the bolts he looks for a torque value – none is given. Some time later having found a table of standard value torques in MICN 3.01.05 he completes the installation of the bolts. Carefully complying with MICN 3.01 he lockwires them.

After referring to MICN 2.95.15 to ensure the lines may be reused he connects the hydraulic lines and is ready to recharge the accumulator. This is described in 3.35.01, Part 1, Section 3; he completes this portion of his job (assuming he knows MICN 2.35.01 on safety precautions on pressure charging).

*Navy equivalent to EO.

He is now ready to adjust the unit but first must replenish the hydraulic system. He finds how to do this in MICN 3.35.01, Part 1, Sect 3. Meanwhile, the supervisor ensures that MICN 2.95.02 is complied with: replenishing oil and hydraulic systems.

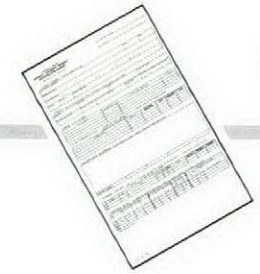
While the technician has been struggling with his part of the job the supervisor has been doing a little bookwork of his own. The defect report and labelling of the old valve require referring to MICN 2.25.21 and 2.30.18. Also, the modification state of the new part had to be confirmed. Famis, Special Technical Instructions, Special Inspections, and Unit Engineering Orders had to be checked to ensure that no inspection or instruction was missed. MICN 2.95.11 was read to find the life of the new item in conjunction with Appendix II of MICN 3.35.03.

After testing and adjusting the new component according to 3.35.01 and 2.95.01 (7) the business of making the appropriate entries in the aircraft change of serviceability and rectification record is begun. MICN 2.30.700 and 2.30.701 supply the details while MICN 2.20.23 (1b), (1c) and (2) list the special inspections required. Other publications that might have been required are MICN 6.15 AV-04 which gives details of the component itself, and MICN 3.01.05 which describes touching up the aircraft finish, required when refitting the panels.

This amounts to 27 different references to properly complete a "simple job" – not counting the subsequent test flight. This hypothetical case shows how a relatively minor job is complicated by having to search a wide range of publications.

In actual practice, of course, the experience and knowledge of the man and of the supervisor may supply much of the required data.

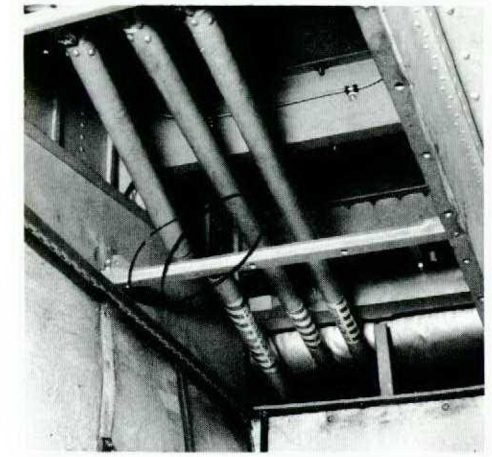
Admittedly, separation of technical details from general engineering practices, methods and safety precautions is necessary. However, the technical publications used by the RCN Air Branch could be vastly improved by more comprehensive coverage in the aircraft 01 series by including information on a particular part (such as torques and lubrication) in the section on that item.



Gen from Two-Ten

YUKON, CARGO DAMAGES RUDDER CONTROL A pre-flight check carried out by an alert flight engineer prior to the second leg of an overseas transport flight revealed stiff rudder controls. Later, ground technicians while checking this condition experienced the same stiffness, then suddenly this resistance to rudder movement became nil. Sometime during the flight, probably during prop reversal on landing, the cargo had moved forward jamming against the control run. This forced the upper panel and its supporting stringer against the rudder control torque tube, with the results as clearly seen in this picture. Had this breakage occurred in the air it could have had disastrous results.

