SAMPLE

FLIGHT COMMENT

JANUARY FEBRUARY 1975

Comments

Would you believe an added cause factor assessment on an aircraft incident that reads Personnel — Other Personnel/Clerk Admin/Judgement. Well it's true. A CF104 pilot found that the left tip tank gas cap cover was missing when he returned from a training trip. The investigation revealed that the cap was lost in flight. Both pilots stated that on the external check the caps were definitely secure. Further checking at the unit revealed that twelve caps had badly worn male dzus fasteners which could cause the loss of a cap. All the worn fasteners were replaced and an instruction was issued from NDHQ calling for a check on the dzus fastener condition before each flight. However, the message containing the direction arrived at the base while the Squadron was away on exercise. A clerk filed the message and it was not received by the Squadron. Sure enough, shortly after another CF104 lost a tip tank cap because of a worn dzus fastener. When one remembers that the difference between an incident and an accident is a difference of degree and not kind the old adage that "flight safety is everybody's business" certainly holds true.

Most military personnel take some form of first-aid training during their careers but very rarely have to use it. This account of an incident that happened recently in a U.S. Naval aircraft highlights the importance of first-aid training for aircrew.

> "During descent from 17,000 ft in a C-9B, the crew chief complained about feeling ill and went on 100 percent oxygen. Passing 12,000 ft he suffered convulsions. The aircraft commander, assisted by a flight attendant, removed the crew chief from his seat and placed him in the forward entrance way. At that time it appeared that he had stopped breathing. His mouth was forced open, a chest massage begun, and oxygen administered after which normal breathing resumed.
>
> An emergency was declared and an uneventful approach and landing was completed. The aircraft was met by an ambulance which took the crewmember to the hospital."

DFS produces a variety of posters which are usually distributed via the monthly FSO Info Kit. The ideas for posters come from many sources but there is always a need for new material. If you have any suggestions which we might use for our regular posters or in the Rotortips/Tiedowns series please send them along. You're closer to the action than we are so help spread the good word around.

NATIONAL DEFENCE HEADQUARTERS
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EDITORIAL

Flying Time is Precious — Don't Waste It

Each time the financial belt tightens one of the areas usually affected is the flying time allotted to air training and operations. An immediate and often emotional response is that our operational capability will be degraded and flight safety will be compromised.

Such a reaction is understandable when well established values are changed but are we being as honest with ourselves and the system as we should be? The answer is not simple nor are there any absolutes. There are so many variables that each situation has to be assessed objectively in relation to our collective experience with that weapons system, its role and the expertise of the people involved.

Provided we do our homework well at all levels and recognize that the variables are constantly changing then we should be able to counter any adverse effect on operational standards and flight safety. The most important factor in this exercise is a constant awareness that while Headquarters assigns the tasks and Commands set the basic standards, it is at the squadron level that the flying time allotted will or will not be effectively utilized. In fact, it is the individual pilot, or crew, who carry the greatest responsibility for getting the maximum benefit out of each and every sortie.

By our own arguments each minute is important so there can be no question of wasting time on unproductive flying. This means that we can no longer afford to do some of those things that are taken for granted in times of relative plenty nor can we allow pilots or crews to decide when they can relax. Our capability and credibility depend on flying records reflecting how good we are — not how good we should be.

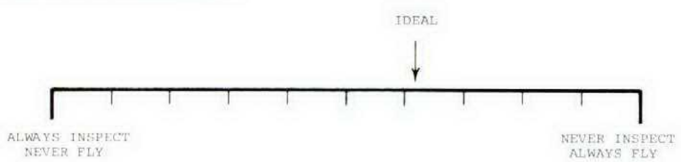
COL R. D. SCHULTZ
DIRECTOR OF FLIGHT SAFETY

RATIONALIZATION

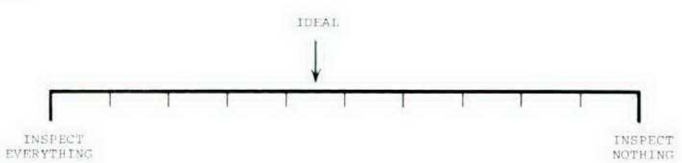
...how often should an aircraft be inspected

Capt B.J. Meindl AMDU CFB Trenton

Suppose you owned a fleet of 50 aircraft, what maintenance action would you take to ensure that your people—along with your investment—did not fall out of the sky? You might consider inspection at regular intervals so that if anything was deteriorating it could be replaced or repaired before it caused trouble. However, since the purpose of your fleet is to transport cargo and passengers you will lose money if your airplanes are not operational, so the question arises: "How often should this aircraft be inspected?" You would want to inspect often enough so that the safety of flight is assured but you would not want to over inspect because profits would dwindle. It is possible to set two extremes and somewhere in between is the ideal inspection frequency, but how is it determined?



Another question you might ask is: "What parts should be inspected?" Here again there seem to be two extremes with the ideal somewhere in between but how would you arrive at it?



You might get answers from the aircraft builder, or from another company flying the same aircraft type; however, because your operation is distinct your ideal or optimum may also be distinct. You might land and take off more often, or your low level flying may comprise a larger percentage of the total flying hours.

Another approach may be to accept the inspection parameters suggested by the manufacturer; fly for a year or two while accumulating maintenance data, then call upon an organization known as Maintenance Systems Development Branch to *RATIONALIZE* your inspection system.

MSDB is a Branch of the Maintenance Engineering Technology Division at AMDU and has as one of its tasks the "Rationalization" of all Canadian Forces Aircraft Maintenance Schedules. "Rationalization" is best described as a comprehensive review of an aircraft maintenance schedule with a view to providing an optimum inspection program, taking into account the aircraft's service role and operating experience. The end product is a maintenance package which optimizes safety of flight in aircraft use and effectiveness of maintenance effort.

The rationalization process is relatively simple in theory but long on effort which is expended in three main areas:

a. Planning;
b. Data gathering and analysis; and
c. Preparation of a new maintenance schedule.

Planning is a mustering of forces, the assignment of a study team, a determination of aircraft role, numbers and monthly flying rate and the convening of a conference which involves NDHQ, CHQ, Unit and AMDU personnel. The conference reviews the existing aircraft inspection schedule, considers Unsatisfactory Condition Reports and accident and incident reports having inspection schedule significance. The conference also provides AMDU with NDHQ, Command and user unit views on suspected or known problem areas.

Following the conference, all significant aircraft technical data is collected for a predetermined operating period—usually in excess of 10,000 flying hours to provide a legitimate sample encompassing all roles assigned to the aircraft. Data gathering is simplified when the aircraft in question is on the Aircraft Maintenance Management Information System (AMMIS). The system is used to assemble technical data pertaining to the aircraft's failure and serviceability history. The MSDB study team can be confronted with fifteen thousand or more maintenance reports which first must be sorted into equipment groups. Each aircraft part is then analyzed in detail to determine how long it operated properly before it required maintenance attention, if any. Each failure report is examined to determine whether the failure was discovered during inspection or while the aircraft was airborne. Most important, each fault must be analyzed to determine its effect on safety. The operational role and the overall capability of the aircraft must be considered. Finally the MSDB team has to decide whether or not a more frequent or more detailed inspection could have prevented the failure. The whole process is a time consuming operation because each of the thousands of parts that comprise an aircraft is studied.

When the data analysis has been completed the existing maintenance schedule is subjected to a penetrating review. Some inspection items are eliminated and inspection frequency of more sensitive items is increased. In three out of four instances the overall major inspection frequency for the aircraft is decreased with no change in system reliability.

During the Data Analysis and the Maintenance Schedule review, the retention of operational capability, the assurance of total airworthiness and flight safety are the governing factors in all decisions.

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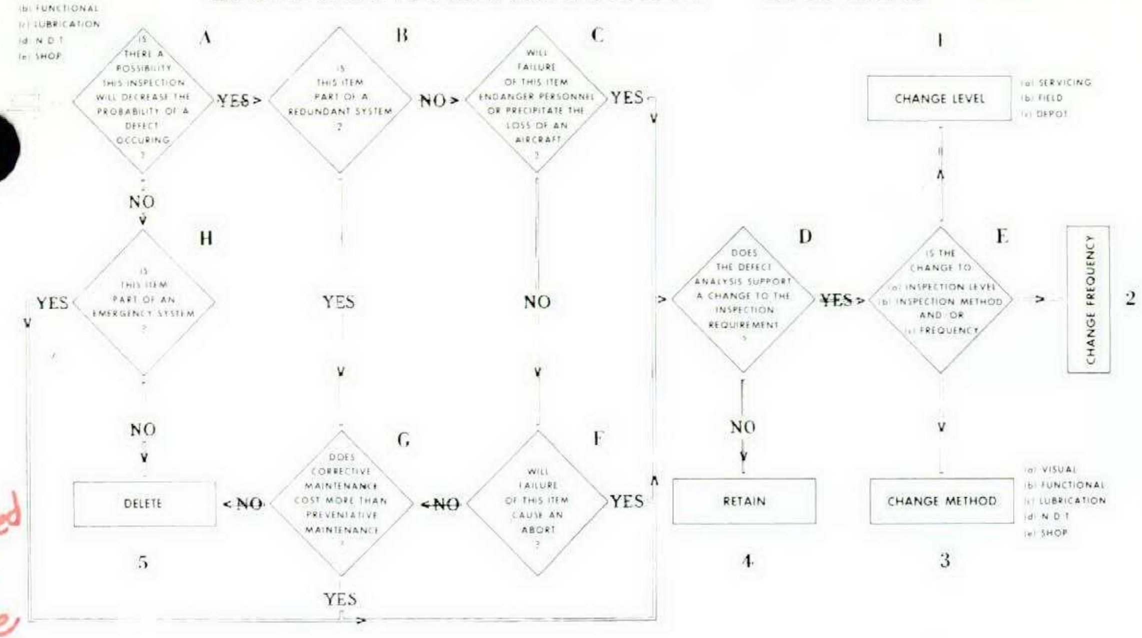
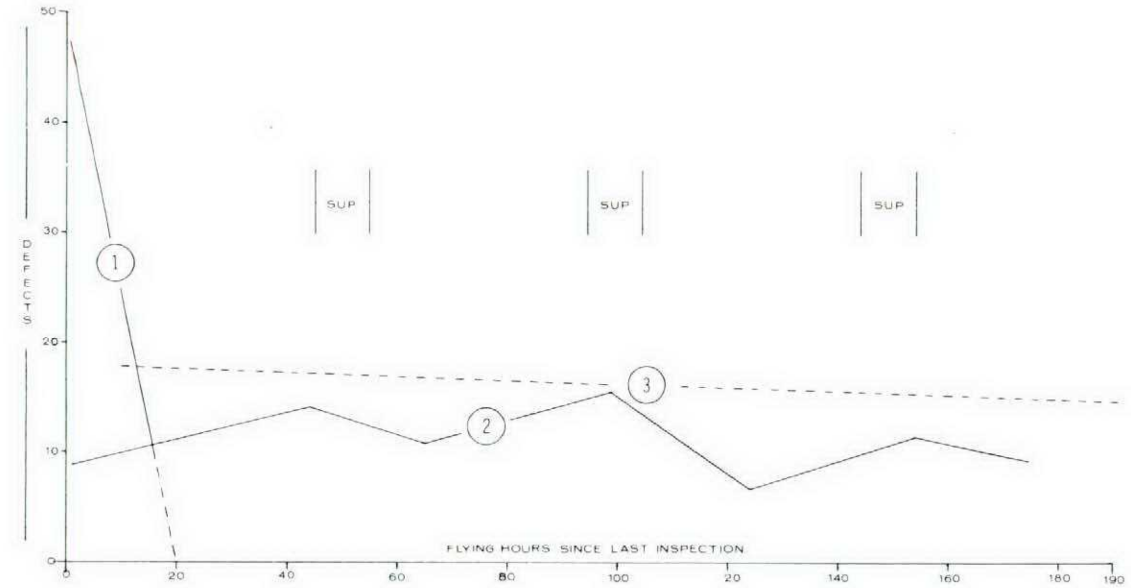
RATIONALIZATION LOGIC



Follow the logic used by MSDB to determine what, how and when to inspect.



This graph displays the statistical trends for unserviceabilities encountered between major inspections on a typical aircraft. Note that immediately following the inspection the defects are high (line 1) decreasing rapidly from 0 to 20 hours. Line 2 shows the cyclic trend as the aircraft flies to and from supplementary inspections, while line 3 indicates that the overall defect rate is still decreasing at the time of the next major inspection. The ideal time to inspect this aircraft would be the hour at which line 3 begins an upward swing.

With the adjustments completed a new maintenance package is prepared for review by NDHQ, CHQ and the user units. This package includes proposed inspection publications, equipment lifing schedules and an Equipment Codes and Inspection Requirements Manual. The end product is a more effective and efficient inspection schedule which is sent to operating units for their use.

Rationalization of scheduled aircraft maintenance is a never ending cycle and every three or four years the same fleet will go through the same process so that its maintenance requirements will continually reflect its operating experience and current inspection requirements. At present twenty aircraft have been or are being studied as indicated on the chart summary. The chart summary is a simple statement of the direct results of the scheduled maintenance rationalization program. These results translate into subst[illegible]duced aircraft down time, reduced maintenance man[illegible] consumption of materiel, improved inspection techniques [illegible] safer aircraft operations. Few other Canadian Forces programs could point to equally outstanding benefits or return on investment as has been produced by the Aircraft Maintenance Schedule Rationalization Program conducted by the Aircraft Maintenance Development Unit.

