FLIGHT COMMENT

EDITION 5 1976

THE FLIGHT SAFETY DIGEST OF THE CANADIAN ARMED FORCES

Aircraft Maintenance in the 1980s'

by Col W. G. Doupe

– LRPA – NFA – AMST – AWACS – WILL THE CF BE ABLE TO MAINTAIN THEM!

When the new Long Range Patrol Aircraft (LRPA) goes into operational service in the Canadian Forces in 1980, it will carry with it much more than meets the eye and much more than the Canadian Forces expected when the decision was made in July 1976 to purchase 18 aircraft and support systems from the Lockheed Aircraft Corporation.

When the F-14, F-15, F-16, F-18 and other aircraft are evaluated for suitability as Canada's New Fighter Aircraft (NFA), the traditional enthusiasm first for comparative operational performances, and second for acquisition costs, undoubtedly will overshadow and possibly blot out entirely the impact of the technologies being acquired. For the aircraft of the 1980s such an oversight will be no less than catastrophic.

Any aircraft acquired by the Canadian Forces in the 1980s, such as the Lockheed Long Range Patrol Aircraft, a New Fighter Aircraft, an Advanced Medium STOL Aircraft (AMST), a replacement for the Strategic Transport Boeing 707, or a Boeing E-3A Airborne Warning and Control System (AWACS) is going to push the Canadian Forces to new aircraft maintenance frontiers. The Canadian Forces may not then be in a position to cope with the challenges.

While the Lockheed LRPA will employ an airframe and engine design which is 15 years old, the equipment the aircraft will carry will stretch anyone's imagination with respect to its technical scope, scale and state-of-the-art. Consequently, the on-board equipment package and the supporting ground installations are going to place novel demands upon maintainers. Furthermore, maintenance of the total weapon system will have to be met and resolved within the context of the maintenance program acquired with the aircraft — a program based on maintenance policies quite different from those practised by the Canadian Forces.

LRPA – THE IMPROVED MAINTENANCE PROGRAM (IMP)

GENERAL

The Improved Maintenance Program (IMP) as applied to the LRPA and developed by Lockheed is a particular application of the modern philosophy of airline maintenance which greatly reduces maintenance manhours and downtime by elimination of scheduled maintenance — under controlled conditions. The basic philosophy involved is not unknown to the CF, but its application on the LRPA will be pacesetting to put it mildly. The methods used by the CF to rationalize maintenance schedules parallel the IMP in some respects. However, IMP has exceeded CF efforts in rationalization in several important respects including the analysis at the component level.

The lack of an adequate information data base at the third level of maintenance is the principal reason why the component studies in the CF lag those of the IMP. Since the USN uses in-Service third line facilities extensively it is easy to impose a comprehensive data collection system. On the other hand the CF depends largely on civilian contractors for most third line maintenance which has made it more difficult to collect accurate data. Now, with the purchase of the LRPA and the acquisition of the IMP, the CF may be forced into changes not only in this area but also in several other aspects of current maintenance policy and practices.

LRPA MAINTENANCE CONCEPTS

There are major differences between the LRPA and CF maintenance concepts regarding:

a. the division of work among first (organizational), second (intermediate) and third (depot) levels;
b. the use of aircraft "Zone" (multi-discipline) inspections conducted by a single tradesman rather than several individual specialists; and
c. the application of equipment "Condition-Monitoring" (no scheduled maintenance of any kind).

The total consequences of a major change in just one of the above areas would be impressive and extremely interesting to contemplate. The evaluation and accommodation of major changes in all three of these areas, in time to meet the date for having the aircraft in squadron service, will be extremely challenging, thought-provoking and probably controversial. In view of the latter, a few more words of explanation of the IMP will help to reveal why the issues are both complex and thorny.

IMP DEVELOPMENT

Development of the P-3 IMP (Improved Maintenance Program) began in November 1972. The basic objectives of the program were to reduce scheduled maintenance and to increase aircraft availability by applying the latest analytical techniques approved by the United States' Federal Aviation Administration (FAA) and Air Transport Association. The basic analysis began with identification of the Functionally Significant Items (FSIs) on the aircraft. These FSIs were chosen on a system-by-system basis as a result of failure mode and effects considerations for each of the individual systems, analysis of existing tasks and evaluation of high-maintenance data. These items were then individually analyzed to justify each requirement for scheduled inspection and maintenance.

By this process all FSIs were assigned to one of three categories as follows:

* *Fixed Frequency Replacement.* An item that demonstrates a predictable relationship between age and reliability degradation.
* *On-Condition.* An item for which an effective maintenance task can be performed to detect degradation or reduction in failure resistance by periodic inspection or testing on the airplane.
* *Condition-Monitoring.* An item which does not require scheduled maintenance. Failure history may be monitored by data surveillance and analysis. Preventive measures require corrective actions other than scheduled maintenance.

Fixed frequency replacement items and on-condition (periodic inspection) items are familiar to all aircraft personnel, but the condition-monitoring element is relatively new as defined in the IMP. *Condition-monitored items require no scheduled maintenance and may be monitored by data surveillance and analysis since the analyses have determined that there are no effective maintenance tasks that can be scheduled in the existing circumstances.*

The maintenance task distributions of the previous scheduled maintenance program and the IMP are dramatically different. Of particular interest is the decrease of on-condition (scheduled) tasks. In the case of the USN P-3 Orion aircraft, the 795 tasks previously imposed for scheduled maintenance were reduced to 434 tasks which is a dramatic 55 per cent reduction.

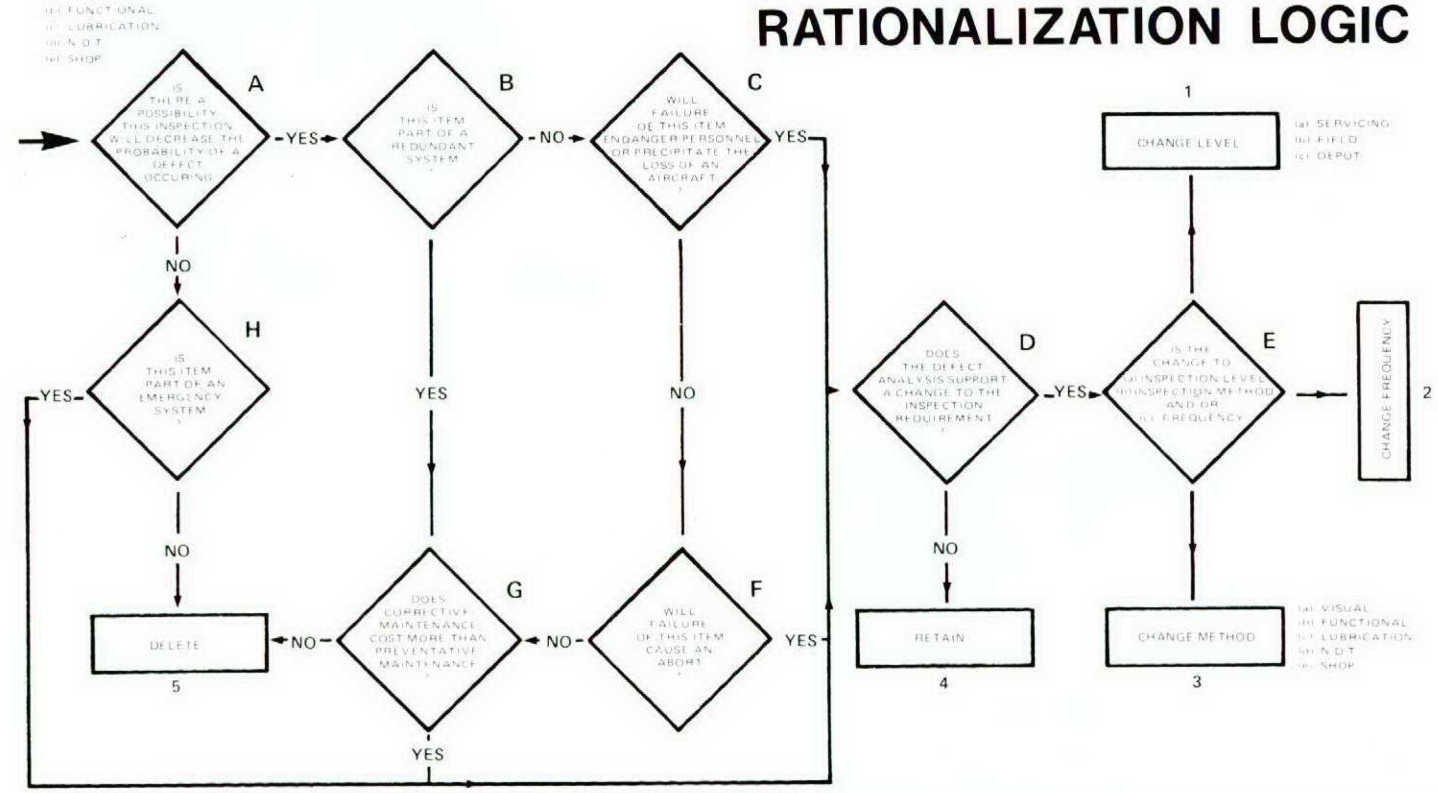
IMP ZONAL EXAMINATION

The IMP Maintenance Requirements Cards are similar in many respects to those presently used for maintenance tasks on CF aircraft. One major difference, however, is the ZONAL EXAMINATION concept employed in the IMP. Scheduled inspection programs usually call out specific points on the aircraft that require periodic maintenance and technicians with specific qualifications are assigned the maintenance action at these points. In the IMP, those specific points that require periodic maintenance also must be accomplished by specifically qualified technicians. However, the IMP also assigns the same technician a "zonal examination" requirement in the same area in which he performs scheduled maintenance.

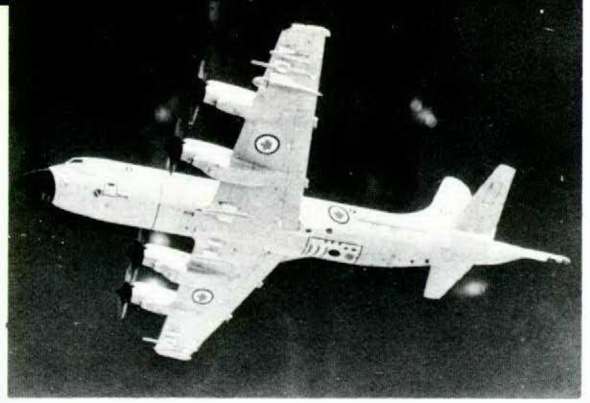
A "zonal examination" is a general examination of ALL the equipment, installations and structure within a specified area. The aircraft is divided into finite geographical segments

A Maintenance Appraisal Team (MAT) will be detached from the Aircraft Maintenance Development Unit to the Lockheed plant in Burbank in September. The MAT's function will be to work with Lockheed personnel to analyze the maintenance concepts and requirements for all systems and components for the new Long Range Patrol Aircraft (LRPA). Left to right above are MWO L Austen, MAT Mechanical Section; Mr G. Bollinger, Lockheed Aircraft Maintenance Support Equipment Engineer; Major L McClare, MAT Leader; Capt T Van-Ramen, MAT Avionics Section Head; Mr F Connell, Lockheed Group Engineer Maintenance Planning.

RATIONALIZATION LOGIC



The aircraft inspection LOGIC PROGRAM utilized by the Canadian Forces Aircraft Maintenance Development Unit (AMDU) is similar to the process approved by the United States' Federal Aviation Administration. The United States Navy and Lockheed Improved Maintenance Program blend such a logic system and a comprehensive information system to minimize scheduled maintenance.



LRPA – CP-140, AURORA, more than meets the eye

called zones with logical boundaries that are defined on the Maintenance Requirements Cards. During a "zonal examination" the technician will carefully check everything within the area for signs of deterioration. When a deficiency is found, corrective action is assigned to a specialist, and the corrective deficiency is inspected by a quality assurance specialist. The "zonal examination" has been employed by commercial airlines in their maintenance programs for many years, and its application was successful during the IMP trial with the United States Navy.

IMP RESOURCE MANAGEMENT REQUIREMENTS

While the IMP has many real advantages, it also has stringent management and resource requirements. For example, DATA MONITORING AND ANALYSIS of the on-going program is mandatory. IMP requires complete and accurate aircraft operating and maintenance information which must be systematically studied and analyzed and corrective actions taken as quickly as experience dictates. This experience can only be monitored by adequate reporting and analysis of information on a fleet-wide basis.

AIRCRAFT TECHNOLOGY IN THE 1980s

The LRPA now officially designated the Aurora has been described as combining the best of two proven basic systems – the engines and airframe of the P-3 Orion with the acoustics and avionics components of the carrier-borne S-3A Viking aircraft. It also has been said by the Minister of National Defence that because of the growth potential of its equipment, the Aurora will remain a superior system into the next century. What has not been said and is not as well known is that the acoustics and avionics systems of the Aurora aircraft will introduce exceptionally demanding and even dramatic changes in maintenance of these types of equipments.

While the operating features, reliability, maintainability and support program for these systems have not been fully analyzed, some features are readily apparent from which certain important conclusions already can be drawn.

Among the chief features of the Aurora's acoustics and avionics system will be:

a. increased miniaturization of components;
b. large-scale circuit and system integration;
c. extensive real time computer processing;
d. increased real time computer programming;
e. increased built-in test equipment (BITE);
f. increased use of automatic test equipment;
g. increased repair by replacement of line replaceable units;
h. increased cost and complexity of maintenance support equipment.