The rear cargo hold had been bulk-loaded with items higher than the overall height of the forward end of the rear hold. No restraining net or stop had been installed in front of the cargo to prevent its moving forward. Needless to say, a fix has been produced to preclude a recurrence.

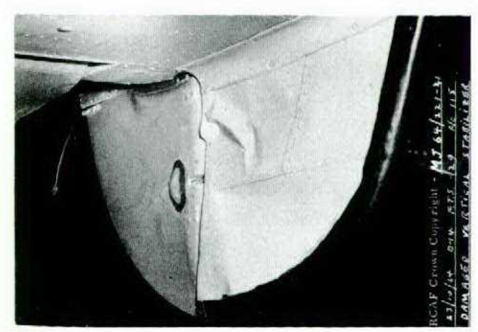


T33, CANOPY EJECTION Two navy pilots were briefed to fly as target for a tracking exercise over a naval vessel. After the starting and post-start checks were done, the front-seat pilot lowered the canopy after being assured that the rails were clear. About two seconds later the canopy was ejected.

It turned out that the pilot in the back seat found the bailout oxygen bottle hose had fallen down between the right side of his seat and the cockpit wall. He was unable to look down for the hose and reach for it at the same time because of insufficient space and his being restrained by the seat straps. He "thrust his hand down blindly," fumbled for the hose, located it and started to pull it out. He was trying to move his hand forward around the right corner of the seat and in the next instant there was a loud bang. The canopy had blown off.

It appears most likely that the pilot grasped the T-handle and hose together and yanked. Later, a bench test indicated a force of 21 lbs was required to pull this handle.

When hoses, lines and the like get snagged in the cockpit – don't solve the problem by force.



C45, TOWING DAMAGE The aircraft was being towed towards the hangar entrance in an area unfamiliar to the tow driver. However, he swung the Expeditor around at the hangar apron, assuming the area to be clear. During this swing the tail struck a metal post damaging the fin assembly. In this case, the provisions of EO 00-50-19 were not complied with due to the small size of the servicing crew.

The metal post which was not marked or painted had been installed to prevent tractor drivers from cutting the corner and running off the hard surface. Our flight safety records bear testimony to dozens of accidents caused by obstructions erected in towing areas which sooner or later damage an airplane.

In-Flight Maintenance Recorders

F/L PJ Jamieson
CFHQ/DMAir

...the cut-off point for maintenance is usually determined by a compromise between flight safety and economy...

The increasing cost and complexity of new aircraft means mounting costs for maintenance. This trend is already apparent and is expected to continue with future generations of aircraft. Maximum effectiveness of this equipment demands the best possible maintenance, but to confine the operating and maintenance costs to an acceptable level every means to achieve this is being explored. Of the many different approaches being examined, one method which appears to have great potential in not only reducing maintenance costs but also increasing flight safety is Aircraft In-Flight Maintenance Data Recorders.

In-flight recording is not a new technique. Aircraft manufacturers extensively instrument their prototype aircraft with in-flight recorders to record data through all phases of flight tests. This technique enables aircraft designers to verify the performance of the aircraft and correct any design deficiencies.

Accident data recorders, now mandatory in commercial airliners, record performance during flight to reveal aircraft behaviour prior to a crash. Though in-flight recording may not be a new technique, the application of this equipment to aircraft maintenance is indeed new.

Aircraft in-flight maintenance recorders consist essentially of two systems:

- an airborne data recording system
- a data processing system.

The recording subsystem produces an accurate and comprehensive record of equipment performance and stresses during flight. The data processing system quickly produces a report on equipment condition which may also be used to predict future performance and time till maintenance, as well as diagnose faulty equipment.

The airborne installation is a tape recorder into which are fed signals from different points, systems and components.