AIRCRAFT MAINTENANCE RATIONALIZATION SUMMARY OF RESULTS

AIRCRAFT	CHANGES IN PERIODICS	INSPECTION ITEMS: DELETED	FREQ DECREASE	FREQ INCREASE	REPHASED AMENDED CHANGED METHOD	ADDED	CHANGES IN SERVICING LEVEL	REMARKS
CF104/104D	*None	68/105	83/112	0	86/90	5/0	None	*Increase from 200-300 hrs. Not accepted
CT114 TUTOR	200-300 Hrs	158	181	-	15	10	AB Check introduced PI deleted.	
CF101 VOODOO	100-150 Hrs	366	171	3	11	42		
CC117 FALCON	150-200 Hrs	124	51	42	46	69	PI extended from 72 hrs to 7 days.	
CH113 LABRADOR	150-200 Hrs	23	14	1	58	18		
CH113A VOYAGEUR	150-200 Hrs	23	14	1	58	18		
CH124 SEA KING		268	302	30	41	19		Flexible Maintenance Inspection.
CP121 TRACKER	25% increase in periodicity	179	17	41	162	45		Changed from Flexible to Consolidated.
CP107 ARGUS	3[illegible]0-400 Hrs	500	80	5	100	60		Formerly 2042 work cards-now 1231.
CC109 COSM[illegible]				-	181	14	PI extended 3 days to 7.	Deleted Supp Check.
							PI extended [illegible]m 72 hrs	Progressive Insp Schedule produced for Mid East.

What is a pilot? What is an air traffic controller?

A Pilot is an Individual of Immeasurable Superiority to his fellow creatures in the street, a Master of the Air wherein he flies his Underpowered, Poorly-instrumented, Misaligned and Multi-patched Aircraft under Dubious Control in complete contravention of the instruction he has at some time received from his Flying Instructors and quite contrary to Regulations published for his confusion by Government Officials, much to the Distress and Damnation of an ulcer-ridden group of individuals known as Air Traffic Controllers.

An Air Traffic Controller is a Person of Solomon's Wisdom sitting in an Ivory Tower, from whence he Sees All, Hears All, and Confuses All through equipment of Mongrel Manufacture, Erratic Serviceability and Random Maintenance, chosen to be only suitable for traffic conditions during a Solar Eclipse on a Friday Afternoon, by a Procurement Officer whose knowledge is derived from Advertisements of Irrelevant Subjects intended to Mislead and Confuse, sponsored by a Foreign Manufacturer in a Foreign Aviation Publication.

Airport News

GOOD SHOW

LT G.J. CLIFFORD AND CPL D.J. FISHER

Lt Clifford and Cpl Fisher were manning the Cold Lake Control Tower when they received a weak and garbled distress call on 121.5 MHZ. The pilot of a light aircraft reported he was "squawking, disoriented and wondering if anyone could bring him in". Lt Clifford immediately responded and established radio contact with the aircraft. He requested a frequency change and then imposed radio silence on other traffic while Cpl Fisher alerted RATCON, Edmonton and Winnipeg ACCs, Saskatoon terminal and 42 Radar Squadron. Lt Clifford passed numerous DF steers to the pilot and Cpl Fisher kept RATCON informed of these bearings. RATCON, however, was unable to locate the aircraft on radar due to thunder showers in the area. Shortly after establishing radio contact, Lt Clifford discovered that the aircraft had only thirty minutes of fuel remaining. Twenty-three minutes after the pilot first called for assistance, he reported he had the airport in sight and made an uneventful landing.

Lt Clifford and Cpl Fisher reacted to this emergency in a prompt and professional manner which undoubtedly contributed to the saving of the pilot and his passenger.


Lt G.J. Clifford and Cpl D.J. Fisher

CPL C.A. WICKS

While supervising the towing of a Tutor into the hangar for a snag rectification, Cpl Wicks, an airframe technician, heard an unusual noise coming from the left main wheel. The wheel was inspected and damage was found on the brake disc. The assembly was removed and the technicians discovered that a brake disc key had broken, causing damage to the wheel bearing housing and brake unit.

Cpl Wick's vigilance and concern which led to the investigation undoubtedly prevented a total wheel failure.


Cpl C.A. Wicks

CPL J.R.R. BOULERICE

Cpl Boulerice, a member of the Val d'Or Weapons Loading Team for Call Shot 74 at CFB Chatham, was waiting in the QRA alert bay while a CF101 was backed into the hangar. The aircraft and tow bar suddenly separated from the mule and continued rolling into the hangar. Cpl Boulerice, seeing that the man in the cockpit was pumping the brakes to no avail, quickly decided that the emergency brake handle- which must be activated for the brakes to function when the aircraft is not under its own power – hadn't been pulled. He promptly climbed the ladder to the cockpit and correctly applied the brakes, bringing the aircraft to a halt before it contacted the rear hangar doors.

Cpl Boulerice's decisive and knowledgeable response to this emergency prevented a costly ground accident. His actions in dealing with a situation not relating to his primary trade as a weapons technician emphasize the concern and professionalism of the small section of aircraft support personnel at CFS Val d'Or.

Cpl J.R.R. Boulerice

CPL A.D. SYME

Cpl Syme, a flight engineer, was conducting a preflight inspection of a Cosmopolitan aircraft when he found a set of wire crimpers in the rear access compartment of the water separator and heat exchange turbine. The wire crimpers, approximately ten inches long and weighing eight ounces, were in an area which is not normally included in the preflight inspection.

Since the crimpers were close to flight control cables, Cpl Syme's conscientious approach to his duties may have prevented a serious inflight problem.


Cpl A.D. Syme

CPL H. LARSEN

Cpl Larsen was carrying out a daily inspection in the cockpit area of a CF5D and was checking the rudder mechanism when he heard an unusual sound. Closer inspection revealed that the canopy jettison cable was rubbing on the right hand brake pedal


Cpl H. Larsen

GOOD SHOW

quadrant. Cpl Larsen advised his supervisor and a special inspection was initiated; a similar condition was found in one other aircraft.

Cpl Larsen's thorough inspection and attention to detail prevented a possible canopy malfunction which could have caused serious inflight problems.

CPL L.E. IRVING

While dismantling a Quick Engine Change (QEC) kit from a JT3D engine for shipment to overhaul, Cpl Irving found one clamp bolt loose and one missing from the N1 tachometer cannon plug. The loose bolt was found in an area where it could have caused possible damage to the inlet fan section of the engine. When a number of cannon plug clamps were found loose during inspections on other aircraft Cpl Irving suggested that a self locking nut be installed on all N1 cannon plug clamps to prevent a recurrence of this problem.

On another occasion Cpl Irving's initiative led to the discovery of cracks under the doubler plates of three aircraft engines. Cpl Irving suggested, through submitting a UCR, that the fleet be checked; seven engines were found to have cracks under the inlet case doublers on three of the four aircraft checked.

Cpl Irving's alertness and professionalism in these instances are indicative of the pride he takes in his work.

CPL P. HENNESSEY

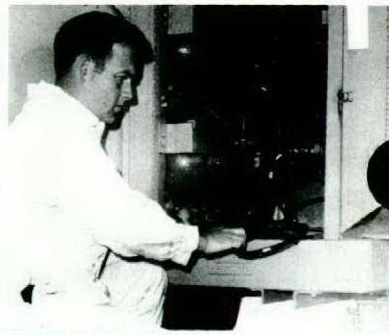
Cpl Hennessey was a crewmember engaged in the post start check of a CF5 aircraft. The pilot was checking control movements when Cpl Hennessey noticed a small extrusion on the right hand elevator bell crank panel. He signalled for the pilot to shut down and on closer inspection discovered a small piece of FOD wedged between the bell crank and the inspection panel.

Cpl Hennessey is commended for his attention to detail and professional attitude which quite probably prevented a serious incident or control malfunction.

CPL L.S. MONK

Cpl Monk, with another groundcrew member, was servicing the high pressure oxygen system of a CF100 at Elmendorf AFB, Alaska, when a tee fitting on a USAF oxygen cart ruptured, destroying the pressure gauge and causing an explosion and flash fire. The groundcrew member assisting Cpl Monk received first degree burns to face and hand; his hair, eyebrows and eyelids were also singed.


Cpl L.E. Irving


Cpl L.S. Monk


Cpl P. Hennessey


Cpl J.A.D. Cloutier

Notwithstanding the possibility of further explosions and fire, Cpl Monk ran to the oxygen cart, shut off the oxygen bottles and disconnected the servicing hose. He then moved the cart away from the aircraft.

Investigation of the oxygen cart by Base Safety personnel revealed that the ruptured tee fitting, plus three more tee fittings at pressure gauges, were made of aluminum instead of steel—which is required at this location.

Cpl Monk is commended for his alertness and prompt action which prevented further damage to the oxygen cart and adjacent aircraft.

CPL J.A.D. CLOUTIER

While performing an AB check on a CF101 Cpl Cloutier smelled burning material in the area of a fuselage panel. He touched the panel and finding it was hot, opened the door and saw the safety flag burning. Cpl Cloutier quickly removed the burning flag, assured himself that there was no further danger of fire, and then informed his supervisor. Investigation revealed no damage to the aircraft.

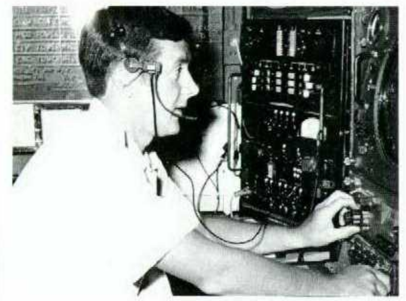
The safety flag is permanently attached to the door panel and is intended as a warning that the door, though in the closed position, is not secured. When locked, as in this case, the flag is tucked up inside. Cpl Cloutier's conscientious inspection averted what could have been a costly aircraft fire and drew attention to a potentially hazardous situation. Although no definite cause for the fire has been determined, UCR action on the location of the safety flag has been started.

CPL R. BOWNESS

Just after coming on watch Cpl Bowness noticed that the port propeller of a Tracker aircraft was overlapping the next aircraft. Although Cpl Bowness was not a member of an aircraft moving crew, he knew that the aircraft was scheduled for an evening takeoff and that the propeller would have to be aligned to clear the next aircraft. On his own initiative, he decided to perform this task. While aligning the propeller, he heard a distinct hiss. After moving the propeller further to determine the approximate location of the sound he then summoned his supervisor. Together they determined that the number eight cylinder of the port engine was cracked from the spark plug to the intake valve.

Cpl Bowness is commended for his initial conscientious action and subsequent follow-up investigation which prevented a possible engine failure.


Cpl R. Bowness


MCpl D.R. Deveau


Cpl R.H. Conley


Sgt W.E. Munden

MCPL D.R. DEVEAU

MCpl Deveau, the Duty Radar Controller, was alerted by Summerside tower in an attempt to radar identify and provide fixing assistance to a civilian Cessna 182. The pilot of the aircraft, en route under visual flight rules from Halifax to Sydney, Nova Scotia, had established radio contact with Summerside tower on 121.5 and advised that he was uncertain of his position. The pilot also indicated that flight visibility was restricted in haze, making visual fixing difficult and that he was unable to receive Sydney VOR. When attempts to locate the aircraft within the Summerside radar coverage area failed, MCpl Deveau provided the pilot with the frequencies for both the Charlottetown and Moncton VORTACS and requested radial information from these two facilities. Working on the radial information obtained, MCpl Deveau fixed the aircraft's position at twenty miles north east of the Charlottetown airport. He was then able to provide the pilot with heading information which eventually led to a safe recovery of the aircraft at the Charlottetown airport.

The Cessna was an estimated sixty miles off track and the pilot was unquestionably lost. Through his actions, MCpl Deveau demonstrated a high degree of initiative and professionalism and set an excellent example for his fellow servicemen.

CPL R.H. CONLEY

Cpl Conley, an airframe technician employed on CH135 helicopter second line maintenance, was assigned as tech crewman on a CH135 during night flying operations. Although a DI had been done during the day, Cpl Conley decided to do an additional panel security and fluid systems check. This check was done on the flight ramp in adverse light conditions just after sunset. While checking the level of the fluid in the No 2 hydraulic system reservoir with a flashlight, Cpl Conley noticed an abnormal discoloration of the fluid. He immediately climbed to the roof deck, removed a cowling, opened the reservoir cap and physically checked the condition of the hydraulic fluid. His initial suspicions of fluid discoloration and contamination were confirmed. He informed the aircraft captain and grounded the aircraft as unserviceable.

Further investigation at the Unit revealed that the No 2 hydraulic system pump was unserviceable and had created an overheat situation within the fluid system resulting in fluid deterioration and contamination.

Cpl Conley's methodical approach to preflight checks and thoroughness and initiative in following up the situation revealed a technical problem that could have had serious consequences.

SGT W.E. MUNDEN

During a brief stopover at CFB St Hubert, Sgt Munden, a Hercules flight engineer, noticed that a fuel tender placarded 80/87 octane, was about to be used to refuel a Dakota aircraft. Knowing that the Dakota normally uses 100/130 octane fuel, Sgt Munden quickly proceeded to line servicing and pointed out the error which was promptly corrected.

Sgt Munden's awareness and response to a hazardous situation was instrumental in preventing a serious inflight emergency.

On the Dials

In our travels we're often faced with "Hey you're an ICP, what about such-and-such?" Usually, these questions cannot be answered out of hand; if it were that easy the question wouldn't have been asked in the first place. Questions, suggestions, or rebuttals will be happily entertained and if not answered in print we shall attempt to give a personal answer. Please direct any communication to: Base Commander CFB Winnipeg, Westwin, Man. Attn: ICPS.

Proposed Amendments

There are many proposals for amendments to our flying publications; CFP 100, CFP 148, GPH 200, 201, 204, 205, 207, 209, etc. The following items will give you an idea of some of the changes to look for.