The features described above are going to have major ramifications for:

a. the levels at which maintenance work is performed, i.e. on-board aircraft, flight line, repair hangar, laboratory or off-base;
b. the type of technician required to do the work, i.e. basic classification;
c. the skill-level of the technician, i.e. line, shop or laboratory level; and
d. the skill-range or specialty of the technician, i.e. automatic test equipment, real-time computer programming, integrated system analysis and repair.

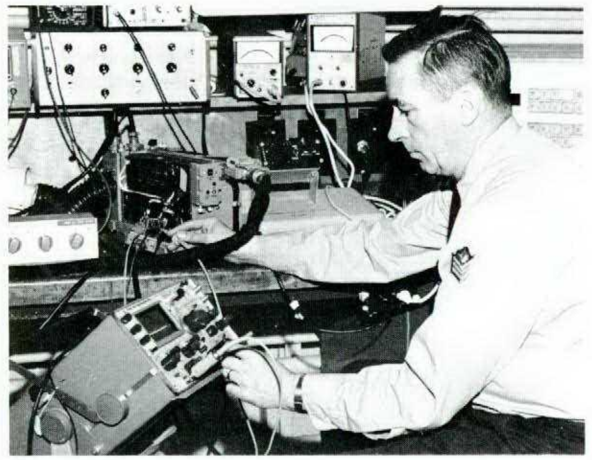
It will be apparent from the above that the technicians employed in maintaining the acoustics and avionics systems of the Aurora are going to experience some major alterations in their work which almost certainly will require adjustments in their trade classifications and trade structure. Such changes were foreseen in recent studies conducted by the Aircraft Maintenance Development Unit. Studies of trends in electronics in aerospace systems, and the maintenance of such systems by other military and civilian operators leave no doubt that the Canadian Forces will soon have to make some major adjustments which the Aurora almost certainly will precipitate. Moreover, with the earlier discussed introduction of "Zonal Inspections" a strong argument could be made for a study of the whole aircraft/aerospace technician trade/rank structure rather than concentrating on the narrower electronics field.

NFA – F-15, EAGLE

AVIONICS TECHNOLOGY

The new Aurora, LRPA with its advanced electronics borrowed from the S-3A Viking aircraft is the forerunner of all the sophisticated electronic technology the Canadian Forces will eventually acquire in each of its future major aircraft replacement programs including the NFA, AMST and perhaps the AWACS. For example, the F-15 Eagle as one candidate for the CF NFA will bring with it "Fly-by-Wire" technology and is only one of many types of aircraft in production and on the drawing boards around the world which will employ electronic control of flight control systems as a replacement or parallel system for conventional hydromechanical systems. The "Fly-by-Wire" system in the F-15 detects pilot commands, measures aircraft response, and adds or subtracts control surface deflection to what the hydromechanical system is providing to achieve desired results. Either the electronic or hydromechanical system is capable of flying the aircraft independent of the other, should one become inoperative. The prototype Advanced Medium STOL Transport (AMST) YC-14 built by Boeing goes a step further and employs light-carrying glass fibres in place of conventional copper wire. Fibre optics appear to be an attractive alternative to conventional copper wire transmission lines on board aircraft as well as in ground support applications such as secure communications for National Defence Headquarters. They are light-weight, have high data handling capacity, offer a high degree of security from reconnaissance or jamming and have a high immunity to electromagnetic interference. In the YC-14 AMST, the Boeing Company uses fibre optics to interconnect the triply redundant digital computers in the electrical flight control system to preclude the propagation of electrical damage from one channel to another.

The above examples merely scratch the surface of the new world of electronics and avionics as they pertain to modern aerospace systems. The F-18 built by MacDonnell-Douglas/Northrup provides another telling example of the trend in all aerospace electronics equipments. Built-in Test Equipment (BITE) capability covers 90 per cent of the F-18's avionics and is used both in the air and on the ground. Warning lights first indicate an airframe failure, and the pilot can interrogate his panel-mounted multimode display to determine more precisely what has failed. Groundcrew checks are made with a built-in test status panel that provides a more detailed indication of faults. The United States Air Force (USAF) has moved to accommodate the trends in avionics by altering its traditional approach to avionics maintenance. "Integrated Avoinics" was introduced with the F-111 aircraft program as the USAF method of dealing with sophisticated and complex avionics systems and associated test equipment. Under the USAF philosophy the technician who replaces a Line Replaceable Unit (LRU) at the flight line is of a completely separate trade than the technician who tests and repairs the LRU and there is no rotation of personnel between flight line and shop activities. The philosophy also requires another separate trade for the maintenance of test stations and computers. The latest programs in the USAF, including the F-15, will employ exactly the same trade and maintenance structure as that currently in use with the F-111.



The Aircraft Maintenance Development Unit has completed many appraisals and evaluations of Canadian Forces current holdings of equipments and planned acquisitions. These appraisals and evaluations, together with analysis of a wide variety of civilian and military maintenance practices have produced important recommendations for the future management of electronic equipments and the training required by the Canadian Forces technicians. Shown above is one of the members of the AMDU who participated in an extensive study of the maintenance support requirements of the recently acquired ARN 504 micro-miniature TACAN system installed in several types of CF aircraft.

Closer to home, studies and evaluations conducted by the Aircraft Maintenance Development Unit (AMDU) specifically on electronics and avionics have produced the following conculsions which inevitably must be reflected in Canadian Forces maintenance practices:

The trend in design/construction of instrument, electrical and integral systems is that of FUNCTIONAL MODULARITY with DIGITAL/LOGIC TECHNIQUES replacing moving parts and increasing the complexity, sophistication and reliability of these systems.

– The BUILT-IN-TEST capabilities of future systems are increasing and eliminating the requirement for ramp checkers.
– AUTOMATED TEST SYSTEMS which functionally test similar pieces of equipment are becoming the main test bed at all levels of shop testing.
– Aircraft electrical equipment is becoming increasingly MINIATURIZED with SOLID STATE, DIGITAL/LOGIC CIRCUITRY.
– Aircraft FLY-BY-WIRE control systems using digital computers are becoming more reliable and versatile than conventional mechanical/hydraulic flight control systems.
– Conventional electro and pneumatic mechanical instruments are being replaced by ELECTRONIC OPTICAL DISPLAYS (Light Emitting Diodes and fibre optics) with increased reliability.
– CATHODE RAY TUBE DISPLAYS are being developed for use in cockpit instrumentation within the next decade.
– Inertial navigation systems contain digital circuitry almost completely. The introduction of ELECTRONIC STABILIZATION is gradually eliminating the requirements for gimbals for gyro stabilization. These systems also contain BIT or LRU level or subassembly level.
– Automatic flight control systems are making extensive use of digital computers with BIT or LRU and subassembly level.
– DIGITAL COMPUTERS are becoming an integral part of individual avionics systems as well as integrating several avionics systems on-board aircraft, and are providing integrated test facilities for on-board testing.
– REAL TIME SOFTWARE, which controls operational on-board computers, have proven to be a problem area which other military organizations are working hard to resolve.
– Software for AUTOMATED TEST SYSTEMS is considered one of the major acquisition and on-going costs and one of the greatest problem areas.
– Design and construction trends of test equipment are following those of avionics systems with the mainten-

NFA – F-14, TOMCAT, utilizes Composite materials in the horizontal stabilizer

ance requirements of test systems, such as automated systems, being as complex and diversified as the state-of-the-art avionics system.

- Automated test facilities are costly and their comparative efficiency as well as cost must be very carefully investigated.
- Each avionics system (including electrical) requires indepth investigations into its maintenance and operational requirements if the maintenance support plan for that system is to be efficient and cost effective.
- Trends in the design/construction and testing of aircraft electrical/electronic equipment, in terms of complexity and cost, predispose the REGIONALIZATION OF MANY MAINTENANCE ACTIVITIES.
- The CF ON-JOB-TRAINING systems for support of avionics (including electrical) will require changes to support the maintenance requirements of future systems.
- The CF TRADE STRUCTURE for support of avionics (including electrical) will require restructuring to support the maintenance requirements of future systems.

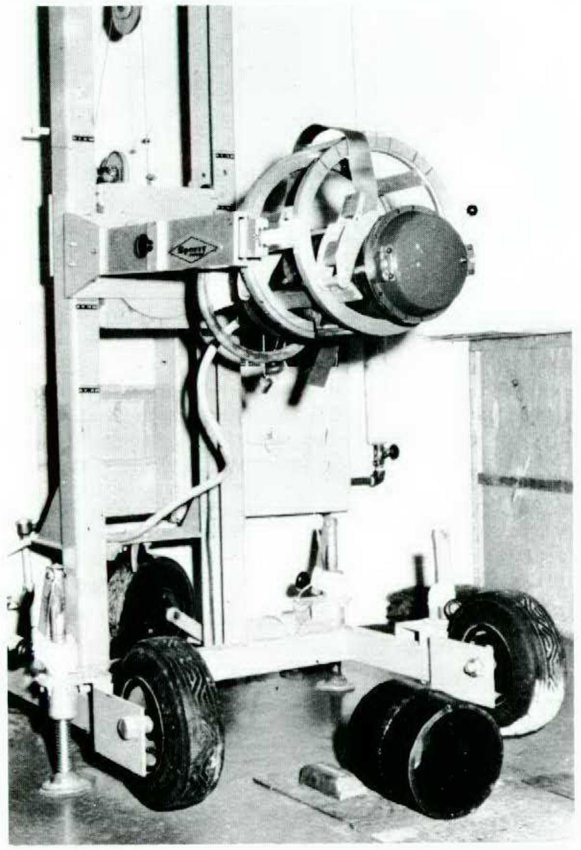
MAINTENANCE REQUIREMENTS OF THE 1980s

The discussion which has preceded has endeavoured to illustrate that aerospace maintenance in the 1980s is going to involve substantial changes in technology which are going to require equally substantial changes in traditional CF MAINTENANCE (and probably operating) concepts, practices, and training, as well as in trade and organizational structures. The acquisitions of the Aurora and the Lockheed/USN Improved Maintenance Program, with their emphasis on "Condition Monitoring" Information Systems, and "Zone Examinations" together with the advanced electronics so dependent upon integrated digital circuitry, computer processing and built-in and automatic test equipment, have set the course. Maintainers can but react, and react they must, for there are many more changes on the horizon that will test their technical imagination and skills. For example, COMPOSITE MATERIALS are already finding their uses in many types of contemporary aircraft, including the F-14 and F-15. Composites represent the near-ideal in light, low maintenance products for use in civil and military aircraft, that generally will increase the payload fraction of total system weight and substantially reduce the birth-to-retirement costs of aerospace systems. No one expects to see a 100 per cent composite aircraft flying in the near or distant future, but aircraft with large percentages of composite structure are near at hand. Among the aerospace production applications that have already emerged are the boron filament – reinforced epoxy skin on the horizontal stabilizer of the Gruman/Navy F-14 and on the horizontal and vertical stabilizers of the MacDonnell-Douglas F-15 fighter. Compared to the titanium equivalent, these boron-epoxy composites are offering weight savings of approximately 20 per cent with all the obvious advantages.

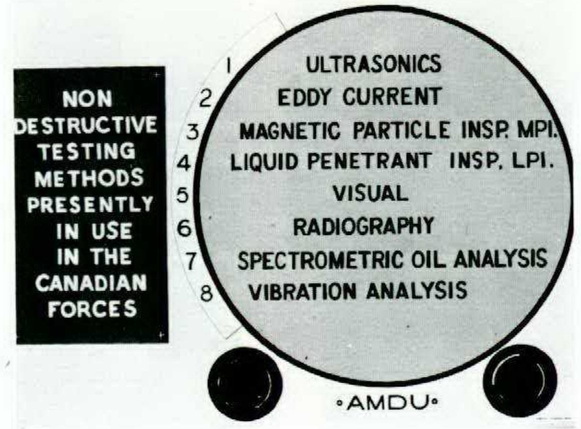
The expanded use of composite materials, especially in aircraft structures, will place new demands not only on Canadian Forces airframe and metal working technicians, but also and perhaps more so, on an already hard-pressed group of specialists in NON-DESTRUCTIVE TESTING (NDT). Coincident with the advance in other aerospace technologies, there has been an international elevation of interest in the science of NDT, and today there are NDT equipments and techniques becoming available that will contribute significantly to the swift evolution of aircraft maintenance.

The potential economic and operational benefits expected from new NDT technology are typified by the reports of a new type of ultrasonic equipment developed by Boeing to detect fatigue cracks underneath fasteners. Such cracks, that initiate around highly stressed fastener holes may be responsible for as much as 50 per cent of all aircraft structural failings. The common practice is to remove all the fasteners in suspected areas, conduct a visual inspection and then install new fasteners. Unfortunately it is not uncommon for holes to be damaged during fastener removal. The procedure is time-consuming and can result in an average cost of $100 per fastener, which becomes very expensive when applied to fleets of aircraft incorporating thousands of fatigue-critical fasteners. The Boeing device, which apparently requires relatively little operator training, can scan two fastener holes per minute, and will reduce the average cost of inspection to an estimated 50 cents per hole as compared to $100 per hole.

Again, in Non-Destructive Testing, NEUTRON RADIOGRAPHY is offering a new capability of considerable import in detecting carbonization of aircraft parts and moisture inside honeycomb structures. Whereas metals are opaque to x-rays, they are relatively transparent to neutrons which instead are absorbed by materials containing carbon and hydrogen. This means that such things as carbon deposits on metal engine exhaust parts, or water – because of its hydrogen content – inside honeycomb composites become visible in neutron radiography. There also are firm indications that neutron radiography may be able to detect corrosion inside aircraft parts which would be a most important breakthrough in aerospace maintenance. The Aircraft Maintenance Development Unit is now in the process of acquiring a neutron radiography capability and will be working directly with other operators to determine the full potential of this possible breakthrough in aircraft maintenance technology.