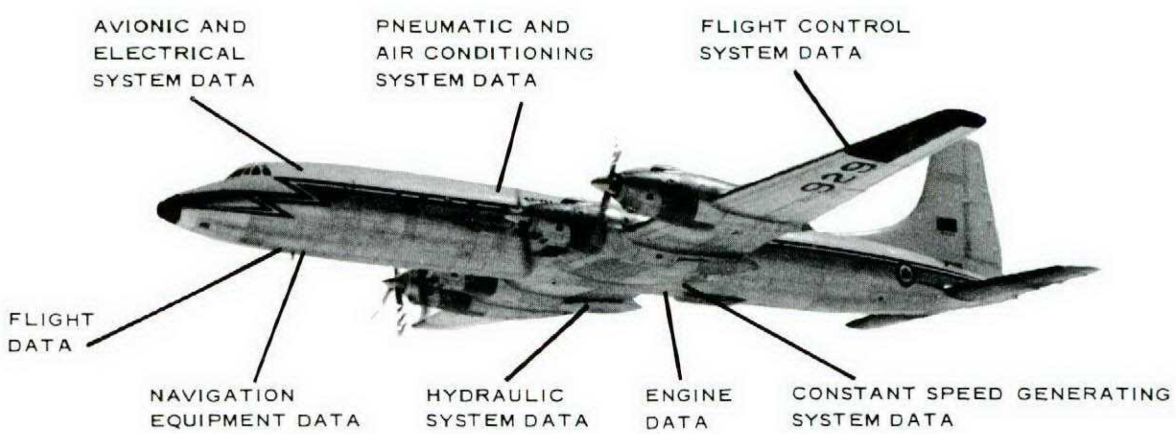
During the course of a flight, the system takes continuous readings, at pre-determined time intervals; these are stored on the tape for processing and analysis in the ground subsystem. This equipment may vary in design but basically performs two functions:

- a "fast read-out" of the tape indicating those parts of the aircraft and systems which are unserviceable. This eliminates wasted time in trouble-shooting, achieving a minimum loss of "downtime".
- provides a history on the condition of the equipment being monitored. For example, this information will allow a more realistic "life" to be set on items and will also reveal fatigue deterioration. Maintenance practices can thus be designed to cater to the actual response of the equipment to operating conditions.