In CFP 100 Category I will be defined as IFR operation down to a minimum of 200 feet Decision Height (DH) and Runway Visual Range (RVR) of 2600 feet or 1/2 mile visibility. Category II will be defined as IFR operation down to a minimum of 100 feet DH and RVR 1200 feet. Only Cat II certified aircraft and crews will be able to fly to Cat II DH. Missed Approach Point (MAP) will be defined as that point on the final approach track which signifies the termination of the final approach and the commencement of the missed approach. Height Above Aerodrome (HAA) and Height Above Touchdown (HAT) will be defined as in GPH 200 and 201. Other new terms will be "landing gear" versus "undercarriage"; Glide Slope/Threshold Crossing Height (GS/TCH) and Ground Point of Interception (GPI).

In GPH 209 look for new chapters on Helicopter Approaches and Standard Instrument Departures (SIDS); the addition of CFAO 55-18 (Instructions For Developing and Revising Instrument Approach Procedures); a radius of turn graph and the removal of temperature corrections.

In GPH 204 missed approach instructions will be defined to eliminate the confusion that now exists when an aircraft conducts a missed approach and has been cleared en route. The latest GPH 204, Vol 8, 7 Nov 74 is now a joint civil/military publication issued every six months. Be on the lookout for special military sections throughout.

In CFP 148 the major changes will be on the ILS, the Canadian Notam System, approach lighting systems, and a method of correcting altimeter errors due to cold temperature.

In GPH 207 there is a proposal to include several commonly used tracks flown by military aircraft; an example is the track from Comox to Enderby.

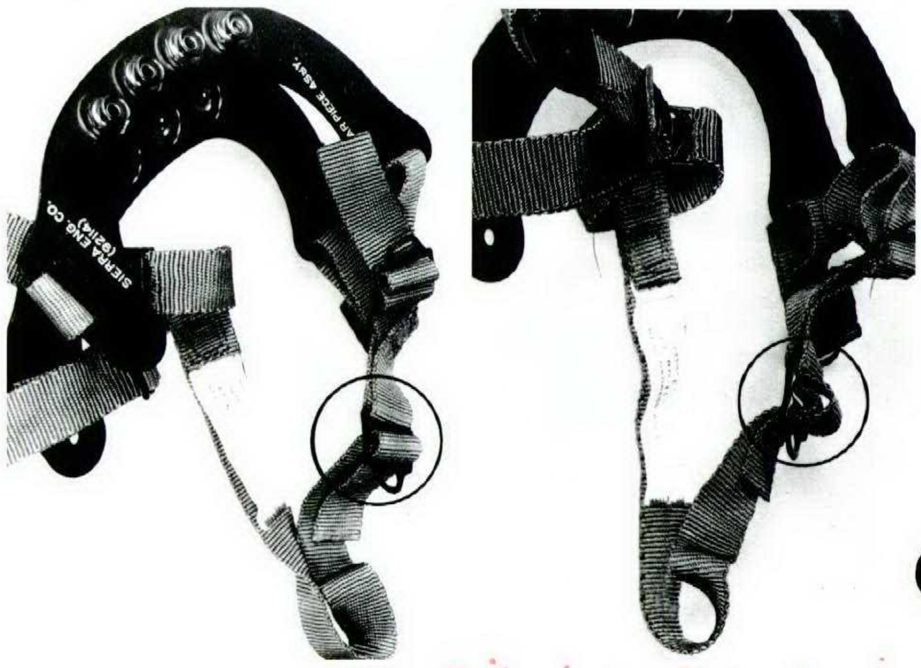
Look for a throwaway GPH 200. The package will result in the ring binder on GPH 201 being removed and replaced by a new type of binding. GPH 200 will be in two volumes, East and West.

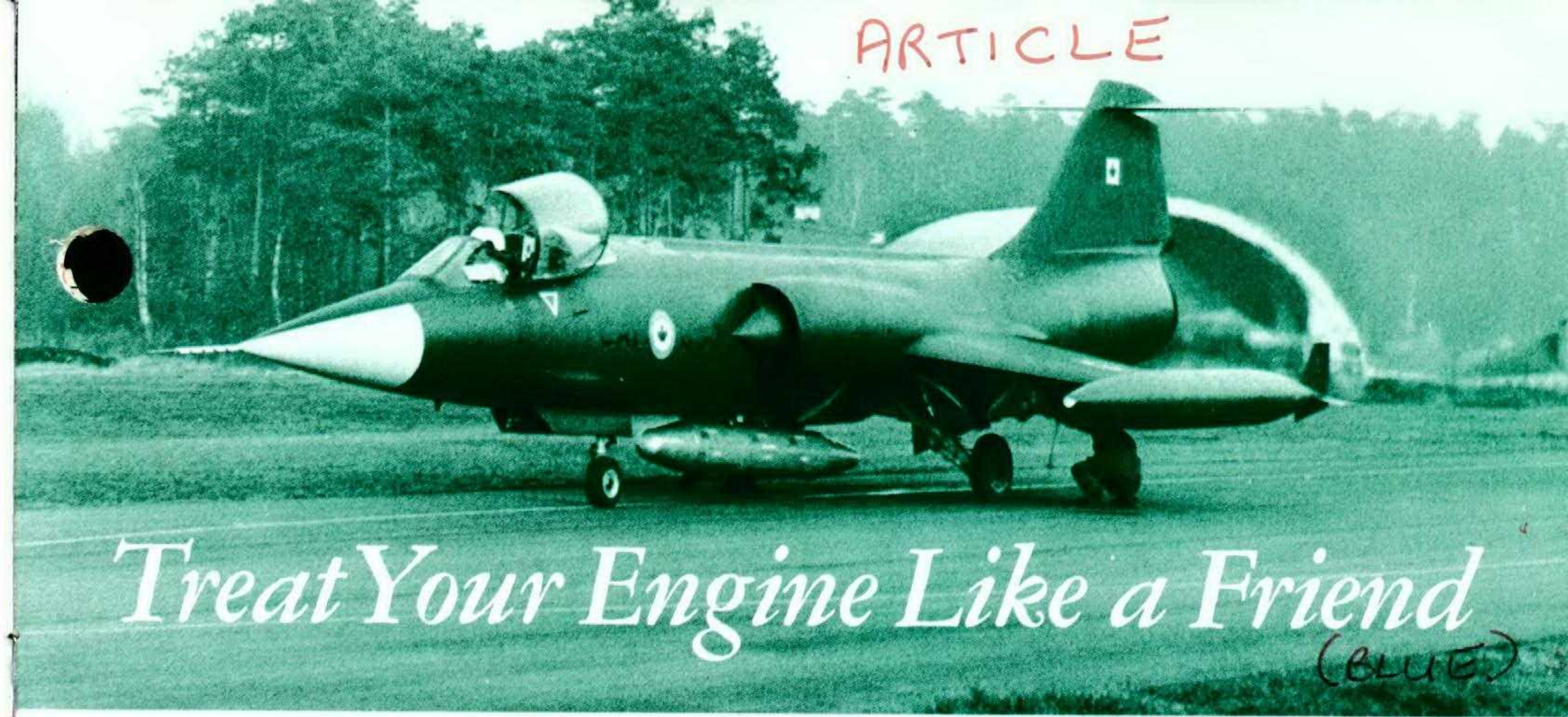
We are also striving to standardize the terminology and definitions in our flying publications so that it will not be necessary to figure out which pub takes precedence.

These are only a few of the proposals. If you have any suggestions, pass them to your ICP or write them up on a NOTUN card and mail to DCARTO/AIR.

Adjustable Murphy

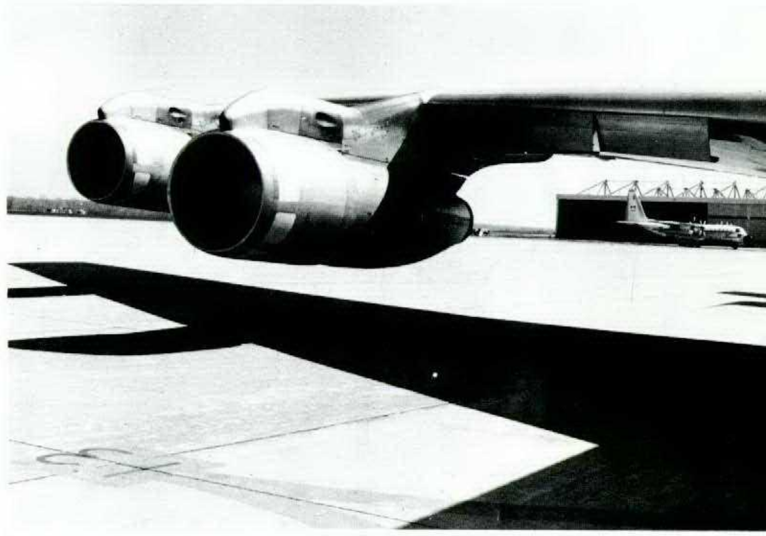
This headband harness which is used as an oxygen mask support can be assembled in two ways. The photo on the left shows the correct webbing position. If your assembly looks like the photo on the right it will be non-adjustable – not the answer if you need oxygen in a hurry.





Treat Your Engine Like a Friend

In an era of complex, expensive engines and a continuing need for greater economy and safety, it is time to take a more critical look at engine operating limits and procedures. We are all aware of aircraft operating limits such as positive and negative "g", crosswind, airspeed and a variety of handling limits, and it is easy to appreciate these as they relate to the structural strength of the aircraft. We wouldn't intentionally exceed these limits and destroy an aircraft. There are also many engine operating limits which if exceeded will destroy, damage or seriously shorten the life of an engine. The following topics are presented in the hope that they will be educational and thought provoking – and that some benefit may accrue.



Power Effects

Complex modern engines have operating limits such as maximum power, takeoff power, military power, normal power, maximum exhaust or turbine temperatures which aren't as obvious as airframe/structural limits since we can't feel the EGT or the RPM, and we can't see the immediate effects of heat, stress fatigue, creep and wear on engine parts.

The accompanying diagram illustrates how much a typical jet engine's life increases when normal power is used instead of military power; the graph also provides a comparison at 90 percent. A similar relationship exists for engine temperature and for reciprocating engines.

The real problem may not occur on your flight but during a subsequent one. An engine that has undergone double or even triple aging (due to poor engine handling) will have a greater likelihood of failure before the next scheduled inspection or overhaul.

Although our missions sometimes demand maximum performance from our engines (as well as our airframes) the established limits and engine trim adjustments allow operations in the high wear region for short periods. It is interesting to note however that airlines usually have considerably lower limits – generally for economic reasons, where costs per mile count almost as much as safety. A 10-15

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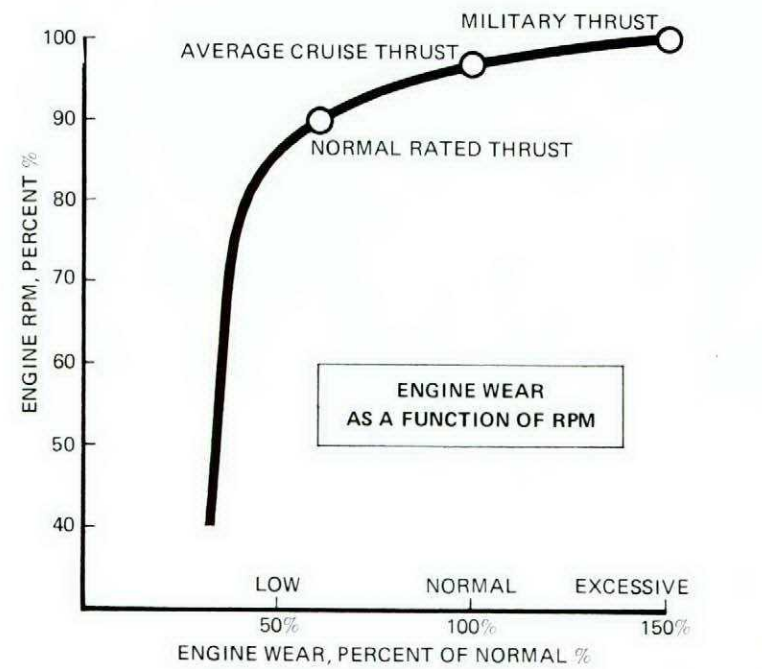


Aeromedevac

...the story of course 7404

Each year, 426(T) Training Squadron at CFB Trenton conducts six Aeromedical Evacuation Courses. The course members learn to act as members of an aircraft crew and to take special flight factors into account when treating patients who are being evacuated by air. Course 7404 brought together three nurses and nine medical assistants from bases across the country. This is their account of the course.

Over a period of three and a half weeks in November-December '74, eleven Canadian Forces Medical Services personnel and a British Army exchange nursing sister were made aware of the many problems and unusual situations that we might encounter whilst caring for patients on an "Aeromedevac". Numerous conditions were simulated, each one reviewing or teaching some aspect of patient care or aircraft procedure. We learned to successfully cope with life threatening emergencies such as massive haemorrhages, tension pneumothorax, or cardiac arrest as well as handling hypoxic and airsick patients. Formal classroom lectures covered most of the theory but many hours were spent practising drills and emergencies in the C130 Hercules "mock-up". During the high altitude indoctrination (HAI) most of us were exposed to a decompression chamber for the first time and ditching drills were realistically simulated in the base swimming pool. Actual in flight situations were set up during a four day cross-country flight in a C130 and the particular problems and techniques of helicopter medevac were demonstrated with a CH113A Voyageur from 450 Sqn, Ottawa.