NDT – Typical X-ray equipment used by Canadian Forces



NDT – Common NDT techniques used by Canadian Forces

BENEFITS OF MEETING THE CHALLENGE OF MAINTENANCE REQUIREMENTS OF THE 1980s

The Canadian Government has acquired the CP-140, Aurora, because the Minister of National Defence and the Canadian Forces have argued persuasively that the new LRPA is the best available to satisfy the specified operational requirement. Undoubtedly, the aircraft also met other criteria and although expensive at a total program cost in excess of one billion dollars, it must have represented the best available bargain at the time. The time frame considered may even have included the long-term operating costs, and probably did so in so far as fuel economy was concerned. The importance that was placed on other long-term (life cycle) operating and support costs is unclear, but if the USN and Lockheed Improved Maintenance Program was a feature in the decision to purchase, then one must conclude that the Department and the Canadian Forces have accepted that modern maintenance concepts will be utilized and that the associated procedures, tools, systems and training also will be acquired or created as necessary.

The tools of modern maintenance practices do not come cheaply and are not acquired overnight. Educated, trained and experienced personnel, and adequate information, are basic to modern maintenance. With those ingredients added to adequate resources and authority, the rest will follow satisfactorily. Then also will the following benefits undoubtedly accrue:

* Specified operational requirements will be met;
* Maintenance personnel costs will be minimized;
* Cost of maintenance parts and material will be minimized; and
* Total performance, including efficiency, economy and SAFETY will be a systematic, planned achievement.

ULTIMATE PENALTY OF NOT MEETING REQUIREMENTS

The penalty of not meeting the aerospace maintenance challenge of the 1980s is, of course, the converse of the benefits just discussed. However, there would be further penalties to absorb, including operator and maintenance frustration, with failure to produce the desired product. Technician frustration probably would get translated into low morale, excessive accident rates and higher-than-expected release rates. All of these are highly undesirable consequences; two of the three are extremely hard to quantify precisely and, therefore, likely to be given less attention than the third which is SAFETY.

Flight Safety is the traditionally best argument for winning support for any change in air element matters, and the argument will reach impressive proportions in the 1980s, since:

* The current cost to replace one AMST is estimated at $5 M.
* The current cost to replace one NFA is estimated at $12 M.
* The current cost to replace one LRPA is estimated at $22 M.
* The current cost to replace one AWACS is estimated at $70 M.

Unfortunately no one has been able to adequately estimate the cost of a loss in life should an aircraft fail catastrophically. Such losses/costs present a real, if perhaps ghoulish, message and cast a fair perspective on the acquisition of needed multi-million dollar items of support equipment, not to mention the relatively low-cost of acquiring specialist and professional technician training.

WILL THE CF BE ABLE TO COPE WITH THE 1980s?

All of the foregoing should leave no doubt that an important, if not pressing, question of the moment is "Will the Canadian Forces acquire the fundamental tools, skills and knowledge to efficiently maintain newly-acquired aerospace systems in the 1980s?" It has been illustrated that the tools in the 1980s must include such items as adequate information systems, skills in reliability analyses and non-destructive testing, as well as an adequate trade structure and suitable training to mention just a few. Before any of that, however, a basic ingredient and prerequisite is the Aerospace Engineer's knowledge of his profession and all its requirements. Everything the CF will need in aircraft maintenance can come only from the proficient AERE who must be able to produce the necessary aircraft design evaluation, the definition of maintenance requirements, and the effective development and operation of the overall maintenance task.

Without question a further basic ingredient and *the* most essential factor in preparing to meet aircraft maintenance in the 1980s is the *quality of management throughout* the aircraft environment. Mutual respect and support by aircrew and maintenance personnel for each other's role and professionalism at all levels of Command in the CF are the best and perhaps the only means by which the CF will be ready to meet the challenges of operating aircraft in the 1980s.

The concepts and practices associated with operating and maintaining aircraft from the time of Baddeck to World War II and beyond have been relatively easy for all to grasp. Thus the RCAF and the CF could permit a fair amount of pragmatism to enter into aircraft management. The 1980s will present a new and challenging environment which also will be much less forgiving of any system weakness. In such circumstances, depending upon, and confidence in the contribution of all members of the team, will not be merely desirable, but will be fundamental to safe and effective air operations.

* THE DOOR TO THE 1980s OPENED WITH THE PURCHASE OF THE LRPA. READY OR NOT, THE CANADIAN FORCES WILL BE SUCKED THROUGH THE OPENING INTO A CHOICE BETWEEN PREPAREDNESS AND ALICE IN WONDERLAND. *

PROGRESSUS PER AUCTUM!

GOOD SHOW

CPL R. PARLIN

Cp Parlin, an Airframe Technician, was carrying out a before-flight inspection on Argus 10725 that was being prepared to depart on deployment to a foreign base. Cpl Parlin recalled having heard aircrew personnel remark after a previous flight that the elevator trim control was stiffer than normal; however, they did not feel that an entry in the aircraft log was warranted. Although the "B" check did not require a functional check of the control system, Cpl Parlin checked the flight controls for freedom of movement.

As Cpl Parlin moved the elevator trim control wheel he detected a slight increase in the force required to move the trim through one area of movement. He proceeded to check further and after operating the system through several more cycles in an attempt to locate the binding, the elevator trim became very stiff. The source of the binding was traced to the elevator trim gear box to the starboard elevator. The gear box was found to bind and sometimes seize when rotated slowly in a clockwise direction.

By carrying out this extra functional check on the flight control system, Cpl Parlin's thoroughness and persistence enabled him to detect a serious defect which could have developed into a serious flight hazard had this aircraft departed on its assigned task. For his professionalism and devotion to duty Cpl Parlin is to be commended.

CPL H.E. WIESNER
CPL L.A. SOVEY

Cpls Wiesner and Sovey had completed rectification of a hydraulic snag in the left wheel well of a CF104 aircraft when they noticed a very slight trace of hydraulic fluid on the right side of the upper fuselage at the aft section disconnect point. Although there is usually some seepage in this area, they decided to investigate further.

They removed two panels and when hydraulic pressure was applied by moving the horizontal stabilizer, fluid was found leaking from the lower high pressure line which was cracked. Had the leak not been discovered, the aircraft would very possibly have had a complete loss of its hydraulic systems and a very serious in-flight emergency would have resulted.

The fact that Cpls Wiesner and Sovey detected this cracked line, especially when they had been working in a completely unrelated area, demonstrates their superior sense of responsibility.

Cpl R. Poulin

Cpl R. Parlin

Cpl H.E. Wiesner
Cpl L.A. Sovey

CPL R. POULIN

While performing maintenance on a CF-101 aircraft hydraulic line, with the port engine running, a technician inadvertently dropped his wrench. The wrench came in contact with the line transformer and the hydraulic line. The resulting short put a hole in the line and ignited the now spraying hydraulic fluid.

At this same time, Cpl Poulin was doing routine checks around the aircraft. When he saw the smoke coming from under the aircraft, he initiated engine emergency shut down procedures. Without hesitation, he operated the available fire fighting equipment and had the fire extinguished in a matter of seconds.

The fire was adjacent to fuel lines and any hesitation could have had catastrophic results. Cpl Poulin's alertness and exceptionally quick reactions bestow credit on himself and the Canadian Armed Forces.

CPL G. MACLEAN

While performing a preflight inspection on a CH113 Labrador helicopter, Cpl MacLean discovered a broken bevel washer located between the horizontal hinge pin and the lag damper piston rod on the forward rotor head. A break or crack in the washer is difficult to see because of its location. If the broken washer had gone unnoticed the washer could have fallen out completely, causing the lag damper to move at the bearing end. This would likely have caused the lag damper shaft to break, allowing the lead-lag movement of the blade to be uncontrolled. It is possible that blade intermeshing would have resulted causing the helicopter to break-up in flight.

Cpl MacLean is to be commended for his thorough inspection and strict attention to detail. Cpl MacLean's keen observation in a critical area prevented a potentially serious accident. His action exemplifies the contributions made to flight safety by conscientious technicians.

Cpl S.L. French

Cpl J.G.F. Robineau

Cpl G. MacLean

Cpl R.D. Reynolds

CPL J.G.F. ROBINEAU

On Saturday, the 27th Mar 76 at 1000 hours, both East and West arrestor cables were in the up position. The East cable being the one in use. At that time, MCpl Dubé and Cpl Robineau were planning to carry out a cable retrieve exercise. In doing this, they checked the West cable for its condition as this would have been the cable used for training.

On the way back to the fire hall to pick up the remaining crew, Cpl Robineau suggested to inspect the East cable. They found the South East sheave and pre-tensioning assembly under 3" to 4" of water. On closer inspection they observed an abnormal (2 feet) slack between the purchase and pre-tensioning cables (normal allowance is 5"). Cpl Robineau advised control tower that a short retrieve would have to be carried out. They then proceeded to the pull-pits and pulled 12" to 15" of cable out of the bell mouth without pulling any cable back into the fair-lead tube. This means, that the purchase cable was only stretched and not moved. MCpl Dubé replied: "affirmative – with an abrupt stop". Tower then ordered cable down. Time approximately: 1015 hours – 1030 hours. CE cable maintenance was on the airfield during this time and informed the control tower that the East cable is not unserviceable, that it is serviceable, that there is only a bit of ice at the sheave. Upon receipt of that message the tower ordered the East cable up. Immediately, Cpl Robineau negated the statement made by CE cable maintenance by answering to tower: "NEGATIVE, THE CABLE IS UNSERVICEABLE, IT IS FROZEN SOLID IN THE GROUND. CE maintenance crew later confirmed the cable unserviceability, as they were also pulling the cable without success.

Had Cpl Robineau not acted in the assertive manner stated, the East arrestor cable would have been in fact had an actual arrestor cable engagement by a CF 101 Voodoo tail number 017. An inoperative arrestor cable would have, most likely, caused damages to the aircraft and arrestor cable equipment.

CPL R.D. REYNOLDS

Cpl Reynolds, an Airframe Technician, employed in the Aircraft Projects Branch Hydraulic Shop at the Aircraft Maintenance Development Unit, recently discovered a potentially hazardous situation in CF-104 low pressure pitot static hose assemblies. Twenty-four of the required eighty-three hoses had been maufactured and checked serviceable in accordance with all requirements; however, Cpl Reynolds was suspicious of the integrity of the assemblies because he had experienced unusual difficulty during manufacture. He approached his supervisor with his suspicions and production was immediately halted to investigate the situation. A fibrescope was obtained and the completed assemblies were inspected revealing a constriction of the inner hose diameter at the assembly ends. Disassembly of several samples further revealed that the rubber hose ends were severely gouged by the end fitting. It was suspected that the rubber hose received from Supply for the Project did not conform to the military specifications and therefore, an urgent UCR was submitted. This resulted in a Depot screening of the particular type hose stocks and finally the removal of the inferior hose from use. As a result of this thoroughness and technical competence, Cpl Reynolds probably prevented a very serious defect from occurring in a CF104 pitot static system, the consequences of which could have been extremely costly in terms of Canadian Forces aviation resources.

Cpl Reynolds displayed excellent judgment and a thorough understanding of the critical importance of his support role to safe aircraft operations. He detected a potentially hazardous situation and probably prevented one or more serious aircraft accidents or incidents.

CPL S.L. FRENCH

On Saturday 07 Feb 76, Otter aircraft 9421 returned to CFB Downsview. Cpl French of 400 Air Reserve Squadron proceeded to carry out an after flight inspection. During the inspection Cpl French noticed a small crease on the left hand side of the aircraft, above the tailwheel. Closer inspection revealed five sheared rivets in the vicinity of the tailwheel. The absence of these rivets, if undetected, could have led to failure of the tailwheel assembly, especially since the aircraft is often deployed on rough, unpaved fields. This may have caused severe handling problems on landing.

The very fact that he noticed the sheared rivets is an indication of the thoroughness of his inspection. His actions were undoubtedly instrumental in averting a possible hazardous situation.

CPL C.A. ROE

While performing an airframe "A" Check on a CH147 Chinook, Cpl Roe noticed what appeared to be a crack in the fillet of the aft synchronization shaft Thomas coupling adapter. A subsequent magnetic particle inspection confirmed the presence of a crack one half the circumference of the fillet.

Even after removal of the adapter it was extremely difficult to see the crack with the naked eye, thus indicating Cpl Roe's alertness and attention to the most minute details involved in the "A" Check.

The synchronization shaft adapter on the CH147 connects drive shifting between the mixing transmission and the aft transmission. Failure of the adapter results in loss of aft forward rotor synchronization which results in catastrophic destruction of the aircraft. The aircraft was being prepared for ferry to CFB Ottawa for Operation GAMESCAN which would involve a great deal of flying in a very short time frame, thus setting the stage for just such a failure.

Cpl Roe's action did, without a doubt, save an extremely valuable resource as well as possibly many lives.

CORPORAL R. PINHORN

Corporal Pinhorn was detailed to carry out a Serviceability Assurance Check (SAC) on Argus aircraft 10710 which was on two-hour standby. During this inspection, Corporal Pinhorn in his usual highly professional manner, went beyond the minimum requirements of the Aircraft Maintenance Instructions (AMI) and discovered what appeared to be a crack in the exhaust pipe leading from No. 1 Power Recovery Turbine (PRT) of No. 2 engine. Further investigation revealed that the exhaust pipe was broken completely off, which required the Power Recovery Turbine to be changed and another aircraft placed on standby.