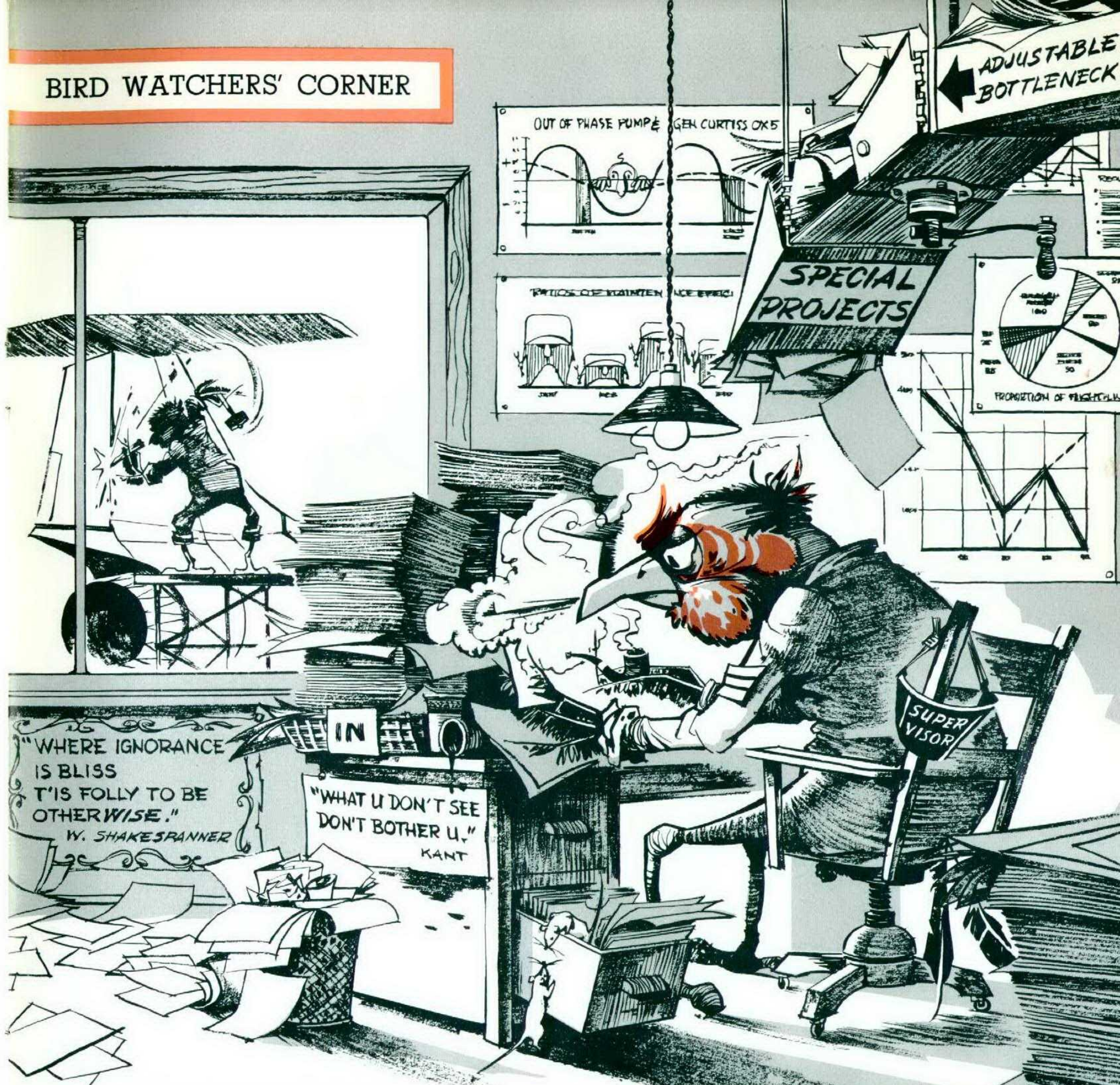
To date, aircraft maintenance has been linked to flying time or calendar time on the basis of experience and testing, with refinement added as operating experience is obtained. Such a system is based on a crude estimate of the probability of failure; the cut-off point for maintenance is usually determined by a compromise between flight safety and economy.

One of the most promising techniques of reducing maintenance cost is "on condition" maintenance, as opposed to the present time control or block time between overhaul maintenance. In any component failure pattern there is considerable spread; if early symptoms of failure were detectable, a component could remain in service rather than be withdrawn at an arbitrary life, and very worthwhile gains in safety and economy could be achieved. This principle is the basis of "on condition" maintenance; the airborne maintenance data recorder is the tool which will make it a reality.

This is just a broad-brush presentation of the philosophy of maintenance data recording. The requirement is self-evident and the state of the art gives definite promise. You may be sure that maintenance data recording will become an accepted and widely used technique in aircraft maintenance within the next three to four years.