Considerable importance was placed on the assigning of patient priorities and classifications thus determining the degree of urgency of the evacuation and the requisite amount of care required for the patient during the flight. Medical equipment, its use and adaptation to aircraft normally used for medevac flights, was another subject which received "in depth" treatment. Our responsibility for our patients would be from the time they were received at the Aerial Embarkation Hospital. It would be our task to provide all the normal nursing care and to be prepared for any in flight emergency.

The aircraft was to become "an extension of the hospital ward"—or so we were told. However, we soon realized how the lack of space, the absence of some equipment normally found at "ground level" facilities, and an environment which was often far from stable, hindered the job of the medical flight crew. Fortunately there was no shortage of enthusiasm—and this always helped us overcome the problems. Numerous practices of litter loading drills and patient care in the C130 Hercules "mock-up" soon indicated what allowances we would have to make for crowded conditions and an unfamiliar environment.

Capt Morrice "rescues" Pte MacBournie, a non-swimmer, during ditching training.

During our stay at Trenton we became familiar with all the possible litter configurations in different aircraft types. Many hours were spent preparing load plans for groups of patients with dissimilar medical disorders. We learned to install litter support devices and to calculate and secure medical equipment for any specific medevac situation.

An introduction to aircraft navigation and meteorology enabled us to brief our patients on the particular flight profile. We were also made aware of the problems of en route turbulence and the possibility of delay or diversion as a result of adverse met conditions.

Drills in the base pool trained us to practise safety and survival of self, patients and crew prior to, during and after a crash landing or ditching. The requirements for this part of the course included locating the safety equipment, boarding a life raft and assisting simulated patients aboard. Aircraft familiarization lectures detailed the position of crash axes, fire extinguishers, escape chutes and emergency lights.

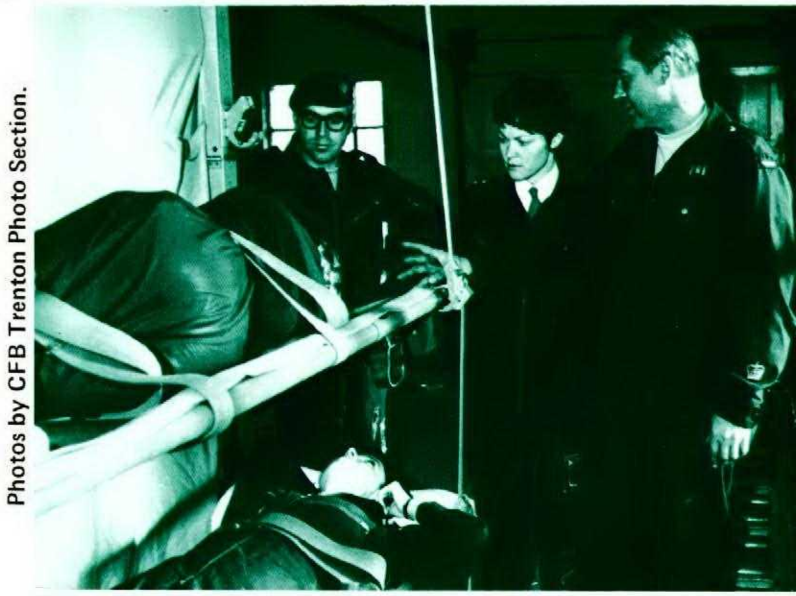
The culmination of the first few weeks of lectures, drills and demonstrations was a four day "medevac" flight. Eight course members acted as patients on each leg of the journey while the remainder worked as the flight medical crew. As expected, we had more medical emergencies than Ben Casey, Marcus Welby, and Medical Centre combined but our expertise and training was evident by the treatment of LCol Resusci-Anne, our training mannequin who underwent cardio-pulmonary resuscitation on each leg of the flight and still survived to take in the bright spots at Nellis Air Force Base.

After successful completion of the course, students are qualified to serve as members of an aeromedical evacuation team on the Hercules, Boeing 707, Twin Otter, Cosmopolitan and Buffalo aircraft and in personnel-carrying helicopters. Graduates are qualified to fly on other aircraft following an aircraft familiarization conducted in accordance with the On Job Training standard for aeromedical evacuation personnel. ■

Oxygen equipment check for Cpls Patterson and Veilleux during HAI.

MCpl Dunk, 426 Sqn Safety Systems instructor, gives instruction in life raft procedures.

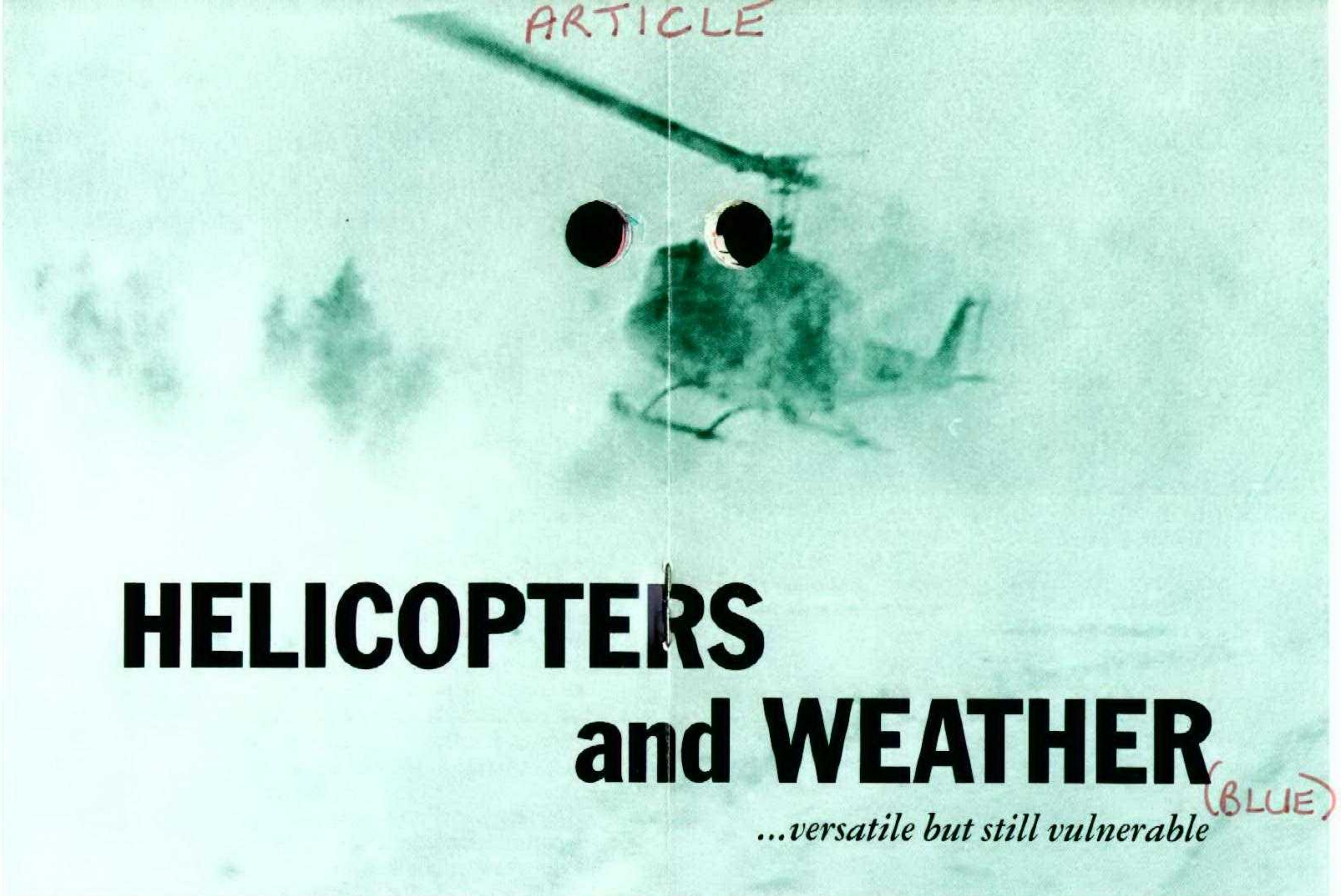
Photos by CFB Trenton Photo Section.



WO Bryski explains litter restraining techniques to Capt Morrice and Sgt Moneypenny.

Lt Purves adjusts litter supports in the C130 "mock-up".

Cpl Hall places a patient's backrest in position.



HELICOPTERS and WEATHER

...versatile but still vulnerable

Because of the helicopter's unique ability to manoeuvre at very low speeds, hover, fly sideways and backwards, climb and descend vertically and land virtually anywhere, many pilots believe that rotary wing aircraft can fly in, over, under or around any kind of weather. This belief could be tolerated but for the fact that many of the believers are helicopter pilots.

Of course it takes a certain amount of blind faith to fly helicopters in the first place, what with all that whirling and twirling and hoping that those vibrations you feel are all good ones. The versatility of the machine makes it fun to fly in good conditions but when the weather starts coming down or closing in, the helicopter driver often has to make decisions which fixed wing fliers never encounter. Our helicopters operate in many different environments and are sometimes subject to very strict operational control, but time and again the ultimate decision to continue with a mission falls back on the aircraft captain who may be a 3,000 hour veteran or a 300 hour beginner. The lives of passengers and crew may well depend on that decision.

Here is a report of an accident which happened nearly ten years ago to a (then) Canadian Army CH113A Voyageur helicopter:

> "Three CH113A helicopters were en route from CFB Rivers to CFB St Hubert. On the leg from K.I. Sawyer AFB to Kincheloe AFB in northern Michigan the flight encountered deteriorating ceilings and visibility. At about the mid-point of the leg the flight detoured to the north to avoid an area of low cloud and was then able to continue east along a main highway. At this point the aircraft were in a loose trail formation at 1/2 mile intervals, flying at 150-200 ft AGL. The leader reduced speed to 80 kts and then to 60 kts as visibility decreased to 3/4 mile. Shortly thereafter the leader suddenly lost ground contact. He attempted to climb and turn 180° on instruments to return to the clearer area. During the turn the pilot became disoriented and lost control of the aircraft which crashed in tall trees on a heavily wooded hill. The helicopter caught fire and was destroyed. The fire crew members were injured, one fatally."

– and in another country five years later:

> "The pilot of a Whirlwind helicopter delayed his morning takeoff because of poor weather and then took off in the afternoon when the conditions showed some signs of improving. He arrived overhead an airfield close to his destination and set course for the exercise area. (Another aircraft on an approach to the airfield reported solid cloud from 25,000 feet down to 400 ft with embedded Cbs giving moderate turbulence). The helicopter was seen flying quite low – "100 feet" – in pouring rain and murky conditions. The pilot reported the bad weather and announced that he might be back very shortly. The rising ground was converging with the cloud base when the helicopter was last seen. The pilot then advised that he was IMC (Instrument Met Conditions) and requested a homing back to overhead. At first the Controller asked him to remain clear of the southern area of the airfield. A minute later the pilot was instructed to steer 080°. A call from the helicopter pilot that he was climbing to get on top "came as a bit of a surprise". Further calls as he climbed through 4000 and 5000 feet were received then some 2 1/2 minutes after calling " through 5000' " came the dramatic message "Mayday Mayday Mayday . . . out of control". No further calls were heard and the Whirlwind crashed into the ground killing all four occupants."

Both of these accidents involved helicopters inadvertently entering conditions where visual contact with the ground was lost. MOT and FAA files contain accounts of many similar accidents to civilian helicopters. There is no reason whatsoever for CF helicopter pilots to be complacent and think that it won't ever happen again. It can and will unless the whole subject of helicopter flying in bad weather is given continual emphasis at the flying schools and on the squadrons. What then are we advocating? – courses on how to fly in bad weather using actual conditions? Do we wait for a day with 50 ft forward visibility and take our junior pilots out for a navigation trip? Do we show them how to get over telephone wires by finding the pole and climbing up the side of it – or else going underneath at that point because that's where the wires are highest? There are many little tricks which astute pilots have learned over the years as they groped about in the murk but surely there would be little point in training like this for below limits weather flying. After all no two weather

. . .got it wired? – you may be right.

conditions are ever exactly the same and when would you decide that you had reached a passing grade? It would be like setting up a flying training programme for kami kaze pilots or running a course for hari kari candidates. Just how far would you go before you were satisfied that the student could do it properly? No, the answer is to avoid getting into the dicey situation in the first place. Let's look at the problem from three positions. First, the preflight planning phase when all the met facilities are available; second, those occasions when you are your own met man and finally, the en route decision making process when all your preflight planning goes down the drain.

PRE-FLIGHT PLANNING

Intelligent pre-flight planning would probably save many of the lives lost every year in weather related helicopter

"Why bother to check the weather – you're going anyway – aren't you!"

mishaps because most of the missions would never leave the ground. In the Canadian Forces, CFP 100 and Command and Unit flying orders are quite explicit about the minimum ceiling and visibility requirements for helicopter flight. However, because pilots know how difficult it is for a forecaster to give an accurate assessment of the weather conditions close to the surface there is always the temptation to go and take a look – the old "give it a try" trick. This kind of thinking, where a pilot "knows" that he can "sneak and peek" his way through is a direct contravention of flying orders and should be treated as such. A successful arrival at destination *in spite of* the forecast should not be hailed as a good show but rather as an extremely poor example to younger, impressionable pilots who may lack the experience of the old-timers. If the VFR limits are considered too restrictive then there are adequate channels for bringing about a change. Simple defiance and disregard of the established orders proves nothing, improves nothing and just erodes the framework within which that intangible yet so desirable trait called "airmanship" is developed. Fortunately flagrant disregard of flying orders is a rare occurrence among professional military pilots.