The Aircraft Maintenance Instructions states in part that: "Man 2, Aero Engine, SAC 1 Walk Around, Check power plants and CSD for fluid leaks". It is apparent from this statement that had Corporal Pinhorn not examined the entire engine in the critical and expert manner in which he did, the undetected broken exhaust pipe would have caused an engine fire and possibly could have jeopardized the safety of the entire aircraft and crew. The rapid response required of the standby aircraft and crew in a Search and Rescue mission or other operational response certainly would have been seriously compromised to a point where precious hours would have been wasted.

MCPL J. EDWARDS

While conducting a primary inspection on a CT-133 engine, MCpl Edwards noticed what appeared to be an overheated area on the aft part of the turbine. As the distance from the end of the exhaust pipe to

Cpl C.A. Roe

Corporal R. Pinhorn

Cpl C. Bradley

Corporal J.L. McDonald

the turbine was too great to allow an accurate assessment, MCpl Edwards crawled up the exhaust pipe for a closer examination which revealed a foreign object jammed against two stator blades. This object was a piece of metal with no bright areas on it and was basically the same colour as the surrounding metal which made it extremely difficult to see. Subsequent investigation identified this metal piece as a portion of the number four flame tube swirl vane.

The initiative and attention to detail displayed by MCpl Edwards in following up his intiial detection prevented extenisve engine damage and a possible in-flight emergency.

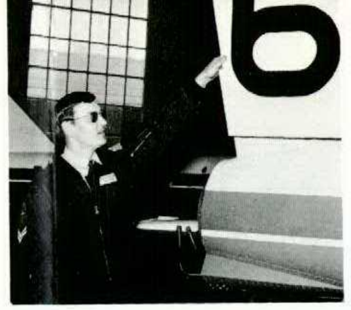
CPL. G.A. FRIESEN

While performing an "A" check on Snowbird Tutor aircraft # 180 on 9 Dec 75, which had just returned from performing aerobatic sequences, Cpl Friesen checked the rudder for freedom of movement and found that movement to the left was severely restricted. On his third attempt he heard an object drop into the aft section and the rudder restriction was alleviated.

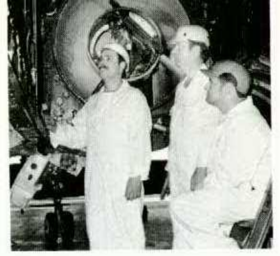
On reporting his findings, the aircraft was towed into the hangar and further investigation revealed a bolt approximately 1/8" by ¼" long had jammed between the lower rudder hinge shaft and the airframe, and by moving the rudder, the bolt had fallen into the aft section.

This was Cpl Friesen's first day employed with the Snowbird Team. While he was performing the "A" check, other aircraft were running and taxiing in the immediate vicinity. Cpl Friesen was also wearing ear defenders which made it very difficult for him to hear such a small object drop.

Although an "A" check calls for only a visual check of all flight controls, Cpl Friesen went beyond specified requirements. His vigilance and meticulous attention during this inspection prevented a possible in-flight incident and revealed a serious defect which was repaired before further damage could occur.



Cpl. G.A. Friesen



Cpl J.P. Clelland
Cpl J.H. Devison
Cpl R.R. Skinner

MCpl J. Edwards

Capt R.W. Stone

CORPORAL J.L. MCDONALD

Corporal McDonald was performing a hydraulic check on a CF104 aircraft following start-up when he noticed a metal tag attached to the hydraulic generator motor assembly by lockwire was about to break free. Considering the tag to be a potential FOD hazard particularly to the throttle mechanism directly below, Corporal McDonald removed the tag before flight.

Corporal McDonald inspected other squadron aircraft and found several in a similar condition. Some tags had broken free of the lockwires and were found in the aircraft engine compartment. He brought this matter to the attention of his superiors and a 1 Canadian Air Group Maintenance Squadron Project was initiated to remove the drain line instruction tag from the hydraulic generator motor on all aircraft.

Through Corporal McDonald's persistent and professional approach to his duties a potential hazard was eliminated.

CPL C. BRADLEY

While carrying out a "B" Check on a CT-133 aircraft Cpl C. Bradley observed that one of a series of four screws holding the forward end of the Main Landing Gear (MLG) attachment fitting was protruding slightly in comparison to the others. He tested the nut and found it loose and was able to pull the screw completely out since the head was sheared off. Continuing his examination he found another sheared screw.

Subsequent checks on two other aircraft at Ottawa revealed similar problems. As a result of his discovery a fleet Special Inspection (SI) has been raised which involved replacement of the unserviceable screws.

Cpl C. Bradley displayed exceptional diligence and initiative in his close scrutiny of an area which is very difficult to inspect. His expertise revealed a serious problem and allowed rectification to occur without an accident. Cpl C. Bradley's dedication is to be commended.

CPL J.P. CLELLAND
CPL J.H. DEVISON
CPL R.R. SKINNER

Upon lowering the engine panels on CF101 1010-54 during a Primary Inspection, Cpl J.H. Devison heard an unusual noise. Upon investigation, he found broken nuts and bolts as well as pieces of metal lying on the lowered engine panel. Unable to locate their source, Cpl Devison gave the pieces to Cpl R.R. Skinner, an Aero Engine Technician, for identification. When a thorough inspection of the engine revealed that the engine was serviceable and intact, Cpl Skinner called upon Cpl J.P. Clelland to investigate further. Cpl Clelland's investigation revealed cracks in the keel web adjacent to the forward engine mount, an area normally not inspected. Subsequent investigation revealed that the cracking on 101054 was severe and that separation of the engine from the aircraft was imminent. Further, a Special Inspection of the Voodoo fleet revealed similar damage to other aircraft at Comox, Bagotville and Chatham.

For their alertness, tenacity and professionalism in discovering aircraft damage and thereby preventing an aircraft accident.

CAPT R.W. STONE

Capt Stone was on a local familiarization flight in a T-33 with Sgt Brown a member of the Canadian Forces School of Aeromedical Training. Upon selecting the landing gear down the left main gear indicated unsafe. Another T-33 flown by Capt Hutchison joined up on Capt Stone and advised that the left main was approximately 80 percent down. Ground personnel were contacted for advice and a gear up selection made. The chase aircraft advised that the left main door was approximately 4 inches from being fully closed. A gear down selection was made with the left main gear remaining unsafe, and the chase aircraft confirming that it was again only 80 percent down. The emergency gear lowering system was used along with the application of "G" and sideslip with no improvement of the landing gear position.

Capt Stone elected to burn off fuel while briefing his passenger on ground evacuation procedures. The aircraft was landed on the right side of the runway and right aileron applied to decrease the load on the suspect gear. At approximately 20 knots the left main gear slowly collapsed and the left tip tank contacted the runway causing superficial damage to the tip tank and landing gear assembly. The aircraft was quickly evacuated and the fire department applied fire suppression foam to decrease the fire hazard.

Capt Stone is commended for his calm reaction to a serious inflight problem, his timely request for advice from ground personnel to help solve the problem, and finally a very professional landing resulting in minor airframe damage.

Open Challenge V 1976

by Capt J.C. Thibault

Open Challenge V was held at CFB Bagotville and CFB Chatham 16-28 May 76. Though the competition was plagued by poor weather conditions and shortages of personnel due to the upcoming Olympics the exercise was an overall success.

434 Squadron arrived at CFB Bagotville on Sunday 16 May to be greeted by LCol Bertrand, members of 433 ETAC and a bright sky with no sign of clouds in sight. The deployment from Cold Lake to Bagotville was effected using three C130 Hercules. The 434 Squadron team was comprised of fifty-one members in all while 433 ETAC supplied an equivalent number of personnel including support staff. At 1600 hours the 10 TAG umpiring staff arrived by modern CSR123 (Otter) aircraft in time to witness 434's impressive six aircraft arrival fly pass. Following the customary exchange of greetings and a few cold ales, 434 Sqn members were escorted to their accommodations. This consisted of a post World War II H hut which at great expense had been restored to its original condition. With one hundred men to a room, it soon became known as Stalag 434.

On Monday afternoon all competitors assembled at the CFB Bagotville base theater for the competition briefings. Col Tousignant welcomed Cold Lake personnel and assured them of all possible support from CFB Bagotville. The rules of the competition were then reviewed in separate briefings to the aircrew and the maintainers. The stage was now set and the only unpredictable factor to the start of the flying part of the competition on Tuesday morning was the weather.

The Big Weather Man in the Sky had decided that Open Challenge V was not to take place as scheduled. Tuesday morning began with low ceilings and occasional drizzle and rain. After a weather check by one of 10 TAG umpires, it was decided that a practice interdiction mission to Valcartier range was possible. Though most of the sorties were flown the practice had to be cancelled in early afternoon when the weather deteriorated further. All adjourned to the bar in hopes of excellent weather for the following day.

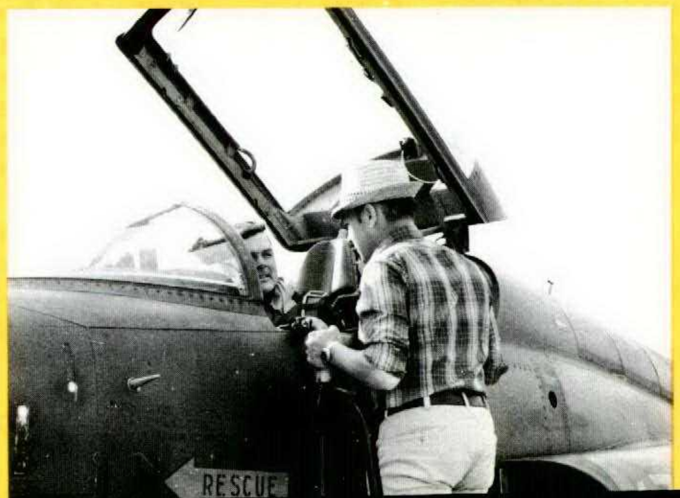
On Wednesday 19 May 76, once again the weather man was not on our side. Low overcast ceilings and rain showers countermanded any scheduled flying. It was then decided to begin maintenance competition one day earlier and thus stay on the program. The afternoon saw the single engine change competition for 434 Sqn.

Thursday 20 May 76 will go down in history as being a day with the worst possible weather conditions. As it had become customary the flying schedule was scrapped. The maintenance competition continued with 433 ETAC performing a triple tire change and a single engine change. At the end of the afternoon 434 Sqn wrapped up the maintenance competition with a triple tire change.

434 aircraft arrives at Bagotville 16 May 76.

C130 Hercules arrive at Bagotville 16 May 76.

LCol Bertrand welcomes LCol Clements CO434 to Bagotville.



Col Tousignant Bsse Commander CFB Bagotville looks on.

434 TAC F Sqn vehicles shown outside the barracks.

21 May 76 was trying very hard to win the Bad Weather Day Award of the Year. In spite of these adverse weather conditions, morale was good. The weapons up-load competition was held with both squadrons simulating combat turnarounds while loading BLU 27 fire bombs, MK82 500 pound bombs, and LAU 3A rocket launchers. This concluded all maintenance static functions of the competition and at this point 433 ETAC led on the score board by a small margin.

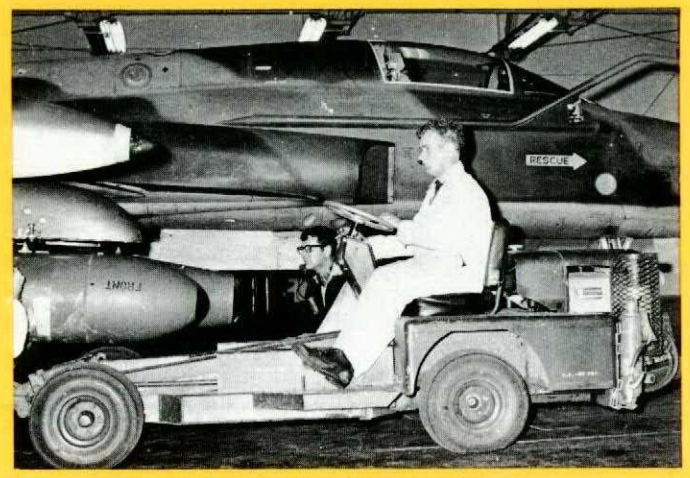
Saturday 22 May was to be the day of the recce competition. The competition would consist of two missions for each of the twelve competitors flying to the Valcartier range and locating, photographing and identifying three well camouflaged military targets on each mission. The weather had started out with the usual low ceilings and rain showers but by mid morning it appeared that conditions were finally going to improve. After a weather check it was decided to launch the first set of mission. As could be expected, by the last sortie on that first set of missions He had decided that that was enough flying for one day. After consultations with the squadron team captains, 10 TAG umpires declared that the marks obtained on that one set of missions as well as results of a quiz on aircraft and military vehicles reconnaisance administered to the photo interpreters would decide the winner of the recce phase of the competition. Both squadrons now made preparations for the competition. Both squadrons now made preparations for the deployment to CFB Chatham the following day.

By 1400 hours Sunday 23 May 76 CFB Chatham saw the complete invasion of 10 TAG personnel with the arrival of three C130 Hercules, twelve CF5's, and some eighty-five personnel. The weather that had put a damper on things all along seemed to be with us again and hanging low over the Miramichi. All adjourned to their respective messes to enjoy the well renowned Maritime hospitality and renew acquaintances with long lost buddies.