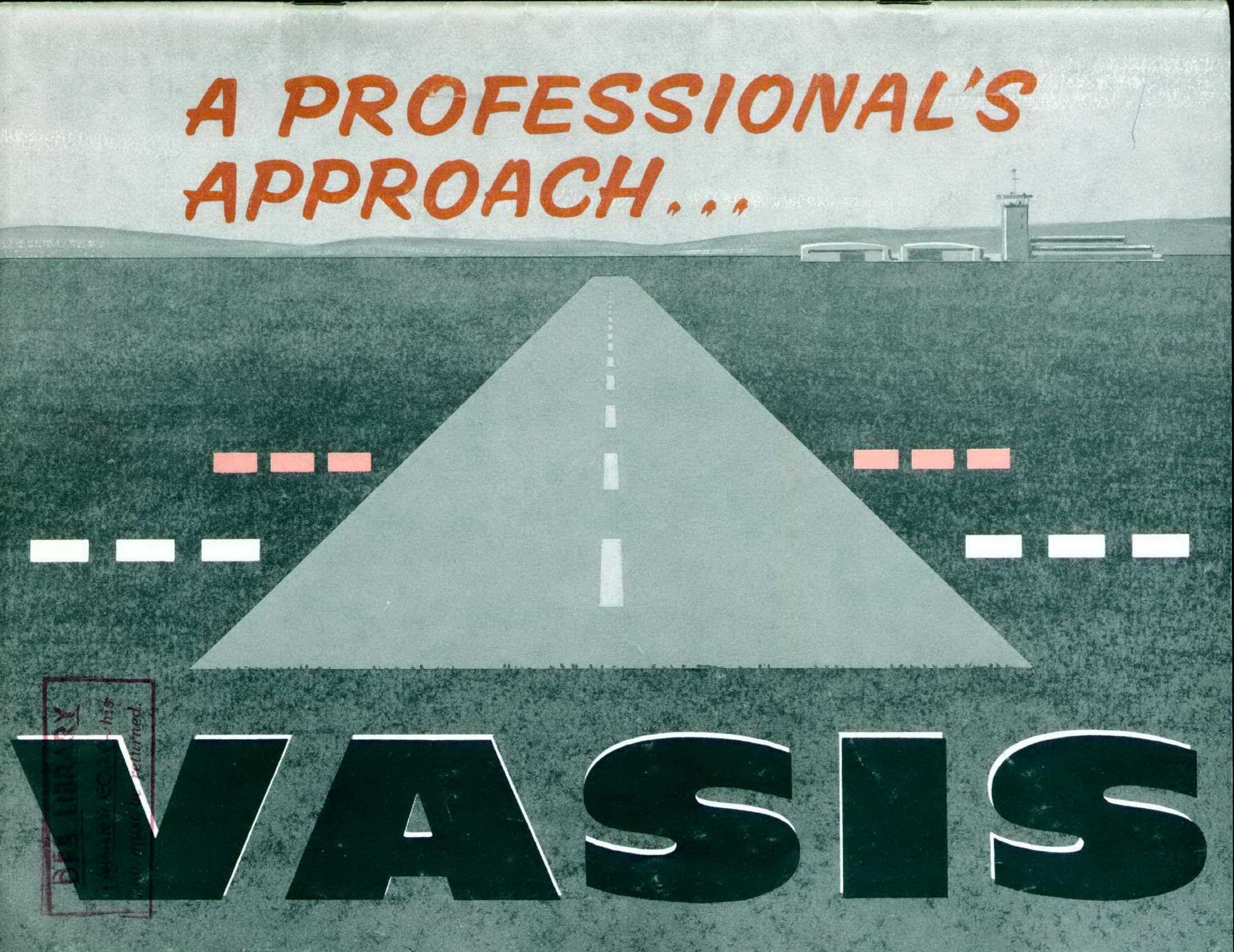
BIRD WATCHERS' CORNER



SANCTUARY-SEEKING SUPERVISOR

A whisp of smoke and intermittent mumbled protestations about "this d—— paperwork", identify the Supervisorus Privatum. In his office retreat the hoarded nesting material – files, forms, charts, reports, memos, rosters, schedules, and the like – are painstakingly assembled and processed. Meanwhile, the maintenance work in the hangar proceeds uninterrupted by the annoying imposition of his on-the-job supervising. His desk nest, a bulging repository for the precious material, is transformed imperceptibly with the passing years into an enormous "IN" basket and the walls, resplendent with bureaucratic ornamentation complete the scene. Stationary among his stationery, the Sanctuary bird's call is scarcely heard above the rustle of paper and scratch of pen:

ONEOFTHESEDAYS I'LLGETOUTOFTHISMAZE


A PROFESSIONAL'S
APPROACH...
VASIS