Flight planning when all the facilities are available is therefore relatively straightforward – simply abide by the rules. If anything, err on the side of caution (most pilots have their own personal fudge factor scale). But what about the myriad helicopter missions that take place far away from the luxury of met men and maps, charts and radar scopes. What about checking the weather by phone with a forecaster who may be 500 miles or more away from your position? What do you do when he tells you that your visibility should be 1/2 mile in fog yet you can see for twenty miles. At least in this case you may have grounds for a spirited long distance discussion on the merits of his crystal ball – but what about the morning when you crawl out of your tent at 74° 30' north and you're not 500 miles from a forecaster but 500 miles from a telephone. You may be on a SAR mission or caught up in a land force exercise. Whatever the circumstances you don't have a cut and dried met forecast on which to base your go-no-go decision and you will probably be open to some pretty subtle pressures aimed at getting you to crank up those rotors.

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Few pilots like to sit around waiting for the weather to improve: they naturally want to slide behind the pole and get on with the job. You know you have limits of 1/2 mile visibility but just how far is that? In one direction it seems much better than a mile, and the snow is just light showers – snow grains – not really a visibility restriction like the heavy wet stuff. You're sure you'll be able to see the ground without too much trouble. Besides, you'd really like to make it home today if possible, wouldn't you, and the weather might stay like this for days. Then there's the patient for medevac you're trying to reach. You'll feel pretty bad if you don't get there in time.

You may well be subject to peer pressure from other members of the crew who are equally keen to move on. "I've flown in worse than this" you'll hear someone say or "so and so wouldn't think twice about flying today".

If you are involved in an exercise with the land forces then the commander with whom you are working may take some convincing that it isn't safe for you to fly. After all, if his trucks and APCs can operate in the fog and navigate around the area then why can't you? What's so different about a helicopter – it's only an airborne truck anyway!

What's the answer? Well, if the answer was simple there would be no requirement for this article and helicopter pilots would always make the right decision. Fortunately they do, most of the time, but they still get sucked in occasionally and it's those odd occasions that can lead to a tragic accident.

If you don't like the look of the situation then don't go! Your training and experience and the wings you wear on your chest will help you make the right decision. It's also your prerogative and duty as an aircraft captain: when you signed out the aeroplane you signed on for the responsibility – accept it.

So much for flight planning; but even the best forecaster in the world or pilot with 100% every year on his IRT met exam will still be fooled by Mother Nature. The classic condition, the one we all know so well, occurs when everything is going silky smooth. The forecast is reasonably good and you're happily bouncing along when suddenly the whole thing turns to worms. Before you know it, you've got problems. Sound familiar? Well it's just not true. You always have warning that the weather is turning sour – it's just that pilots either tend to ignore the obvious signs (perhaps hoping it will just go away) or they make such small changes initially to the flight profile that the final requirement for a quick 180° appears to have just snuck up on them.

Let's take an example. You're flying along FDH (fat, dumb and happy). In the distance, perhaps five miles away, you see some low cloud hanging about a range of hills which lay across your track. It seems to be clear at one end of the range but that would mean a considerable detour so you decide to try your luck getting through one of the valleys. As you get closer you have to descend to stay under the stratus and the visibility is decreasing. You pick a valley and start through the hills. Your speed gets slower and your altitude gets lower and eventually you end up doing a 180° half hovering turn desperately trying to maintain visual contact with the trees which are trying to disappear into wisps of fog. You backtrack down the valley and take the detour. Excellent – you just made the right decision before you got into real trouble. But what if you had lost sight of the ground during that pedal turn or hit some wires that were strung across the valley or become disoriented as you banked around and descended and crashed into the trees. Your decision to turn

Approaching the lake there are lots of visual cues . . .

. . .but if you fly straight across!

If you don't slow down in time . . .

. . .you might really find yourself in it!

around would have come a little too late. You may believe that you shouldn't argue with success but let's go back to the beginning of this escapade and see if there are any guidelines that we can establish – a sort of aide-mémoire for the helicopter pilot who runs into weather.

First of all, *have a suspicious mind.* Met men don't intentionally tell lies (usually) but you should always be prepared for conditions other than those forecast. As soon as you noticed the low cloud that wasn't mentioned in the briefing you should have been on the *qui vive.* The next point to consider is *any change in your planned flight profile.* Look at it this way. If you flight plan from A to B in a straight line at an altitude of say 500 ft AGL and an airspeed of 100 kts then, under normal conditions, you would expect to maintain that track, altitude and airspeed. In other words, once established en route your collective and cyclic inputs should be minimal. If however, you find that you are about to deviate from your track, and/or altitude and/or airspeed because of weather then the situation is no longer "normal". Your groundspeed calculations will now be awry and your fuel consumption is going to increase dramatically as you slow down – and keep an eye on your position on the map. *Now* is the time to start taking stock – not twenty minutes later up a blind valley.

The next two considerations are vitally important because neglect of them figures heavily in helicopter bad weather accidents. They are *speed* and *visual contact.* Speed in deteriorating conditions is usually too high. This factor alone contributes to many mishaps. Changes in the opacity of snow showers or of mist layers cannot be anticipated in time to slow down before visual contact with the ground is lost. The speed *must* be reduced long before the conditions are encountered. If not, then last second attempts to slow the aircraft invariably result in large cyclic movements with a consequent attitude change; a nose high condition which gives decreased forward visibility – when visibility is what you are trying to maintain.

If visual contact with the ground is lost during the flare to kill off airspeed then the natural reaction is to attempt to turn towards the clear area just left behind. This gives us a helicopter with a high nose attitude, decreasing airspeed and a low collective setting about to turn 180°. Obviously there will be cyclic, collective and pedal inputs to accomplish this turn. Because the aircraft is at a very low altitude i.e., on the trees, it is important that level flight be maintained. A climb will put you into cloud and a descent will drop you into the pine needles. Now if you don't think that's a tricky task in marginal visibility just you go out and try it on a good VFR day with lots of altitude and see how level you can stay! So *repeat* quote *repeat*, that airspeed has got to be back in lots of time.

One of the cardinal sins in fixed wing flying is to try and sneak along under the weather. Students at flying schools are continually lectured that if unable to maintain VFR they should turn around or climb and file IFR. The turn around recommendation applies to helicopters but not so the climb advice. Unless the conditions are ideal helicopter pilots should be very wary of climbing willy-nilly into instrument conditions (more on this later). To maintain good visual contact the aircraft must be low. This way you will be looking at your references rather than down on them. It's too easy for wispy stratus or snow flurries to come between you and the ground if you are high – and high means above 50 feet. Keep features in view which provide definite visual cues. Fence posts, telephone poles, hydro lines, highways all give vertical and horizontal references. Over a forest or woods in poor visibility the relatively flat carpet of tree tops can lead to disorientation especially when turning. And don't get sucked into leaving good ground contact such as a lake shoreline and setting off across a wide open expanse – especially if it's snow covered.

Obviously you should fly higher as the visibility improves but if you are caught out in really bad conditions i.e., reduced visibility in snow, rain or fog, then get down close to the ground until you can find a place to land.

Hopefully you will never find yourself in this kind of tight situation. By thinking ahead and watching weather develop you should be able to avoid it either by detouring, turning back, or landing and letting it go by. If you do go too far some day then learn from the experience and pass on the good word. Don't assume that you are now qualified to try worse conditions next time.

Any discussion of helicopter flying in weather would be incomplete without some mention of mountain flying and helicopter instrument flight. Mountain operations are so complex that a later article will be devoted entirely to this subject. But here are some observations on instrument flying.

Icing problems effectively prevent helicopter flight in cloud for approximately six months of the year in Canada. On the other hand, clouds in the summer often pose a hazard because of thunderstorm activity and the turbulence associated with cumulus build-ups. Add to this the inherent instability of the machines, a dearth of appropriate instrumentation and (usually) a lack of fuel to guarantee alternate requirements and the whole idea of helicopter IFR flight may seem impracticable. But recent experience has shown that there are many occasions when helicopters can safely fly IFR even without sophisticated auto-pilots and ASE systems. The secret again lies in careful flight planning. Where is the freezing level? What are the icing conditions? What is the ceiling en route? What turbulence are you likely to encounter? Do you have an out in the event of an emergency which requires you to land as soon as possible. After all you don't have an escape system like your jet jockey friends.

So IFR flight should be looked upon as just another aspect of the helicopter's versatility – but don't get complacent about it. Taking chances on icing conditions, filing into known areas of Cb activity or filing between layers when the freezing level's at the surface are not recommended patterns of behavior. Our helicopters are highly versatile – just like the people who fly them. But they are equally just as vulnerable.

Fod First

Just as the T38 pilot gave the pull-chocks signal, a young airman spotted fluid on the nose steering unit. The pilot was given the hold signal, and the airman headed for the nose steering unit to take a closer look. As the airman passed forward and below the left intake, the engine began to vibrate and stall. The engine was immediately shut down, and the crew deplaned.

Here was the first in FOD history: The airman was a young lady, and the foreign object that entered the engine was her wig.

AEROSPACE SAFETY

Maritime Coastal Operations

Since its formation in 1951 as a carrier based ASW squadron VS 880 aircraft have been a familiar sight over the waters off Canada's east coast. Five years after the scrapping of HMCS Bonaventure and a year after ASW ceased to be the squadron's primary role, the Trackers are still very much in evidence. At present VS 880 is the only squadron on the east coast with a full time commitment to defence priority one, the maintenance of Canadian sovereignty, and is the principal unit patrolling inshore coastal waters out to the 100 nautical mile pollution control limit.

Capt Owen
VS880
CFB Shearwater

Although the loss of the ASW role and the demanding flying associated with it has undeniably changed VS 880, many of the old hazards remain with us and the job is still a challenging and rewarding one. The role requires that most flying be done at altitudes of less than 1000 feet over one of the harshest flying environments in the world; the sometimes violent, always unpredictable, North Atlantic. Our operations–ranging around Nova Scotia, Newfoundland and the Gulf of St Lawrence all year and as far north as Frobisher Bay in the summer–bring us into contact with the whole gamut of east coast weather. Fog, rain, icing and strong winds are among the environmental hazards frequently encountered. Anti-exposure suits are standard flying clothing for at least eight months of the year: by the time the seas warm up in September the air has cooled down so much that "poopie" suits are again necessary. Our two principal bases of operations, St. John's (Torbay) International and CFB Shearwater, are usually one and two in Canada for days below VFR and IFR. Our operational limits of 500-3 within eight nautical miles of land and 300-1 outside that limit means that flying is carried on in some pretty dirty weather. Three hundred feet may sound like more than sufficient clearance over terrain where elevation varies only a few feet from sea level, but consider the surprise a pilot gets at 100 feet off Newfoundland in June when the large surface contact on the nose at one mile looms out of the mist as a 200 foot high iceberg. Another environmental hazard to be reckoned with are the large number of sea birds that follow the fishing fleets. Surveillance of any vessel may involve low-level manoeuvring in a clover leaf photographic pattern at altitudes down to 100 feet. This often has us competing for use of the same airspace with herring gulls and their brethren, as the accompanying picture shows.

Since the Tracker carries neither navigator nor fixing aid outside its normal IFR fit despite the fact that it habitually operates in a limited or nil aids environment, all squadron pilots are part time navigators and quickly become proficient in DR techniques assisted only by a Doppler radar. Certain patrols require an aircraft to operate without a fix from land for four or five hours: couple this with the always variable weather and sticky situations can develop.

. . . competing for use of the same airspace with herring gulls.

Our main sovereignty role is supplemented by secondary tasks such as SAR, fleet support duties, personnel/parts transport and other sundry tasks which entail launching of our standby aircraft (four hour standby 365 days per year). These missions often take us to some pretty out of the way places (Saglek, Newfoundland for example) and we may be additionally hampered by a lack of VHF Nav/Comm equipment. As a general rule we are limited to latitudes below 70°N and inside the area of compass reliability by the limitations of our GHARS (Gyroscope Heading and Altitude Reference System).

Our various tasks require an effective flight safety program and 880 is particularly active in this field. The squadron holds monthly sessions for all aircrew at which any flight safety related topic may be aired: any incidents of the previous month are also reviewed at this time. The squadron flight safety committee usually meets the day after the aircrew meeting to discuss any problems brought up at that session.

Although the Tracker will shortly enter its third decade in RCN/CF service, there is every indication that it will be around for a while. Its avionics are getting a bit tired but the airframe remains strong and the engines reliable. As a cost effective coastal patrol aircraft it has no match among other aircraft presently on the CF inventory. The Saskatchewan farmer may never see a "Stoof", but it should continue to be a familiar sight on the east coast for some time to come.

ABOUT THE AUTHOR Capt Owen graduated from RMC in 1970 and received his wings at CFB Gimli in June 1971. After holding at Moose Jaw for six months he was posted to VS 880 in Jan 1972. He is presently employed as squadron navigation officer.

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percent reduction in available thrust is worth a 50-100 percent increase in engine life.

We are not advocating attempting to get your aircraft off the ground at less than full power for fixed wing, or at less torque than you need in a helicopter, but keep the following points in mind for engine handling:

- know and observe the published limits for every phase of flight
- don't fly the engines right up to the limit when the mission doesn't require it – a slightly slower cruise not only saves a little fuel but significantly reduces engine wear
- use proper procedures both before and after flight. Most engines require some ambient airflow for adequate cooling thus the specified power restrictions for most engines. Also keep an eye open for FOD. After landing there is still one more requirement – allow sufficient time for the engine to cool and contract uniformly before shutdown so that rotating and stationary parts (the turbine shrouding in particular) don't rub
- observe and report any engine abnormality, however slight, that could signal possible internal problems
- finally, co-operation with the ground crew and the engine quality programmes is required. It is of primary importance that a thorough set of notes – gauge readings and symptoms – are provided when writing up an engine problem.