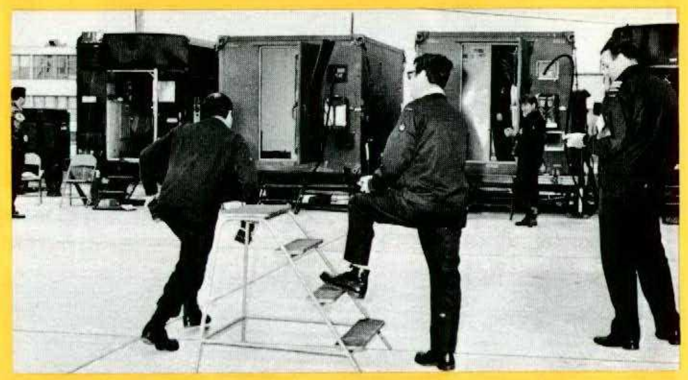
Monday's weather held true to form and once again the interdiction competition had to be postponed. Morale was still surprisingly good with the maintainers as well as the aircrew. All decided to make the best of it and various missions were organized to the harbours of New Brunswick to purchase immense quantities of lobsters which were later to be boiled and consumed with copious quantities of white wine.

On the morning of the 25th of May the tide appeared to be turning our way. Though the weather was less than ideal, it was sufficient for the staging of the interdiction competition. This competition consisted of a low level leg along the flats of New Brunswick with a time on target of plus or minus five seconds and a maximum displacement error of 250 meters.

Cpl John Arbuckle and MCpl Al Walker work quickly during the triple tire change competition under the scrutinous eyes of umpires CWO Bienvenu and Capt Chura. 434 TAC F Sqn team Captain Capt Robbie Robertson watches anxiously in the background.

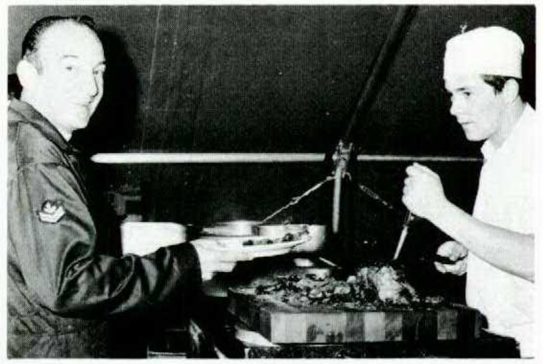


Cpl Bob Fortune concentrates on centering the LAU-3A rocket launches competition. Watching closely is WO Quessy of the official judging staff.



Racing to photo processing Van during photo recce competition. Maj Tremblay (right) doing the timing MCpl Ives Tremblay waiting at the door of the photo van.

After several days of rain, the ground crew felt quite at home outside the tents.



A little food in the Mess tent.

RNLAF exchange officer Capt Arnold Tombal takes his helmet bag from MCpl Pat McCann after his return flight from the weapons competition in Chatham.

LCol Bertrand doesn't appear to be pleased with his mission.

Capt George Hawey doesn't look impressed with the L-14. MCpl Rock Dupuis looks on.

Lt Hans Lie (Norwegian) and Capt Joe Kupecz (both winners of Interdiction trophy).

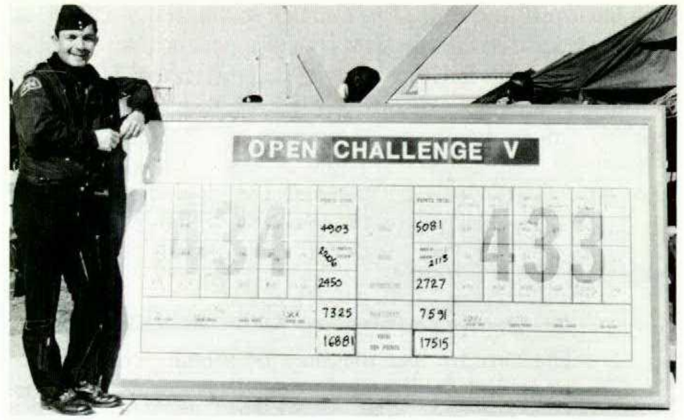
434 TAC F SQN PHOTO AND PHOTO INTERPRETER'S proudly show their trophy.

The pilot was then to proceed to a predetermined pull-up point from where he was to effect a ten degree dive bomb delivery on an old Sherman tank. The accuracy of the bomb delivery as well as total exposure time determined the amount of points received by each contestant. The weather held out and all twenty-four missions were flown. At the completion of the day's competition it was announced that 434 Sqn had reduced 433 ETAC's edge in total overall points with the results of the recce phase, and LCol Clements had won the individual recce trophy. The results of the interdiction competition were compiled and here again 433 ETAC took the advantage while the individual top score was shared by Capt Joe Kupecz of 433 ETAC and Lt Hans Lie of 434 Sqn. With one more day of clement weather, twenty-four range missions could be completed and wrap up the flying phase of the competition.

26 May 76 was CAVU. Eight sections were launched to Tracadie range. Each pilot was required to perform a predetermined set of events. The events consisted of two bombs in the skip pit, two ten degree bomb deliveries on a fixed target, two 20-30 degree bombs on a fixed target, three 20-30 degree rocket deliveries on the same fixed target and finally two passes on a 25' x 25' strafe panel with a maximum of one hundred rounds of 20mm bullets. After the day's events and while the competition results were tabulated, a section of four, comprising both team captains and two pilots from Headquarters, was launched to Tracadie range for a small off-the-record competition. As was to be expected, even though they were rusty, the flying exprtise and super-human ability of the Headquarter's aces assured them an easy victory over the regularly flying and proficient squadron pilots. As the results became known of the day's range competition, 433 ETAC had forged further ahead with Capt George Hawey winning the individual range trophy and 433 ETAC assuring themselves the victory of Open Challenge V 1976.

Thursday 27 May 76 saw the redeployment of both squadrons' personnel and equipment to CFB Bagotville for the closing ceremonies and trophy presentations. The Armament Trophy was presented to 433 ETAC by LCol Huddleston, Deputy Commander 10 TAG. The Photo Interpretation Trophy was presented to 434 Sqn by LCol Bertrand, CO 433 ETAC. The Maintenance Trophy was presented to 433 ETAC by LCol Clements, CO 434 Sqn. The Capt Denis Lambert

The "last supper", in Mess tent (left to right) Maj Len Couture (CopsO 433); Ronald Hébert O'keefe representative, Capt Joe Kupecz (433); LCol Huddleston (DComd 10 TAG); LCol Clements (CO 434); Col Tousignant (Base Comd at Bagotville); BGen Lacroix (Comd 10 TAG); LCol Bertrand (C) 433); Mr. Bergeron; Capt George Hawey; Lt Hans Lie.

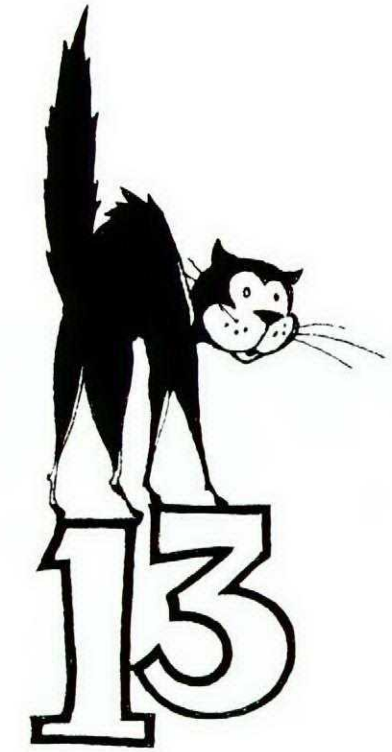


Capt Robertson next to scoreboard – he was the 434 Sqn team Captain.

Trophy for the highest range score was presented to Capt George Hawey, 433 ETAC, by Col Tousignant, Base Commander, CFB Bagotville. The Canadair Trophy for the highest interdiction score was presented jointly to Capt Joe Kupecz, 433 ETAC, and Lt Hans Lie, 434 Sqn, by BGen Lacroix, Commander 10 TAG. The Capt Peter Felix Trophy for the highest individual recce score was presented to LCol Clements, CO 434 Sqn, by Maj Gen Vincent, Commander Air Defense Group. The Gen Sharpe Trophy for the overall winner of Open Challenge V 1976 was presented to LCol Bertrand and the members of 433 ETAC by BGen Theriault, representing LGen Carr, Commander Air Command.

Following the ceremonies, a mess dinner for all ranks was held in the mess tent that both squadrons had shared for all meals during the competition. The atmosphere was now different. The competition was over, the winners were proud, the losers were promising themselves to do better the next time and the closing mess dinner took place with the usual camaraderie and respect for each other's skills that you will find within two such professional squadrons. Open Challenge V was a success. Open Challenge VI 1977 will be an even greater success.

Who Said 13 Is Unlucky?



The CH-3E is a variant of the CH-124 (SH-3A) . . . if it could happen there, it *can* happen here!

A couple of CH-3E instructor pilots set out on an autorotation training mission to sharpen their proficiency. One pilot flew five consecutive autorotations to a taxiway and then began alternating autorotations with the other pilot. On the thirteenth approach, the pilot initiated the flare at 150 feet but the rate of descent didn't decrease as expeceted. Realizing that he 'was too low, the pilot called for speed selectors and began recovery as the engines responded. But before he could recover from the chopper's 15 to 18 degree nose-high attitude, the tail rotor contacted terra firma. Unaware of any connection between the "clunk" he heard and the tail rotor contact, the pilot continued the recovery. But then, as it moved forward just ten feet above the taxiway, the helicopter developed a right yaw. The crew landed and shut down the helicopter.

Inspection revealed five wiped-out tail rotor blades, a cracked intermediate gearbox case, gearbox cowling damaged beyond repair, and shrapnal damage to other aircraft surfaces. The most likely cause of $7,500 worth of damage was insufficient airspeed during the flare and delayed power-off recovery.

from Mac Flyer

Authority and Responsibility

The two are like the sides of a coin. You cannot welcome or assume authority to make life and death decisions and at the same time back away from the responsibility for those same decisions.

It hasn't been many years since the image of an aviator was one of an intrepid, scarf-in-the-wind individual who thrived on danger. He was measured by his valorous spirit and by his willingness to demonstrate complete lack of fear. There was never a bridge with span so small he could not fly under it, nor a cow so slow he would not chase it. Among his colleagues and him there was never a dare too extreme nor a wager too meagre to gamble for. To win a drink of bourbon he would gamble with his life – many times he lost and died. But even in death his hero image lived on. Ballads were written of his exploits and toasts were made in esteemed remembrance. It made little difference whether his death resulted from an act of heroism or a vain attempt to prove the impossible. He was a member of an elite (and forgiving) group. His era has passed.

We've come a long way in establishing the impression that today's Air Force pilot is a mature, thoroughly capable and reliable individual – the type of professional our fellow citizens can feel secure in trusting with their lives. But we are handicapped in these efforts by an occasional blunder by one of our own. Each year there have been instances where our pilots ignored all the training and education that had been pumped into them and deliberately went beyond their own and their aircraft's limits. Some gave in to temptation and attempted manoeuvres that could only end in disaster, others buzzed their friends or their wives. Their shows were as spectacular as they were heartbreaking for the spectators.

Since Lincoln Beachey pioneered low level aerobatics years ago, hundreds of airmen have proven they can fly aerobatics safely if they are proficient. Hundreds of others have proven that aerobatics are deadly for those who are not proficient. Accidents due to aerobatics are, fortunately, rare in today's Air Force.

As a group, most pilots feel they are capable of handling any manoeuvre at any altitude. The very nature of their profession requires this confidence, for without an aggressive outlook our combat capability would be seriously degraded. And every squadron must feel that it has the very best of pilots – heaven help him who admits he might be the weak link in the chain.

We expect our pilots to know their airplanes, systems, procedures, and themselves well enough to cope with any manoeuvre that may be required in the conduct of their mission. This is as it must be. However, low level aerobatics and thrill seeking deviations from mission briefings cannot be condoned if we are to maintain our professional stature. Accident records have proven, time and time again, that spur-of-the-moment skill testing of one another's ability or impulsive exhibitions of airmanship close to the ground often end in disaster. In the majority of such cases, the pilots involved only proved their fool-hardiness.

In an accident in another command involving two aircraft attempting a low level manoeuvre (barrel roll), the second aircraft dished out and struck the ground, killing the pilot. The manoeuvre was not necessary to mission accomplishment, nor was it briefed prior to flight. Here are a few excerpts taken from the analysis portion of the investigation:

" . . . . Since men have flown airplanes, they have proven their prowess by performing dangerous manoeuvres at low altitude. Both the capability and willingness to perform these manoevures have been equated to the essential traits of the fighter pilot: courage, skill and aggressiveness. The unwillingness to perform these manoeuvres, the suppression through disciplinary action of those who do perform them and the rigid enforcement of regulations restricting such manoeuvres have been equated to an over-cautious, non-aggressive, old-womanish attitude. Therefore, the pilot is subjected to a very powerful form of social pressure. He violates flying regulations to maintain the aggressive image that is most acceptable to the group with whom he works and lives . . . The fact that we have lost hundreds of aircraft (and airmen) to accidents of this nature bears witness to the impact of this form of pressure. Furthermore, repeated emphasis on enforcement of valid regulations, emphasis on aircrew professionalism and emphasis on flying safety has failed to halt accidents of this type. The irony of this situation is that accidents involving intentional violations of flying safety regulations are perhaps the most preventable type of aircraft accidents. Aggressiveness, when directed toward mission accomplishment, is an essential trait in any Air Force officer . . . we cannot afford to lose this quality in our pilots. However, the term aggressiveness cannot be condoned as rationalization for irresponsible conduct, violation of regulations and failure to accept the resonsibilities of command".

What do we mean by accepting the responsibilities of command? When the canopy is down and the wheels are in the well, the pilot carries an almost absolute authority. But with that authority to make life and death decisions and at the same time back away from the resonsibility for those same decisions. The two go hand in hand – it cannot be otherwise. The pilot is accountable for the conduct of the mission. This means following the best established procedures and carrying out every phase of the flight as your commander expects you to do. Each time we launch on a mission, we should carry the awareness of this authority and responsibility foremost in our thoughts. Performing reckless, chance-taking manoeuvres at low altitude is definitely not characteristic of a responsible attitude.

When a man accepts and wears pilot's wings, he possesses skills and qualities that set him apart from other men. Those who are not willing or able to accept the responsibility and accountability for their performance in the cockpit should aggressively seek other employment. The only other choice is an end to responsibility and an end to the confidence and trust in those who wear our wings. Men can never trust those who don't hold themselves accountable for what they do.

When your pinned on your wings you joined a proud, competent group. The rewards are great and we enjoy one of the proudest heritages in any professions. But the price of membership is high, the demands are great. There is no room for the reckless and the foolhardy among the pros.

Courtesy USAFE Airscoop

Recently CFB Portage La Prairie achieved a notable milestone when it completed 5 years of accident free aircraft operation. This achievement is particularly commendable in light of the fact that a majority of this flying was done in the primary fixed wing training and basic helicopter training roles, both of which are potentially more hazardous than normal operational flying because of the input of highly inexperienced students.

Pictured in front of the sign commemorating this accomplishment are (left to right) Maj Vern Taskey, Col R.D. Schultz the Director of Flight Safety, LCol Peter Harle, then Acting Base Commander and CO3 CFFTS and Maj Thompson the BFSO.

A recent review of AETE Flight Safety Records has revealed that the unit has not had a drag chute failure for over one year. This is a commendable achievement by the Safety Systems Section, who pack, service and maintain the drag chute system on the Unit's CF104 and CF5 aircraft. To achieve such a milestone over a period when other operators of similar aircraft have been plagued by drag chute and system faults, reflects highly on the professional attitude and attention to detail of the men involved. Flight Comment takes pleasure in congratulating the AETE Safety Systems Section who are shown gathered by the tail of one of their CF5 aircraft.

REFUELLING MID-AIR COLLISION

Courtesy of Flight Safety Review—Strike Command

A Victor tanker took off from RAF Marham on the 24th March for a refuelling exercise with two Buccaneers from RAF Honington. The detail was to last for thirty minutes using a standard towline East of Newcastle. Before the tanker rendez-vous the Buccaneers were authorised for a bombing detail at Cowden range.

The first part of the sortie was complete as planned and after the rendez-vous the first Buccaneer completed his exercise and accepted 2000 lbs of fuel from the Victor. The second Buccaneer was then cleared to position behind the port wing of the Victor for his detail – his first air-to-air refuelling (AAR) sortie. (The other Buccaneer remained clear on the starboard side of the Victor). The pilot made his first dry contact on his first approach, remained in contact for one minute, and then broke away to allow the Victor to turn through 180°. Both Buccaneers held their respective positions clear of and behind the tanker.

When cleared by the tanker the Buccaneer (No 2) began his second approach for a dry contact. This time the Buccaneer probe struck the rim of the Victor drogue and deflected it to starboard. However the forward motion of the Buccaneer, relative to the Victor, was not arrested promptly and the drogue and hose became draped over the Buccaneer with the latter coming within 10 feet of the Victor wing. The Buccaneer captain elected to avoid the Victor by climbing above the Victor wing; he was seen to go high and then drop back. The starboard undersurface of the Buccaneer wing struck the port tailplane of the Victor and then moved backwards and outwards across the port elevator.

The collision was not felt by either the Buccaneer or the Victor crews. As the Buccaneer banked away the drogue separated from the hose and dropped clear. Shortly afterwards the damaged tailplane assembly of the Victor broke away and the aircraft bunted rapidly to a vertical attitude – it was seen to disintegrate and burn just above cloud tops. Only the Victor captain survived the accident; the Buccaneer landed safely at Honington. The captain of the Victor had been warned by the Buccaneer that the Victor tailplane was oscillating and in turn he had warned his crew to abandon the aircraft before he lost control – subsequently the Victor crew acknowledged the order to "jump". The Board considered that the rear crew failed to escape because of the high negative 'g' forces experienced during the bunt manoeuvre. It is also presumed that the co-pilot was unable to initiate ejection because of his inability to reach the seat operating handles due to the 'g' forces, and his short stature and arm length. The captain also had difficulty in reaching the seat-pan firing handle – but managed to reach and pull it with the third and fourth fingers of his left hand – his right hand was shielding his face from a suspected fire in the cockpit. (The Board discount a fire and consider the intense heat and light seen by the captain was a reflection from the fireball outside the cockpit). The captain parachuted to safety and ultimately was rescued and taken to hospital by a SAR helicopter.

Editoral Comment

This accident was cuased by the failure of the Buccaneer pilot to appreciate that a dangerous situation was developing after he struck the drogue rim on his second approach, his failure to take appropriate corrective action to prevent his aircraft approaching too close to the Victor wing, his decision to pull high to avoid a collision and subsequently his failure to turn in a safe direction after pulling high. In mitigation this pilot was on his first AAR sortie and maybe was expecting advice from his navigator who was more experienced in the role.

Whilst the navigator was very experienced on the Buccaneer and had been detailed to monitor and advise his pilot during the AAR on refuelling positions, speeds and techniques, his recent experience in AAR was very limited. Also he had been injured about six months previously when his aircraft was struck by a large bird which penetrated the canopy. Therefore when the Victor drogue started to bounce against the Buccaneer canopy he ducked into the cockpit instinctively and did not see the developing dangerous situation. His next clear recollection was the drogue rubbing hard against the canopy as the Buccaneer climbed to its highest point above the Victor wing. On review it was considered that the navigator exercised reasonable care throughout and was not negligent.

As a result of this accident AAR procedures have been reviewed for all aircraft. However, in the interests of flight safety, there are several learning points that can be gleaned from this tragic accident, namely the question of escape and survival.

Escape from the Victor

As mentioned previously, although the rear crew had been ordered to "Jump" the tail came off and the Victor bunted very rapidly to the vertical; they were overtaken by events. There is little doubt that thereafter the rear crew had no chance of escaping. On the other hand it may be said that the difficulty experienced by the pilots was unexpected. Investigation afterwards however revealed that the seat-pan handle was only marginally accessible when used with the Type ZA hardshell Personal Survival Pack (PSP). This PSP replaced the old Type R Mk 1 PSP, of fabric construction, in the late 1960's. The Type ZA PSP raises the previous sitting height of the pilot by about 2-7/8 inches and thus places the ejection handles an equivalent distance further away from the pilots hands. This change of PSPs was also carried out on the Vulcan and a similar problem obtains; the Victor K2 is not affected. The only solution which would enable all pilots to reach the seat-pan handles was to provide large flexible handles to replace the small rigid handles originally fitted. Immediate action has been effected by the issue of an STI to replace the existing handles with some surplus, currently obsolete handles of the appropriate form. A redesigned handle had been approved and will be introduced by modification action to supercede the interim handles. This should be completed before the end of the year.

The captain left the aircraft successfully although there is some doubt as to whether the ejection was self-initiated or involuntary. The evidence however indicates that he was ejected at the precise moment that the tanker exploded. Notwithstanding the captain made a safe descent into a rough sea and was fortunate to avoid the aircraft debris that was falling around him.

Sea Survival

After landing in the sea the captain boarded the liferaft and cut himself free from entangled parachute lines. Although he activated the Sarbe beacon it failed to function because of a switching fault – but he did not know this. (Immediate serious defect action was taken to check all Sarbes and prevent a recurrence). However he was located by the lead Buccaneer and a passing ship. With help so close at hand one could have expected that his problems were over, unfortunately it was not so and it is no exaggeration to say that he nearly died. Why?

There was a high sea state – swell 25 to 30 feet and a very strong northerly wind of 45 kts – and the ship which came to the rescue was unable to take the survivor on board. Although he was shielded by the ship's hull the crew were unable to bring him aboard. They launched a large survival dinghy and two crew members on board were successful in transferring the survivor into it, but once again they were unable to effect a transfer to the ship. This all took time and although the sea temperature was about $8^{\circ}C$ it was still very cold – especially with the strong wind. The rescue helicopter arrived after the survivor had been on the surface of the sea for almost two hours (see also the account of the rescue by the 202 Sqn crew). By this time the survivor was at the limit of his endurance as a result of hypothermia – he had lost the use of his lower limbs, and was semi-conscious and delerious. Once again – Why?

The captain was wearing an immersion suit, but was not wearing adequate clothing underneath – the inner coverall was not readily available at Marham at the time and the two piece Acrilan pile garments are not worn regularly because of bulk. From the moment the survivor boarded the liferaft he began to lose body heat to his surroundings. Although he pulled the lifecraft canopy over his head and shoulders, he failed to inflate either this or the floor. He was concerned lest he should fall out in the heavy seas and because he was holding his knife between his teeth rather than returning it to its sheath and run the risk of puncturing the dinghy. (He had used the knife to cut away the parachute lines). Later he spent almost an hour unprotected in the open dinghy during the rescue attempts by the ship, and at times was lying in deep water within the large dinghy. He was also wearing normal cape leather gloves (rather than the water resistant variety which are bulky for routine use in the cockpit) and he lost one of these subsequently when a sailor tried to lift him by the wrists. He remembers being thrown a lifebelt and being unable to hold on tight enough to be lifted by it, and also remembers losing his glove. However his memory faded after about 90 minutes of the two hour ordeal and he has only the vaguest of memories of lying in the MS5 liferaft to which he was transferred by the ships crew. His first recollection thereafter is recovering in hospital.

When rescued by the helicopter the survivor was very cold to the touch and was thought to be paralysed. The helicopter crew took every precaution to keep him warm; he was wrapped in blankets, covered with a polythene cover and the cabin heat was turned up to full. However because of the distance out to sea it took a further sixty minutes before he could be got to hospital. There his body temperature was found to be $30^{\circ}C$ (the normal is about $37^{\circ}C$). At this temperature consciousness and tendon reflexes are lost and a further $2^{\circ}C$ reduction may lead to heart failure. It is clear that having survived the accident and in spite of rescue being close at hand, nevertheless the Victor captain's chances of survival were in grave jeopardy. It is also clear that the actions of the helicopter crewman (who was also injured) were instrumental in reversing the hypothermia.

We are very pleased to record that the helicopter winchman, MALM Todd, was awarded a Queen's Commendation for his actions during this rescue.

What can we all learn from this harrowing survival – especially as Winter is looming over the horizon.

a. An immersion suit does not have any thermal insulating properties on its own – it only keeps the underclothing dry.

b. It is essential to wear sufficient insulating clothing for survival at all times.

c. To reduce the loss of body heat when in the dinghy the canopy and floor of the dinghy must be inflated. Just separating the two layers makes a lot of difference.

d. The canopy Velcro fasteners should be used to prevent the ingress of water as waves break over the liferaft.

e. Wear water resistant gloves – although not perfect they do improve the retention of finger dexterity for some time in the liferaft – it could be essential if boarding the liferaft is delayed.

f. Your survival battle is not over until you are put into that nice warm hospital bed.

What is cockpit discipline? We know it includes the little things such as awareness, attentiveness, and order. But some flight crews seem bent on finding out the hard way . . .

What It Isn't

by Maj Albert R. Barbin Jr.
Associate Editor, Mac Flyer

Much has been written about the meaning of discipline as it pertains to the serious business of safely operating airborne machinery. But much of the often used rhetoric, high powered verbiage, and lengthy analysis has yet to corral this elusive and difficult-to-define term. And no further attempt is going to be made here. Such a commodity is as necessary to flight as fuel in the tanks, generators on the line, and crew members at their positions. So instead of dwelling upon what discipline is or should be, we'll use a different approach to spark aircrew introspection into the meaning of discipline.

Here are five accident summaries, three commercial and two military, in which flight deck discipline momentarily lasped and disaster followed. Each error began during a different phase of flight – one on the ground, one during departure, one during en route descent, one after handoff to approach control, and the last during the approach. The accidents should never have happened, but they did – and they vividly illustrate exactly what cockpit discipline IS NOT.

On the Ground

Preparing their airliner for departure, the captain and first officer responded to a series of pretakeoff checklist challenges voiced by the second officer. But the litany of challenge and response concealed a fatal error.

When the second officer announced, "Pitot heat," the first officer reached overhead and responded "Off then on." But the pitot heat switch remained off. Apparently neither crew member took time to visually check the switch position.

The aircraft climbed steadily through areas of icing and turbulence. As the pitot heads and drain holes iced up, the aircraft's airspeed indicators began an insidious deviation on the high side. Thinking turbulence or a weather phenomenon was responsible for the abnormally high airspeed, the pilot counteracted with increased pitch. The aircraft stalled and quickly wound itself into a tight spiral. Recovery attempts were futile as excessive G-loads ripped the horizontal stabilizer off. The airliner crashed in a wooded area, killing its three-man crew.

After Takeoff

The crew of a chartered twin-engine airliner radioed the local Flight Service Station that they were climbing VFR and standing by for an IFR clearance. The FSS specialist heard the call but his repeated attempts to raise the aircraft and transmit the IFR clearance were unsuccessful.

The prescribed IFR departure at the airport requires a climb to 8,000 feet within two miles of the airport prior to airway transition, but the aircraft continued its VFR climb into a clear but moonless sky. The blackness was suddenly illuminated by a burst of flame as the aircraft slammed into a 6,280-feet mountain.

Although skies were clear, an almost complete absence of light virtually eliminated the contrast between the terrain and the sky. Investigators could not conclusively pinpoint the cause of this crash that claimed 40 lives but considered the possibility that "clear skies" may have caused complacency and distraction that diminished the crew's awareness of mountainous terrain.