A truly professional pilot not only accomplishes his mission effectively and safely but also wisely and judiciously by understanding and respecting the operating limits of his airplane, and by constantly interpreting his power requirements in terms of premature engine wear and untimely engine failure.

Turbine Blade Fatigue

How many drivers have ever gone to the engine bay and discussed engine overhaul? Not many we'll bet, but did you know that throttle technique can go a long way towards extending engine life and decreasing maintenance time. Throttle bursts, while they may not result in or be evidenced by compressor stalls, cause one thing you can't see – overtemperature. Turbine blade overtemperature shows up as thermal fatigue or material overstress damage due to non-linear temperature gradients (expansion/contraction at different rates).

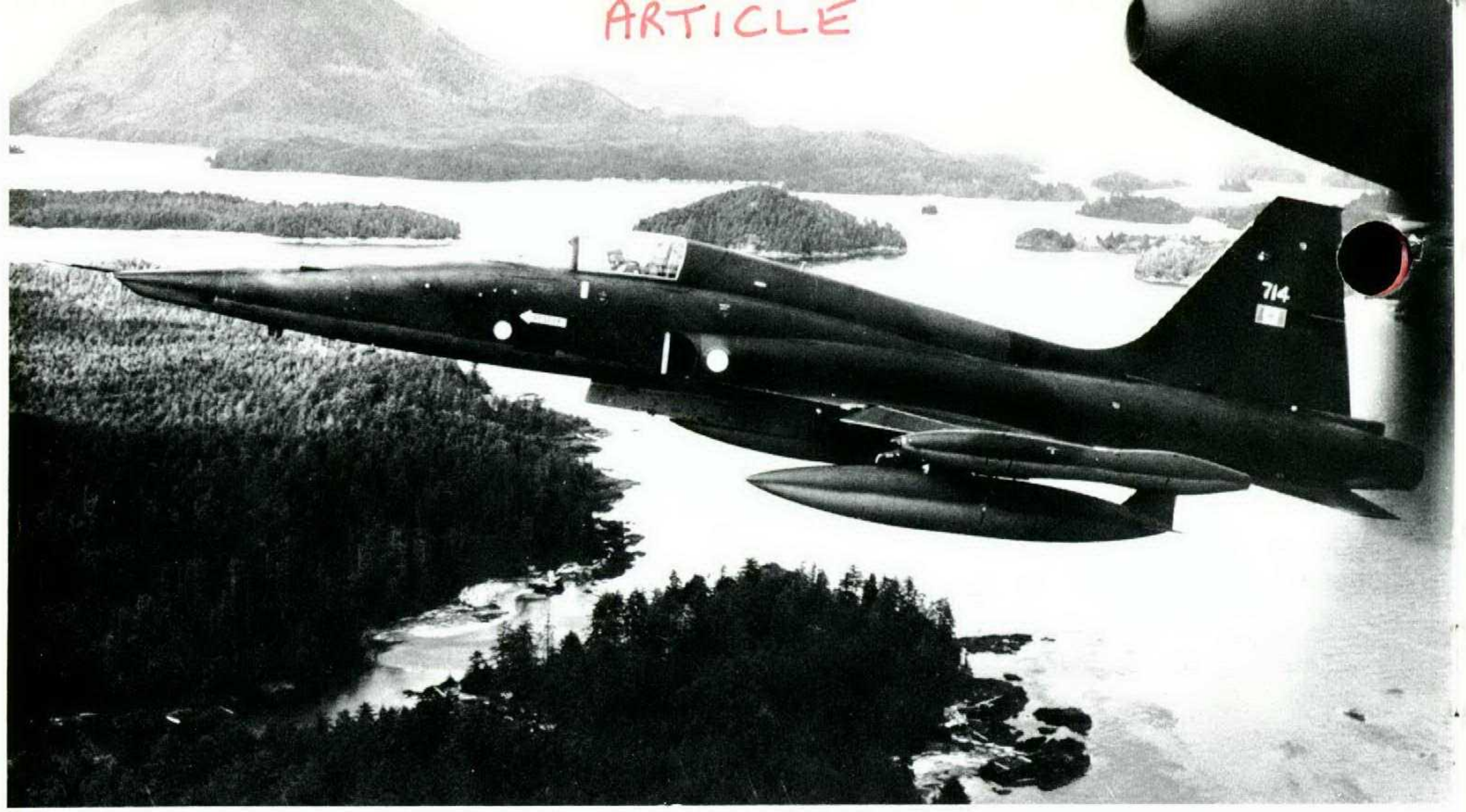
Turbine blades with varying cross section thicknesses are very susceptible to this type of stress in the thin leading edge section. With repetition and in time, cracks appear and eventually the blade breaks due to these transient periods when exhaust gas temperatures are changing rapidly. Rapid throttle accelerations/decelerations will therefore have a direct influence on turbine blade life.

In summary, don't make those sudden throttle movements unless required for the mission. When you pull out of the chocks, take it easy. Those few extra seconds you spend on smooth throttle techniques on the ground or in the air can do a lot to extend the life of your engines.

Turbine Inlet Temperature

In some multi-engine aircraft, turbine inlet temperature (TIT) readings can indicate the presence of eroded thermocouples. When one or more of these probes fail, readings will be incorrect and even worse, the turbine itself may be exposed to excessive temperatures. Engines with TIT, fuel flow and torque readings for example allow a comparative assessment provided they are properly rigged and are operated in accordance with correct procedures. High fuel flow and torque on one engine as compared to the remainder, probably means that the actual TIT is higher than that indicated. Throttle adjustment to align torque/fuel flow but with a lower TIT could identify the fault, i.e., a thermocouple failure.

Remember – generally speaking, throttles should be in close alignment for the same indicated TIT. When fuel flow/torque are higher than normal on one engine, use the other engine readings to set power. Over a period of time turbine damage can result from excessive TIT which, due to probe erosion, may not be indicated by the instruments. Finally, make sure the discrepancy is corrected. ■



PRESSING THE ATTACK

...can be hazardous

Put your ordnance on target but *never* overlook preparation for making a safe recovery.

The term "target fixation" may suggest a hypnotic trance-like condition brought on by looking at some feature of the target, e.g., its perfect symmetry. However, accident reports indicate that in reality it is often simply a matter of concentrating too much attention on getting in a favorable firing position to the neglect of a most important part of the bombing/strafing problem—a safe and timely recovery.

There are several possible reasons for this. It could be a deliberate violation of minimum safe release altitudes to score a better hit, or it could be unintentional. For example, if a poor dive entry is made, the time available for tracking is usually insufficient. This may cause a pilot to unintentionally descend below the minimum safe altitude while he is engrossed in solving the tracking problem.

Regardless of the reasons, delays in initiating recoveries from dives cause a substantial number of accidents annually. In addition, it is the suspected cause factor in quite a few "undetermined" accidents.

How can accidents such as these be prevented? There is no easy answer but here are some precautions:

- First, plan your delivery carefully. The type of delivery selected will depend upon the type ordnance and the target defenses. Any of several deliveries may be suitable in a given situation; however, the pilot must be intimately familiar with the speeds, altitudes and G-loads involved from entry until recovery is completed.

A knowledge of altitude required to effect recovery after ordnance release is paramount, but the method used to determine the specified release/recovery altitude is equally important. On high angle runs, with attendant high release altitudes, the pressure altimeter will usually be the primary method of determining the release/recovery point. In minimum altitude bombing, a reliable radar altimeter will become increasingly important but the pressure altimeter will still be a primary reference in most cases. There is one very important point, however, in minimum altitude bombing/strafing: never place blind reliance upon altimeters, tone warnings, etc. Rather, use all available instruments for guidance in determining the drop point but strive to develop a seaman's eye which will enable you to visually recognize the lowest point at which a safe pullout can be accomplished. Other important points to consider are:

- Altimeter error. Know all there is to know about altimeter lag, position error, etc., in the aircraft you fly.
- Use an accurate altimeter setting. This is particularly important in minimum altitude deliveries. An outdated altimeter setting can easily introduce errors in the order of 200-300 feet either up or down!
- Take into consideration the elevation of the target. This factor can easily be overlooked in making runs on targets of opportunity near sea level. Remember that several hundred feet of elevation can spell the difference between disaster and a safe recovery.
- Beware of uneven terrain, particularly upslopes along the recovery course.
- Excessively steep dive angles have been implicated in more than one accident—and many low pullouts. When using established target facilities, ensure that target personnel report dive angles and low pullouts to the pilots concerned when they have the capability to do so. In addition, low pullouts should be indicated on the copies of scoring records furnished to the squadrons concerned.
- Make full use of all instruments available during night bombing. Ensure targets are well lighted whenever possible but recognize that disorientation is a real hazard during night deliveries, even under the best of conditions. Inasmuch as safe night deliveries will depend upon instruments to a greater extent than day deliveries, increase release altitudes sufficiently to allow for a safe recovery under the worst conditions that may be encountered. Note particularly that pinpoint lights surrounding a target at night can be a hazard because they can easily be confused with stars on a clear night under the right condition.
- Finally, and perhaps most important, use care to make a good entry (roll-in). Accurate ordnance deliveries require precise control of airspeed, dive angle, altitude, etc., at the moment of release and a careless or incorrect entry can needlessly complicate the problem. It is true that one factor can often be adjusted to compensate for another, e.g., less speed to compensate for a steep dive angle. However, these adjustments require extra attention by the pilot and a pilot who is already busy performing other tasks associated with the run can easily become overloaded to the point where he fails to give proper attention to the all-important recovery.

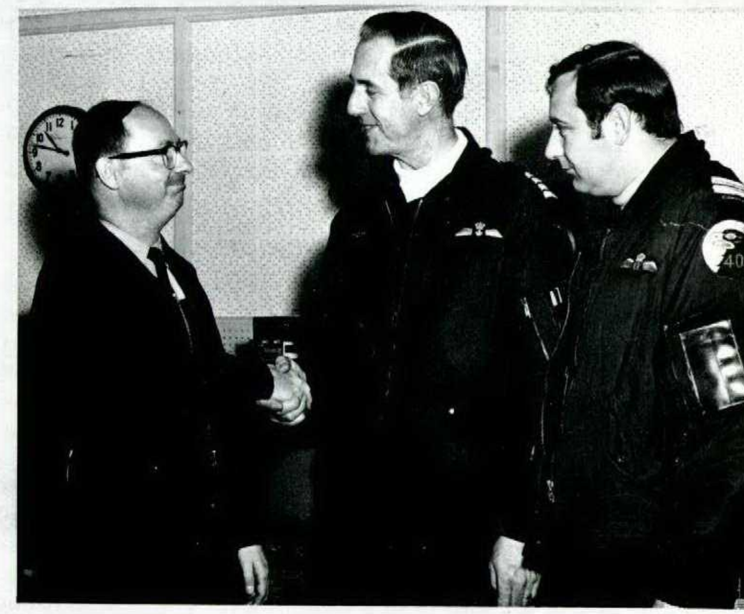
The ability to accurately deliver ordnance on a target is the hallmark of a good fighter/attack pilot. COs and other aviation commanders recognize this and prescribe training cycles which provide individual pilots with ample opportunity to practise their profession.

Ordnance delivery is usually looked on as an interesting and enjoyable aspect of flying. For one thing, a pilot gets to put his aircraft to some measurable use. The flying itself is exhilarating because it involves rapid changes in headings, altitudes and attitudes. In addition, considerable competition often springs up among pilots and squadrons. This is fine; it is an important factor in honing the rough edges and adds zest to the job, but pilots should never become so concerned with getting hits that they unnecessarily endanger themselves or their aircraft.

APPROACH

20,000/25,000 Letdowns

Shown receiving congratulations upon completing his 25,000th GCA approach is Sgt T.A. McLennan, Radar Controller at CFB Comox. Congratulating him is Col R.L. Mortimer, Base Commander, CFB Comox who flew the approach in a CF 101 with navigator Capt P.K. Ott.



Shown receiving congratulations upon completing his 20,000th GCA approach is WO Ron Harrington, Radar Controller at CFB Comox. Congratulating him is Col R.L. Mortimer, Base Commander, CFB Comox who flew the approach in a CF 101 with navigator Capt P.K. Ott.

Keep it clean!

Capt D Matthews
NDHQ/DAES

...washing compressors improves performance

This article is a condensed version of a more lengthy technical paper presented by the author at a Gas Turbine Operations and Maintenance Symposium held in Edmonton, Alberta, 20-23 Oct 1974, sponsored by the National Research Council.

Have you ever wondered what happens to that rotating mass of metal at the front of your engine when you land on a dusty runway or fly through smog or hover over the ocean waiting to pull up a shipwrecked survivor on your rescue hoist? Probably not because you're too busy. Rest assured though; someone is concerned. We in the Directorate of Aeronautical Engineering and Simulators want you to get the optimum performance from those gas turbines. In short, we want to ensure they're clean so that you can do your job without worrying. Let's explain.

Types of Compressor Performance Degradation

Basically, there are three different types of aircraft gas turbine engine compressor performance degradation, all of which can cause disruption of design airflow and loss of optimum performance. These are erosion, corrosion, and foreign material build-up.

The first of these, erosion, can lead to premature engine failure within 10-20 percent of normal overhaul time. Very simply, erosion is the gradual wearing away of compressor blade surfaces by the continuous impingement of small sand or dust particles. (Remember the dusty runway?)

To combat this problem, there are two options. One is to develop a filtration or particle separator system to remove solid particles from the air, thereby increasing weight and reducing engine efficiency. The other is to design stronger blade material and/or erosion resistant coatings. This latter option is the one which most engine manufacturers now utilize and it is here where erosion and compressor cleaning are inter-related.

The hazard—which is not readily recognizable to engine maintainers due to its long term effect—is that operation in a sandy or dusty environment gradually reduces or removes protective blade coatings leaving unprotected blade surfaces susceptible to the damaging effects of corrosion when the aircraft returns to a more humid or salty environment.

We believe erosion is a problem in CF operations and its indirect effects, such as corrosion, can be beaten with the help of regular compressor washing.

The second kind of compressor performance degradation is corrosion, which is defined as the destruction of a material by chemical or electrochemical reaction with its environment. In the case of aircraft the most familiar cause is sea salt spray and, when salt is deposited on compressor blades, corrosion takes the form of both direct chemical attack and galvanic corrosion. Salt, being hygroscopic, attracts moisture from the air which in turn sets up the electrochemical action of a galvanic cell or directly attacks the metal structure.

As in the case of erosion, corrosion can be arrested only by a combination of methods. The use of new materials such as Inconel 718 and titanium alloys for compressor blades together with coatings such as Nubelon and Serme Tel is effective only when combined with regular compressor anti-corrosion washes followed by the application of an inhibitor or preservative.

The third and final type of compressor performance degradation is caused by the build-up of foreign material on compressor blades and housings. This form of contamination is one of the hardest to detect and, like erosion, affects the engine over a long term. The obvious result of this build-up is that a distortion of design airflow over the blades occurs, thereby causing the compressor to operate in an off-design condition which decreases the surge margin and the power output.

This form of performance degradation is usually found—at least in our experience—in aircraft operating in humid, dusty areas or in industrialized, smoggy areas high in atmospheric sulphur content. These conditions are encountered by nearly all types of aircraft—helicopters, fighters, and transports alike.

Methods of Detecting Performance Degradation

At present the most widely used method in the Forces for detecting a dirty compressor is routine maintenance, usually on a periodic inspection, which could mean as little as one check every six months. By far the most effective method is engine trend monitoring (ETM). The only aircraft presently using this method are the CH135 helicopter, CC138 Twin Otter and CC137 Boeing 707, of which only the CH135 has regular compressor cleaning. ETM is the daily comparison, by means of a trend chart, of basic engine parameters to their performance baselines. Usually, these parameters are N1, N2, EGT and Fuel flow. A dirty compressor usually manifests itself as a gradual rise in EGT, N2 and fuel flow over a period of several days. Cleaning tends to bring the trends back closer to their baseline values. We are attempting to institute this method on more aircraft as its benefits become known.

Current Canadian Forces Compressor Cleaning Methods

Up to this point, no mention has been made of the difference between compressor cleaning and compressor washing. By choice we have broken these down into performance recovery cleaning and anti-corrosion washing respectively. Performance recovery cleaning refers to the periodic cleaning with either a liquid or an abrasive to regain lost power caused by the build-up of foreign matter in compressor air passages while anti-corrosion washing refers to regular washing with water or water/alcohol to remove corrosives such as salt deposits.

Engineering Orders detail the pressures, flow rates, mixes, materials, and volumes required for the effective cleaning/washing of the compressors of almost all of our gas turbine engines. Close examination of orders indicates some of the problems apparent when operating a large fleet of aircraft which have different roles and which use engines of different manufacturers.

Of foremost importance is the fact that nearly all manufacturers recognize the need for compressor washes or cleaning of some sort. However, most companies do not specify *regular* cleaning/washing but rather leave the onus on the operator to inspect his engines and to determine when compressors must be cleaned/washed based on either visual observation or a determination of lost performance. In addition, all the procedures are different.

We would like to see standardized compressor washing procedures for all our engines, including length of washes, how they will be done (motoring or running), and the regularity rec... wa... har... per... pro... proc... ours... salt... lies... not... mate...

Runway Check!

On receipt of a reported RVR of 200m for takeoff the airc... was taxied to the threshold of Runway 09. In view of... patchy nature of the fog the Captain decided to taxi the... length of the runway to prove that visibility was consiste... adequate for takeoff. In doing so the aircraft overran the... threshold, damaging two threshold lights and two tires.

(Non...

T400-CP-400 engine on overhaul which had not been regularly washed. The dark trailing edge build-up is quite evident. Fig 2 shows the results of washing this compressor. At the top end of the curves, say 37,000 rpm, there has been more than a 6 percent increase in power due to washing. In fact, for this engine, Ng dropped as much as 300 rpm, T5 as much as 20°F and SFC as much as .005, when it was washed. What is

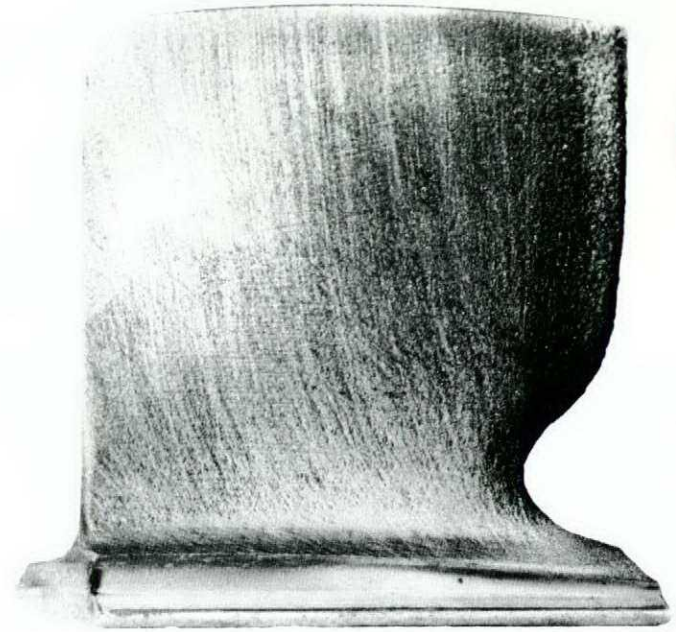


Fig 1 Erosion of T400-CP-400 compressor blade

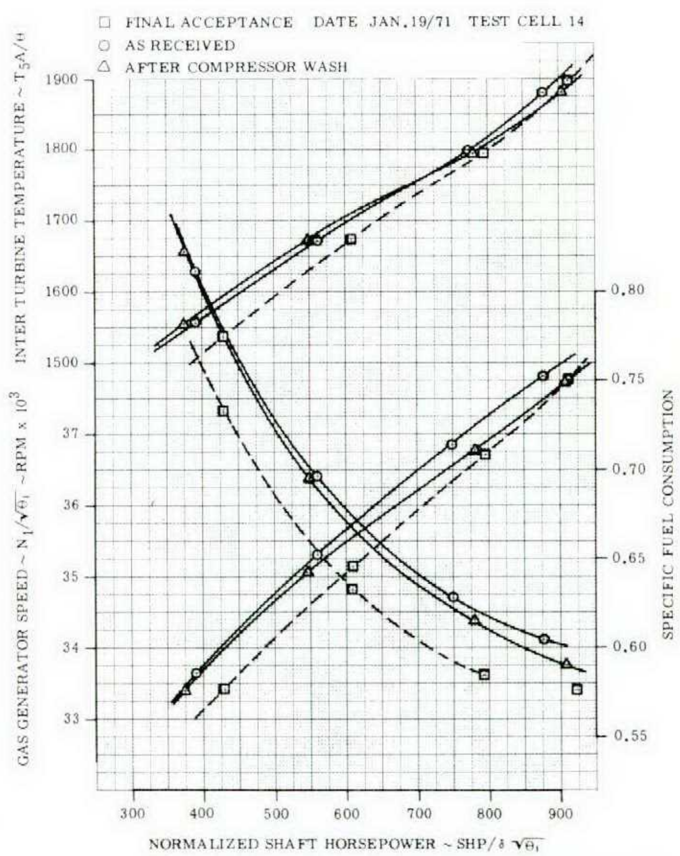


Fig 2 Performance recovery resulting from compressor washing on T400 engine

Corrosion of engine blades

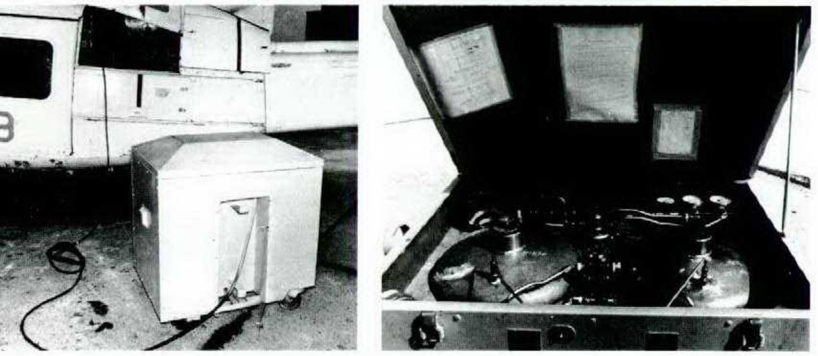


Fig 3 Wash cart for T400-CP-400 engine

difficult is to prove that a program of regular anti-corrosion washing will indeed help to sustain power and increase TBO, even when operating in environments other than salt. The engine mentioned above spent the majority of its time near Edmonton, far from the ocean and, although it probably showed little power loss in the field, it exhibited only marginal performance at overhaul until it was washed.

Furthermore, even when wash procedures are followed, the job is sometimes not done correctly. A common occurrence is rusted compressor casings caused by inadequate drying following a wash. Other similar problems have shown up on overhaul even on engines such as the T58 which are regularly washed! Such things as compressor blades seized in their casing tracks and corrosion pits on blade and vane airfoils are all the result of poor washing technique. We cannot help but be self-critical when it comes to this lack of adherence to specified procedures.

A final costly problem which we encounter is one of ground support equipment. With the exception of three specially designed wash carts, almost all other GSE is manufactured locally by base personnel. This includes modified stirrup pump fire extinguishers with insufficient volume, poor flow rate, poor mixing, and inadequate distribution of spray wash. Our attempts at designing wash carts capable of supplying required volumes and flow rates are meeting with only limited success due to the very large span of these variables. Although we are pursuing the idea of having all new purchase engines fitted with wash rings and capable of being washed using one of our present carts, some difficulty arises when these new engines are grossly over or undersized compared with those which are compatible with present wash carts. For example, the new LRPA engines will require a volume and flow rate much greater than that required by the smaller T400, T63, and CF 700 engines for which carts have been designed. In fact, a new cart will have to be designed f the LRPA. The co-operation of engine companies in provid procedures for use with our carts and in providi engine-mounted wash rings capable of accepting the carts and their fittings is required.

Example of Typical GSE

Fig 3 illustrates what we are attempting to do. This shows a wash cart which has been designed for the T400-CP-400 engine. Of interest are the compactness and manoeuvrability of the cart, the rinse and wash bottles and lines, and the simple single line hook-up to the engine-mounted wash ring connection. It is this sort of design, in varying sizes, that we advocate for future compressor wash ground support equipment.

Conclusions and Recommendations

Operating aircraft gas turbines in certain environments can cause compressor performance degradation in the form of erosion, corrosion, and foreign material build-up. The best preventative for this performance degradation is regular compressor washing and action should be taken as soon as possible to implement washing procedures on all our engines.

Engine trend monitoring on a daily basis has proven to be the best method of detecting compressor performance degradation for those aircraft presently using this system in the Canadian Forces and should be instituted wherever possible.

The majority of aircraft engine manufacturers recogniz the need for compressor cleaning but fail to stipulate th periodicity and also fail in many cases to provide liquid wash procedures or common wash solutions, methods, inhibitors, or ground support equipment. Manufacturers should be approached to provide standardized wash procedures and methods for all gas turbine engines which the Canadian Forces operate.

Ground support equipment used by the Canadian Forces in conjunction with engine compressor washing is, for the most part inadequate, partly due to a lack of general agreement on the advantages of standardizing equipment or even on the need for such equipment and partly due to the wide variety of pressures, flow rates, and volumes of solutions called up by manufacturers.

GSE requirements should be standardized for the CF and should include the requirement for wash rings mounted on the engines.

Once standardization has been accomplished proper GSE for all engines should be procured.

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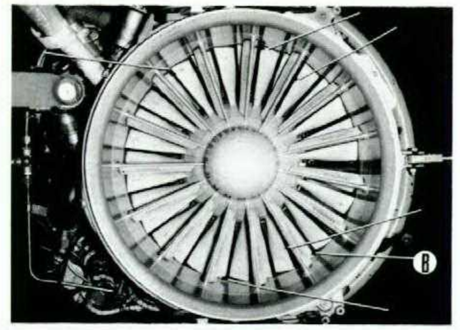
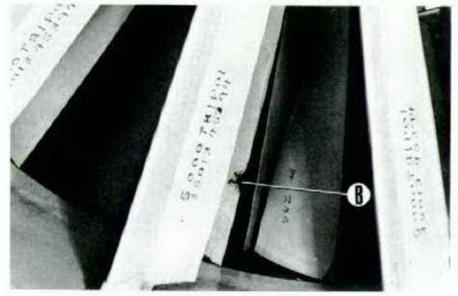
This form of performance degradation is u found—at least in our experience—in aircraft operat

GEN FROM 210

CF5, FOD DAMAGE After completion f an aircraft sampling inspection, a CF5 craft was towed out of the hangar and aken to the normal engine ground run up area for post inspection run up. Three, two engine, run ups were carried out over a period of five days. During the third run up engine stall indications were experienced at 92% and 93% on the left and right engines respectively. Both engines were then removed from the aircraft.