En Route Descent

Less than a half hour from touchdown, the C-141 banked toward the southeast and descended to 17,000 feet. Several radar controllers guided the C-141 toward its destination as the crew awaited clearance to a lower altitude.

Confusing a Navy fighter with the C-141, the radar controller cleared the 141 out of 10,000 feet for 5,000 feet. The 141 crew acknowledged, "Five thousand. Out of ten." That was the last transmission from the aircraft. The wreckage was spotted later just above the 7,000-foot level in a rugged mountainous area northwest of the base.

No one will ever know for sure why the crew overlooked such hazardous terrain before or during the descent – but they did.

Vector to ILS Final

As the aircraft commander initiated the descent checklist, center directed the flight to descend to 6,000 feet and to contact approach control. But the two pilots had difficulty contacting approach control. When they finally did establish contact, the controller issued approach clearance to 5,000 feet. But another aircraft transmission blocked out part of the clearance. The crew, unsure of the assigned altitude, agreed that it sounded like three thousand feet. The AC acknowledged 3,000 feet, apparently assuming approach control would confirm or correct clearance. Although there was no response, the flight continued its descent. Noting a mountain peak on his chart well above 3,000 feet, the navigator cautioned the pilots. Glancing out through blackened windows, the AC reminded the navigator that they were in night VFR conditions and not to worry.

Suddenly, the screech of tearing metal exploded along with sounds of disintegrating turbofan engines and fuel tanks as the aircraft ripped across a rocky plateau, flipped over and burned.

On Final

For several minutes prior to interception of the VOR final approach course, the captain and first officer discussed a variety of subjects. Even after interception the final approach course, the two-man crew continued a conversation unrelated to the operation of the aircraft.

During their discussion, considerable attention was directed outside the cockpit. Neither pilot detected that the aircraft had descended through the final approach fix altitude, well short of the fix. Less than a half minute later the aircraft's terrain alert warning system sounded, indicating less than 1,000 feet above. But descent continued and the aircraft crossed the final approach fix 450 feet below the minumum final approach fix altitude. The descent continued to 500 feet above field elevation. No altitude callout was made. As its crew groped for the runway in low lying fog and thin obscuration, the aircraft crashed more than three miles from the airport.

Laxity, complacency, overconfidence, and error are all solvents of discipline. Even a brief exposure to these elements can precipitate a sequence of events that leaves no room for recovery.

"FAMOUS OBJECTS"

by Thomas D. MacDonald SSgt

The F4 laid on the lonely side of a barren mountain and slowly burned. Different aircraft circled above, cutting through the smoke that blackened the sky. No sign of the aircrew or clues to the accident's cause, they returned to their home base. Everyone would be asked why, but no one will answer. FOD has added one more tragedy to its growing list.

The Air Force spends thousands of dollars on the prevention of FOD every year. Each day we see the poster's and safety clippings in our shops. We're told the immediate and underlying causes of "FAMOUS OBJECTS" through safety briefings and the FOD Prevention Program and yet we still have Air Force equipment damaged or destroyed and lives lost.

Who's at fault? If this question could be answered there wouldn't be a FOD Prevention Program. It's my fault for dropping it and your fault for not picking it up. How many times have we heard this? And how many more times will we keep on hearing this? Only we can prevent FOD.

An aircraft was returning from a cross coutnry mission. The machine performed excellently for all the flying it had done from base to base. The navigator reached into his map case for a book but couldn't find it. The case was full of sandwich wrappers and trash from his in-flight lunches. But he wasn't worried about it. Someone would clean it up when they got home. Someone else had always taken care of it. And besides, FOD is located and found only on the ground.

Maybe the navigator should start to worry. Or has he forgotten about the cockpit pressure regulator behind his seat. If any of the trash becomes lodged between it, his problems would only be starting. And what about the book? I'm sure he'll locate it when his aircraft goes into a turn, and it slides out from under the seat and slams into his instrument panel.

Take a few seconds and think. Only you can prevent FOD.

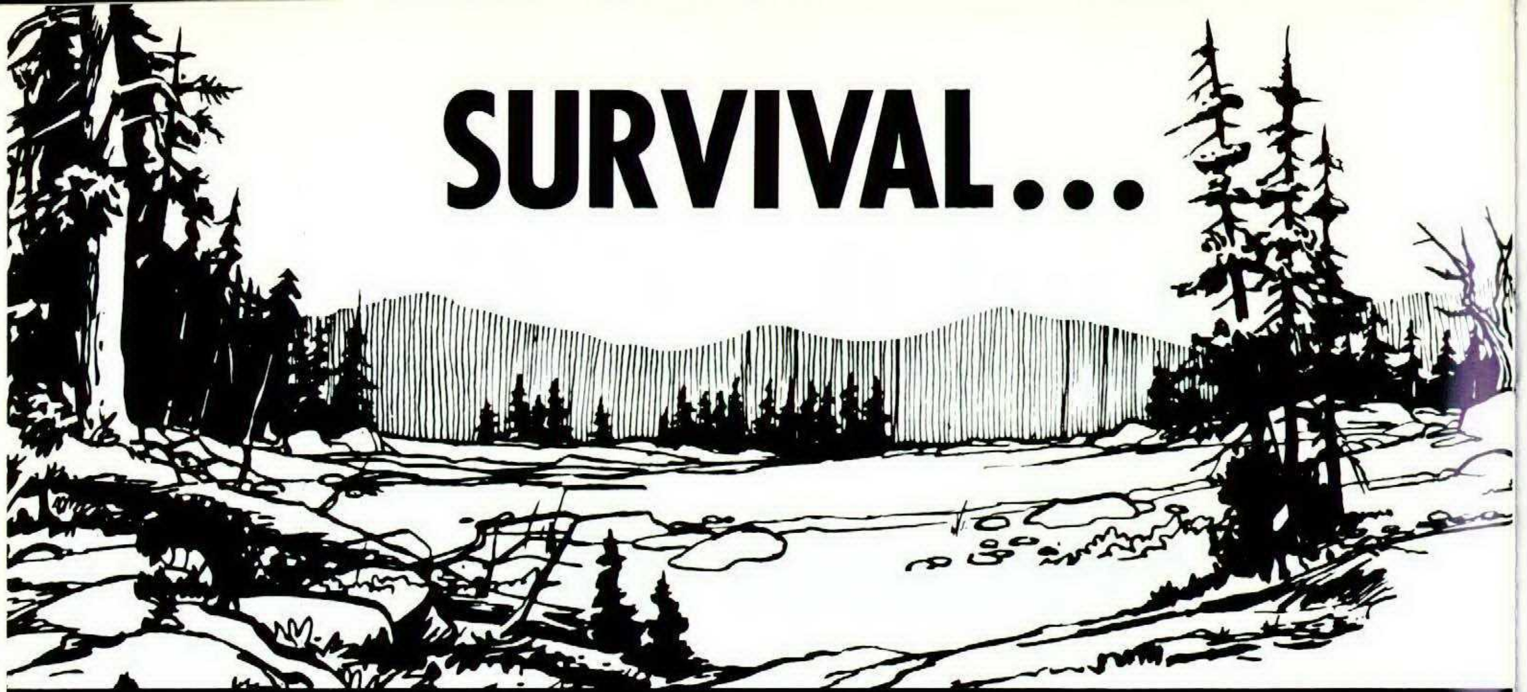
With the phase inspection completed, the aircraft was towed to the flightline. The specialists working in the cockpit installed all their equipment and were ops checking it when a small screw was dropped. After a thorough search it wasn't found and the flightline expediter was informed. Even though it caused excessive extra work the screw was found plus a washer. The correct move is if you drop anything in the cockpit don't keep it a secret. Safety of flight is a maintenance man's job. "FAMOUS OBJECTS" in the cockpit is not just the crew chief's responsibility. There are many places in a fighter aircraft cockpit that can hide telltale F.O.. And we all know that when they do decide to show themselves it means problems. Have you ever received an unsatisfactory report from Quality Control for a "FAMOUS OBJECT" they found in the cockpit. It's our job as crew chiefs to check after everyone who enters the cockpit. Remember its my fault for dropping it and your fault for not picking it up. Having an aircrew come out to fly an airplane and find a "FAMOUS OBJECT" in the cockpit is a fate we can all live without. Lets find it on the ground before flight.

After a long process of troubleshooting, the automatic pilot discrepancy was traced to a bad wire in the front seat control stick. After the new stick was installed and ops checked satisfactorily, the aircraft was released for flight. Further missions on this aircraft proved the corrective action was adequate. On a routine training sortie some days later, the aircrew experienced restrictive stick movement. An emergency was declared and the F4 was brought back home with both crew members fighting the controls. Again extra man hours went into troubleshooting. The cause was a bolt lying in the stick well. It somehow jarred loose and restricted stick movement. Again a "FAMOUS OBJECT" strikes and yet an F.O. Inspection was accomplished before flight. Maybe we are not looking good enough. The safety of the aircrew is in the hands of all maintenance personnel. Lets do our jobs right the first time. There are countless other areas that "FAMOUS OBJECTS" attack.

Think how an aircrew feels when they are in take off roll and a tire blows because it picked a "FAMOUS OBJECT" while taxing. Definitely a situation that could ruin your day.

Would you become upset if the engine you spent the last three days changing ingested a "FAMOUS OBJECT" while on the trim pad. Maybe the next time you saw some F.O. lying on the flightline you would pick it up. We will continue to be briefed and instructed about "FAMOUS OBJECTS". The answer lies with you. It's my fault for dropping it and your fault for not picking it up. Only you can prevent FOD.

EDITORS NOTE: Staff Sergeant Thomas MacDonald is assigned to Organizational Maintenance Branch and is the crew chief of aircraft 529. He is a frequent contributor to Air Force safety publications.



SURVIVAL...

Your Way Out

SSGT ROBERT J. PAETZ
Fairchild AFB WA

You have just been tossed out of your cozy warm cockpit and find yourself tumbling into a survival situation. That's a brand new mission. Could you hack such a mission, not knowing what it entails? Unfortunately, a lot of aircrew members have forgotten that they have an assigned mission even after they leave their aircraft. Let's look at what Uncle Sam says that mission is, and why.

The moment you depart your aircraft, Sam states you're to "return to friendly control without giving aid or comfort to the enemy, to return early and in good physical and mental condition." On first impression, "friendly control" seems to relate to a combat situation. However, even in peacetime your environment may be quite hostile. Imagine parachuting into the Arctic when it's – 40°F. Would you consider this friendly? I doubt it. If you are forced to crash land in the desert where temperatures may soar past 120°F, would this be agreeable? Hardly. The list is endless. Almost any place you might bail out, you can be confronted with situations difficult to endure. You want to "return to friendly control."

The second segment of the mission, "without giving aid or comfort to the enemy," is of course related to a combat environment. This part of your mission may be most effectively fulfilled by following our moral guide, the Code of Conduct. Remember, however, that it should be followed at all times and in all places. It *does* apply to the peacetime situation.

The final phase of the mission "to return early and in good physical and mental condition," will probably be the most strenuous requirement to accomplish. The most important criterion for successful completion of that part of the mission will be your WILL TO SURVIVE. Although this "will" is inherent in all of us, some will find it difficult to activate. Surely you've read stories or know of incidents where people have eaten their belts for nourishment, boiled water in their boots to drink as broth, or have eaten human flesh–though this certainly wasn't their cultural instinct.

One incident where the will to survive was the deciding factor between life and death involved a man stranded in the Arizona desert for eight days without food or water. He traveled more than 150 miles during searing daylight temperatures, losing 25% of his body weight due to the lack of water. (Usually a 10% loss is considered fatal.) His blood became so thick that the lacerations he acquired could not bleed until he'd been rescued and had received a large amount of water. When he had started on that journey, something must have clicked in the back of his mind telling him to live, regardless of any obstacle which might confront him. And live he did!–on guts or will alone.

Let's flip the coin and check the other side of "will." Our location is the Canadian wilderness. A pilot ran into engine trouble, and chose to deadstick his plane onto a frozen lake rather than punch out. He did a beautiful job and slid to a stop in the middle of the lake. He left the aircraft and examined it for damage. After surveying the area, he noticed a wooded shoreline only 200 yards away where he could find warmth, food and shelter; he decided to go there. Approximately half way there, he changed his mind and returned to the cockpit of his aircraft where he smoked a cigar, took out his pistol and blew his brains out. Less than 24 hours later, a rescue team found him. Why did he give up? Why was he unable to survive? Why did he kill himself? Why do other people eat their belts or drink broth from their boots or take a bite out of George? No one really knows, but it's all related to the WILL TO SURVIVE.

Like a lot of other things in this world, your will may be improved upon. Let's take a look at some ways. In an emergency outside the cockpit you may have a tendency to panic or fly off the handle. That can usually be handled by sitting down, calming down and analyzing the situation rationally.

After your thoughts are collected and you're thinking clearly, the next step is making decisions. In all walks of life, some people always avoid making decisions by letting others do their planning for them. But in a survival situation that won't work. You're on your own, and every decision may mean life or death. When you make critical decisions, like how and where to build a shelter, how to signal, and where to find water and food, you've got to be flexible and plan ahead. Flexibility is essential because circumstances may not always go according to that plan. For example, you may have started to construct a shelter and hear an aircraft in your vicinity. You would probably want to postpone the shelter and attempt to get out a signal. I don't mean to be as flexible as jelly, but maybe like jam.