A preliminary investigation revealed damage to the compressor sections consistent with foreign object ingestion. A complete engine strip report subsequently determined that FOD approximately 0.080" and 3/16" (small rivet size) in diameter was responsible for the damage. A conservative estimate of the cost of the incident is $40,000.





The occurrence investigation showed that additional engine runs were made without properly identifying the cause of engine fluctuations, instrument readings and noise on the initial run. Had a complete investigation been carried out at the appropriate time, FOD damage would have been discovered on the right engine and further running would not have taken place. Similar damage to the left engine could therefore have been prevented.

The CF210 investigation also discovered that the technician was not qualified to run up the aircraft. He required recertification of run up procedures, engine operating characteristics and FOD precautions with a qualified supervisor.

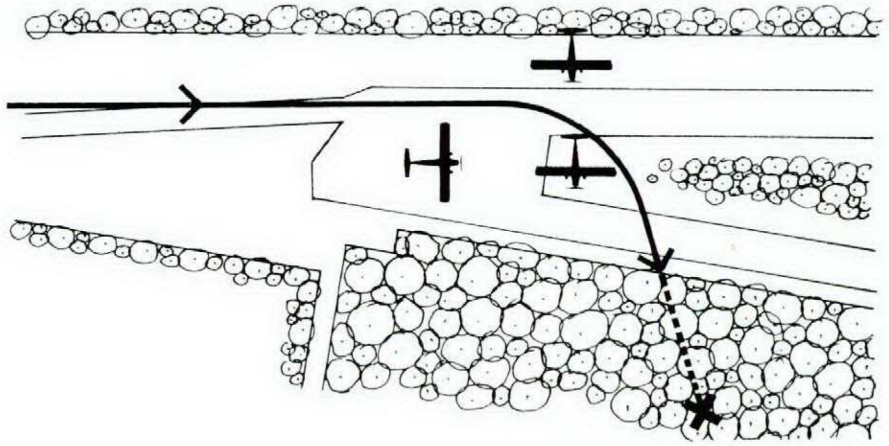
In future, the use of run up screens will be mandatory on the CF5.

OTTER, FATAL CRASH An Air Reserve Squadron was tasked to support militia units on a field exercise in the Swallow Lake area of Ontario. The Squadron detachment deployed to the area with three Otter aircraft on wheels and one on floats. The wheel aircraft were assigned to upport the "friendly forces" and the oat plane operated with the "enemy rce".

On the first day of the exercise a number of missions were flown by both friendly and enemy aircraft. These included photo reconnaissance, supply, and "harassment" of each other's forces. During some of the missions, small paper-bag "flour bombs" were dropped.

The next morning the float Otter took off with four personnel on board. The purpose of the mission was to "harass" a force located in an area three miles away. Approximately 15 minutes later the aircraft proceeded to the gravel strip where the wheeled Otters were situated and made a pass across the area. The aircraft then made a loose circuit to the left and returned; this time it descended to a low altitude. The aircraft banked sharply to the right around one of the aircraft parked on the strip and thus changed direction directly towards trees which border the southern edge of the strip. The aircraft impacted the trees in a slight climb and an approximate five degree right wing down position. Both wings severed trees and the aircraft then rolled sharply to the right towards the inverted position. The wings folded back parallel to the fuselage and the aircraft came to rest 196 feet from the point of initial impact and was consumed by a post-crash fire.

Two crewmembers escaped with minor injuries and the pilot was severely injured. A passenger in the co-pilot's seat was unable to escape and died as a result of the crash.



Runway Check!

On receipt of a reported RVR of 200m for takeoff the aircraft was taxied to the threshold of Runway 09. In view of the patchy nature of the fog the Captain decided to taxi the full length of the runway to prove that visibility was consistently adequate for takeoff. In doing so the aircraft overran the 27 threshold, damaging two threshold lights and two tires.

(Non-CF)

COMMENTS TO EDITOR - LETTER

Comments to the editor

Univers Bold 11pt

GOOD SHOW QUERY

Press Rom Med 10/11 2¼"

Your first Good Show report in the Sep-Oct 1974 edition concerning a CF104D with nosewheel problems left me rather puzzled.

As I understand it the nose gear of a 104D retracts forward and assumes a vertical position when extended. Now if this is the case Flt Lt Leach was in deep trouble indeed, what with his gear 15 and then 45 to 60 degrees aft of vertical. If we assume that your writer doesn't know his aft from a hole in the ground then the story begins to clear up, but only slightly. What concerns me even more is the procedure used. I am fortunate because I fly an aircraft which is large and slow; we usually have a few hours to figure out strange emergencies. We can get out the book and hold a regular committee meeting before we act. You poor 104 jocks are denied this luxury and have my admiration for your instant smarts. However, isn't one of the basic rules in gear malfunctions "Don't recycle"? If something is really screwed up recycling at best duplicates the snag and at worst compounds it. This rule seems to have been violated in this incident and may serve as a poor example to the young and impressionable in our midst.

If there is a good rationale behind the story perhaps a more detailed explanation could be obtained in the form of an article in a future edition.

Further along these lines would it be possible to have a Wing Commander Spry type of column similar to what we find in *Air Clues*, in which the hairy incidents are critiqued and thus inspire controversial correspondence. And how about a competition for our counterpart's nom de plume? LtCol Hindsight?

G.B. Bennett
Major
VP 415 Summerside, P.E.I.

Press Roman Med Italics 10/11 2¼"

Your point about compounding landing gear problems by recycling is valid – in general. However, the CF104 does not fall into the "general" class of aircraft. Flt Lt Leach's response to his emergency was quite correct and by the checklist which we quote below.

a. **SPEED – below 260 KIAS (225 KIAS CF-104D as the nose retracts aft in the dual)**
b. **Ensure that gear position indicator lights are serviceable (LIGHTS – TEST)**
c. **Check landing gear control and landing gear indicator circuit breaker – IN**
d. **Recycle gear**
e. **If gear does not lock-down, return gear lever to the UP position and pull manual landing gear release handle to full extension (10"). Check lights**

NOTE 1

The landing gear lever should be in the UP position prior to pulling manual landing gear release handle because it is remotely possible for an aircraft to have a misrigged landing gear and an electrical system malfunction simultaneously. Under these conditions, if the landing gear is placed in the DOWN position without resulting in gear extension and the manual landing gear release handle is then pulled, the weight of the landing gear will rest on the forward main gear doors. The pressure on the main gear door will not allow the door uplocks to release, thus preventing the gear from extending.

NOTE 2

The handle is provided to release the main landing gear door uplocks and the nose gear uplocks and to open the dump valves which allows the landing gear to lower by gravity and air load forces. The gear is then locked by spring loaded downlocks. Approximately a 10" pull to the stop is required to release the gear.

f. **Return gear lever to DOWN position**

At the time of Flt Lt Leach's incident the EO stated that because of the hazards involved, partial gear or belly landings should not be attempted in the CF104. Rather than attempt a partial gear or belly landing it was recommended that the crew EJECT. In view of this, recycling the gear could in no way worsen the situation.

Subsequent to Flt Lt Leach's incident the following amendment has been added to the CF104 pilot operating instructions:

"Nose gear UP/UNSAFE. With both main gear extended and the nose gear up or unsafe, a landing may be considered. A touch and go landing may be effective in locking the nose gear down under certain circumstances if the aircraft is bounced on the runway.

Note: **The ultimate decision to land or eject rests with the pilot.**

So much for Flt Lt Leach's incident. You are now sentenced to two 18 hour patrols in the Argus for suggesting that the CF104D gear retracts forward. Also, we are not convinced that the critiquing of "hairy incidents" or receipt of "controversial correspondence" necessarily helps in the field of accident prevention. As for Lt Col Hindsight, our friends in Training Command already have the services of his son, Lt Hindsight, in their flight safety magazine Hot Line.

DITTO

The first story in the Good Show section of your Sep-Oct 74 issue makes me wonder about a point which has been hammered into me since I began flying: when the landing gear is down but indicating unsafe, do not recycle. I don't wish to belittle F/L Leach's efforts, he obviously deserves a lot of credit. However, the writer of the story seems to applaud two landing gear reselections. This runs against my grain and I suspect may set a dangerous precedent.

I am certain previous *Flight Comment* issues have had stories such as this one but which kept to a theme of "leave bad enough alone". Have we changed our tune?

R.L. Gaede
Major
VP 415 Summerside, P.E.I.

ditto

THERMAL RUNAWAY SYMPTOMS

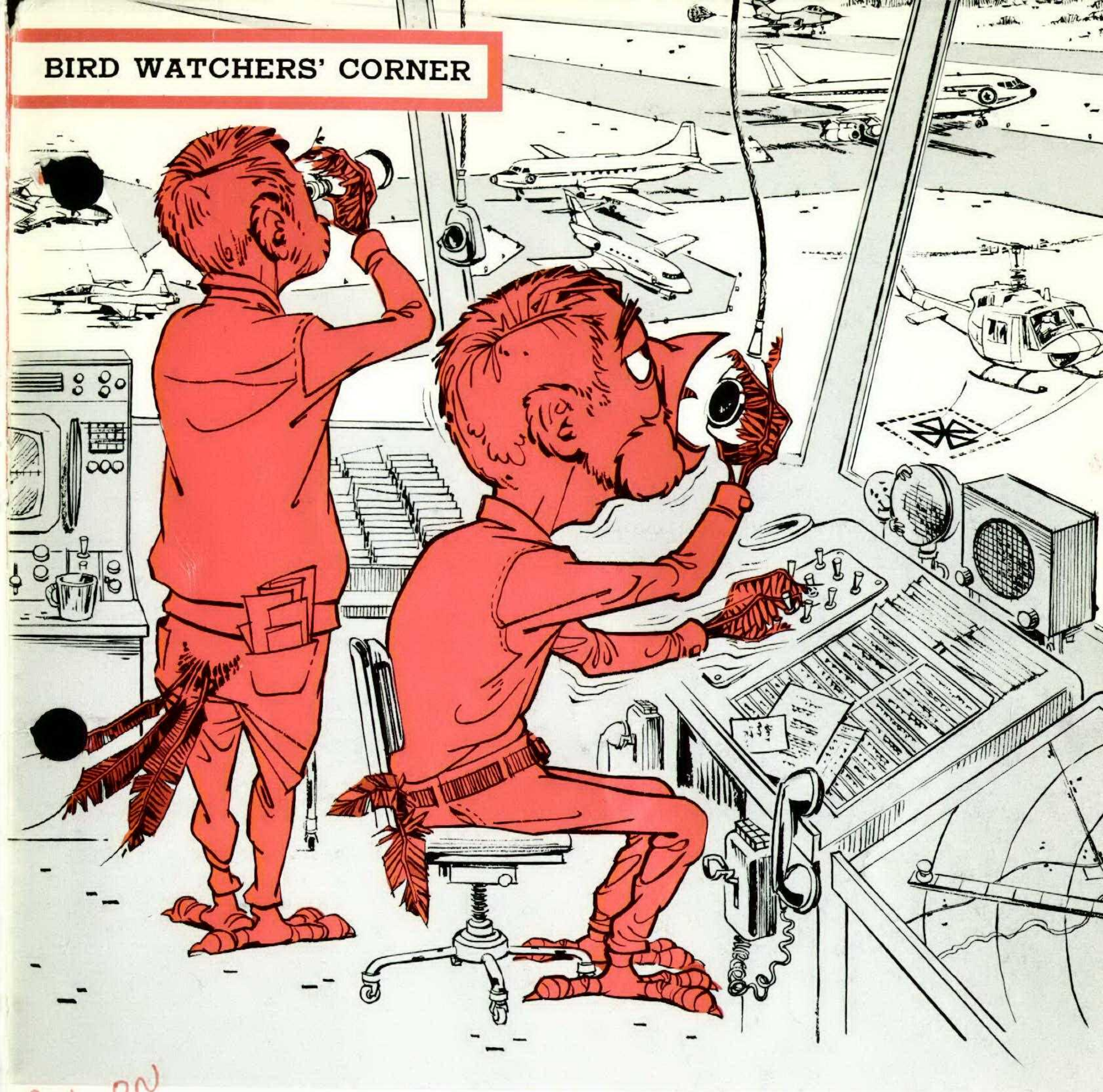
Having recently completed 6-1/2 years as ASO with 403 and 427 Squadrons respectively it has been my experience that the first symptom of thermal runaway is a high or increasing loadmeter reading.

Should this not be included on the placard shown on page 24 of the Sep-Oct issue of *Flight Comment*.

R.J. Atkin
Captain
AETE
CFB Cold Lake

A high or increasing loadmeter reading is indeed the first symptom of thermal runaway and pilots are well advised to monitor that particular dial. We neglected to mention that the placard in question will be placed in the batt compartment and is intended for ground servicing personnel as opposed to cockpit occupants.

BIRD WATCHERS' CORNER



ALL ON BLUE SHEETS

"COOPED UP CONTROLLER"

Birds often nest in exotic places but few of our feathered friends enjoy the luxury of a special glass house at the top of a high tower. This fabulous habitat is reserved for Cooped up Controller. From this princely perch with its permanently percolating coffee pot Cooped up Controller surveys the ground cavorting and aerial antics of the home-based flying flocks. Most of his time is spent issuing clearances and instructions intended to prevent any mid-air tail tangling but he is continually called away from the controlled circuit chaos to cope with the twittering of transient turkeys who are not familiar with the procedures at his base. These day-trippers, who come winging wildly in from all directions, should check their pubs before imprudently appearing. Cooped up Controller is always busy with a bunch of birds hopping from helipads or racing off runways. Sometimes, when things get really hectic, his heart-rending call echoes to the heavens:

NEED-A-BREAK-NEED-A-BREAK-IT'S-ALL-I-CAN-TAKE

Table of Contents 1974