If you get in a pinch and find yourself without an item you feel is critical, use a little "Yankee ingenuity"–improvise. Today you might walk outside and see a tree and wonder how tall it is or what good shade it could provide. But in a survival situation, you have to look at that same tree in a totally different light. It may supply you with shelter, food, signalling, warmth and medicine.

Tolerance is the next topic of concern. You will have to deal with many physical and psychological discomforts, such as creepy crawlers, flying insects, loneliness, and maybe even "Sasquatch." Just by being in the military you've had a chance to learn to tolerate uncomfortable situations. Fine. Apply that to your new environment. You'll probably find it's not so bad.

Facing and overcoming childhood fears is another threshold you may have to cross. Realistically speaking, everyone has acquired childhood fears. For instance, why do you usually turn on the bedroom light when it's dark even though you've been there hundreds of times before and already know where every stick of furniture and every knick-knack is located? Is it a habit, or a reflex? Or could it be that when you were very young someone jokingly scared you in the dark? Maybe as a small child someone told you not to leave the yard because wild animals in the nearby woods might get you. And now you may find yourself in a strange dark woods which is the playground of these wild and ferocious animals. Old fears can be detrimental to your survival unless you learn to overcome them.

Perhaps one of the most important psychological factors to remember is optimism. With today's modern technology, it's likely someone already knows you are missing and a rescue team is being organized to find you. Like the old saying goes, "Keep the Faith, Baby!"

As you can see, the survival mission Uncle Sam has assigned you is not an easy one. This is just a peek at some of the ways you can succeed in that mission if you're ever "fragged" for it. If you find yourself in this predicament, I hope you'll remember that your WILL TO SURVIVE is Your Way Out.

The Ghost

One evening last week it was pretty quiet around RATCON. The weather was low (about 600 ft and 2 miles in heavy rain) and we were using runway 09. The Squadron had cancelled night flying, so we were down to minimum crews (one terminal and one radar controller and a radar technician.) At about 2100 hours, we received a call from Moncton Centre; a T-33 was due in from Thunder Bay in an hour and ten minutes. We were told that it was going to do an ADF approach in Bagotville, then proceed to Chatham, and that its TACAN was unserviceable. No problem — we were still above limits for an ADF approach and our PAR was serviceable.

About 15 - 20 minutes before its ETA, the aircraft called — said he thought he was about 130 NM from Chatham at FL 310. Right!! flick the scope to 120 NM range and have the aircraft squawk 0300 — done — but wait!! the SIF shows the aircraft at 35 NM out — can't be! I have him squawk standby 10 seconds and return to normal power — that has to be the aircraft at 30 NM now. It would be impossible to see a primary target the size of a T-33 at that distance and altitude in heavy precipitation. The aircraft is close and high so I've got to hurry and get him down and in for the PAR approach. OK — 270° turn rolling out heading 180° and descent to 4000 feet should do it. The pilot emphatically disagrees. "I can't be that close", he says — "I agree", says I, "But there you are on my scope". A quick check with Moncton Centre and I find that the aircraft actually is outside my 120 NM scope range. The aircraft continues inbound at altitude and eventually lands safely.

What I had seen on my radar scope was a "ghost SIF"; a false SIF return, the SIF being generated by an aircraft as per normal, but misinterpreted by our ground interrogator. This may occur if the ground equipment is not exactly calibrated and the aircraft is greater than 134 NM from the ground site. I had never seen one before. The weather, aircraft instruments and ground equipment chose the wrong time to make the right combination for a potentially hazardous approach.

The appearance of a "ghost" SIF return is only possible under limited conditions. A "ghost" or "second-time-around" return occurs when unusual atmospheric conditions allow radio frequency signals to travel long distances without the attenuation normally encountered. SIF and primary radar signals from beyond normal range limits can result in fictitious range presentations. This phenomenon can be compared to the situation in which a 30 pound reading is obtained by a 280 pound man on a 250 pound scale. In the Chatham case, abnormal atmospheric conditions must have been present and the aircraft must have been beyond the radar's maximum range. However, its SIF signal, triggered by one interrogation pulse, reached the radar in sufficient intensity to be displayed in the time interval assigned to the following pulse. This mixup in timing is normally impossible because the SIF beacon signals arriving from beyond the radar range are too weak to be detected, but can under these extraordinary circumstances cause an erroneous reading.

Anonymous

First with Tool Control

by Capt Dave Street DAFR 3-2

Three years to the month after the start of their implementation program, CFB North Bay became the first base in the CF to complete their tool control program.

Over 190 technicians in the BAMEO organization have surrendered their tool kits to supply and now work exclusively from tool control kits boards and pouches. The transition has been a long, slow process and North Bay's success is due mainly to the efforts of MCpl "Bud" Ridenour who has worked on the project from the beginning.

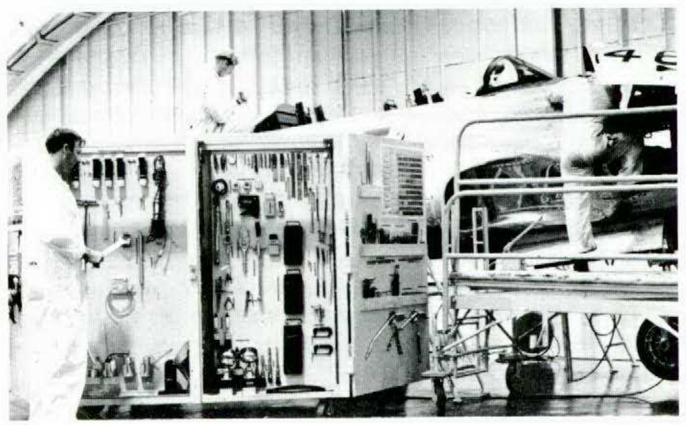
The last tool board being handed over to Sgt Bob Allen by MCpl But Ridenour.
Left-to-right: MCpl Ridenour, Sgt Allen

The last tool box being returned as tool control goes 100%.
Left-to-right: MCpl Ridenour, MCpl Kingsnorth

Tool Control was first developed in Britain where it has been used by the RAF and the RN for some years. The concept has also been adopted in Australia and the United States.

Every good aircraft technician has a secret dread that he might one day drop a tool in an aircraft and not notice its loss. The possible terrible consequence of such a misadventure has led us all to practice tool control for years, each in our own way. Now, at last, a formalized system is available to ensure that when the work on an aircraft is finished all of the tools used on it are present and accounted for. Tool Control also reduces the size of the tool inventory while ensuring that the correct tools are available at the work site for each job.

Tool board in use on the CFT-33 aircraft in the Repair section.
Left-to-right: Cpl Ken Johnson, Pte John Belanger



Field Kit in use on the CF100 aircraft in the Servicing section.
Left-to-right: Pte Lyons, MCpl Doug Billingsley

Tool pouches from the tool boards being used to rectify a servicing snag on the T-33 line.
Left-to-right: Cpl McGrath, Cpl Edwards

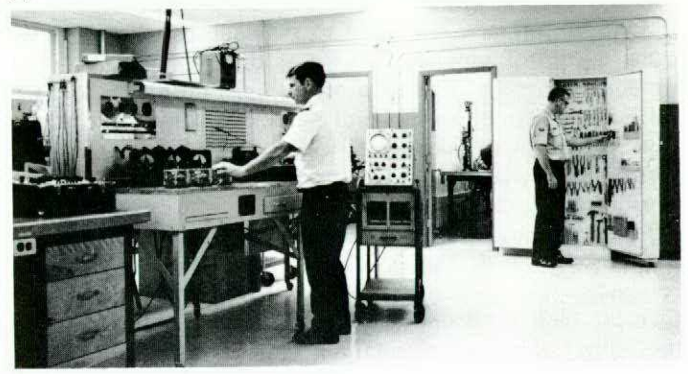
This is accomplished by designing kits to suit jobs rather than the technician.

Every base in the CF which maintains aircraft is in the process of changing to tool control. Some have been using tool control in part of their organization for some time, others are still in the planning stage. CFB North Bay is the first base to have completed the transition!

B

Tool Kits in use in the support shops.
A. Left-to-right: Cpl Jackson, Cpl Hurley
B. Pte Ken Field

A



TIGERS AND FOOLS

"A tiger knows the limitations of his aircraft, and can make it perform to the extent of these limits.

A fool either doesn't know the limits or tries to get 'just a little more' than the book allows.

A tiger knows his personal limits and operates within them.

A fool figures he can push himself a little more and really show everyone what a tiger he is.

A tiger can take an (OR) aircraft and perform a mission to perfection.

A fool will take a marginal aircraft and try to do the same because he thinks he can hack it.

A tiger knows the rules and regulations and while observing them, gives a professional performance.

A fool feels he has to break rules and regulations to show what a tiger he is.

A tiger is not a fool, but . . .

A fool usually thinks he is a tiger."

HEY GUY IN THE TOWER

By Capt J.A.R. Laroque

Have you noticed a lot of brown specks thundering out of the sky and landing on your airfield lately? They're not the Airborne Regiment, and they go WOP! WOP! WOP! instead of ROOOARRRR!

Well, it's the rotary revolution! You can't ignore them any longer. They're multiplying faster than white mice in a Masters and Johnson laboratory. Places like Camp Petawawa, Valcartier, and Gagetown are now flying bases.

What do you know about rotary wing aircraft? Not much you say? Well get with it.

Like all aircraft, but more so than some, helicopters become a control problem as soon as they start taxiing. You wouldn't believe what that rotor wash can do to a parked aircraft. Taxi them downwind and well clear of light aircraft. In winter helicopters taxi higher and faster to avoid white-out conditions, so watch out. That vehicle you have been clearing in front of taxiing helicopters all summer can get you into a subsequent board of inquiry situation when the snow arrives.

Thanks to Walt Disney movies, most people think that helicopters take off vertically. They really don't you know. Oh they lift their skids or landing gear off the ground but then they lower their noses and raise their tails and go straight ahead until they get enough speed to transition to a normal fixed wing type climb. Depending on wind and temperature the straight ahead distance can vary, so always allow alot of room or you'll find yourself having a father/son talk with the DATCO. Also, helicopters normally take-off into wind (not necessarily runway heading) and can cause conflictions with other traffic.

Gosh these birds are slow! There is only one way to get them into and out of your aerodrome easily. Have routes into and out of your zone, and publish these routes in section B of GPH200A. Routes keep the helicopters out of the way of faster moving aircraft and they also assist the controller in that he doesn't have to make a control decision until the helicopter gets in close and he can see it.

There are alot of things a controller can do with a helicopter to work out a confliction but one of the most misused is the 360 degree turn. Many times I have seen a controller give a helicopter a 360 degree turn a mile away from the airport because he has a high performance aircraft 10 miles back. Wouldn't it be better to have the helicopter continue inbound to the field and if it looks like its going to be tight, then have the helicopter land or come to a hover short of the runway? That way at no time is he belly-up to his traffic.

Helicopters have two categories of emergencies, critical and non-critical.

Non-critical emergencies are generally annunciated by caution lights on the instrument panel. If the fault cannot be corrected by resetting circuit breakers, the pilot will either continue the flight using only equipment essential to flight safety or he may land in a field to investigate the problem.

Critical emergencies such as chip detector lights, engine out, transmission failure, governor failure, etc. require either a rapid, power-on descent and landing, or, an autorotative landing. In the event of a tail rotor system failure, the pilot can be expected to try and determine how the aircraft may be best controlled by experimenting with various power control combinations as altitude, time, and conditions permit.

Do you know what an autorotation is? Well you better learn. It's a lot easier than closing down your airfield for a couple of hours to clean up the mess after you approved an auto and didn't know what it was all about.

During certain types of emergencies, the pilot disengages the rotor from the motor and uses the flow of air against the rotor to land the aircraft (in practice autorotations, the pilot simply cuts the power back to idle). The upward flow of air causes the rotor to act like a windmill and slow the aircraft as it descends. At about 50 to 75 feet above ground level the pilot flares the aircraft (drops its tail as if testing to see how cold the water is). The flare utilizes the wind flow of our polluted air to speed up the rotor (more lift) which reduces the forward and downward motion of the aircraft. The pilot then rights the aircraft and hopefully settles smoothly on the newly cut grass of your aerodrome.

Do you know how many kinds of autorotations there are? There are four that you should be concerned with while you're sitting up in that fancy tower.

The "straight-in" autorotation is similar to a very steep final approach. It doesn't present much of a control problem but should be watched very closely as it is an emergency type landing.

The "180" autorotation starts downwind. While the aircraft is descending the pilot will turn the aircraft 180° and land into wind. That's why pilots always ask controllers to pass wind information to them.

The "360" autorotation is carried out when the aircraft is too high or the pilot is trying to land in a confined area. Again much the same thing happens except a 360° turn takes place during descent.

Low level autorotations take place when a helicopter experiences an emergency during low level flight. The pilot will carry out a normal autorotation to the nearest clear area. If he cannot see a clear area he will zoom the aircraft up a few hundred feet and try to pick one out.

Now what should you be watching for when you clear a helicopter for an autorotation? That's right! He will land into wind. Again, that is not necessarily runway heading so watch out for conflictions with other traffic.

What's something else you should be watching for? Well, some helicopters have a bar, called a stinger, located just below the tail rotor. The stinger is spring-loaded and its prupose is to protect the tail-rotor. If during the landing portion of an autorotation you observe the stinger strike the ground, tell the pilot. He will likely want to look at the tail rotor.

There's just one more gotcha you have to watch for. Most heliocopters don't have brakes. Sometimes when they land they skid a long ways. Especially if they are experiencing control problems. Don't ever place crash vehicles forward of the landing area. If you do you might end up with a topless Oshkosh.

HAWK 4 CRASHES AT COMOX

On 5 July 76 CF101 aircraft took off from CFB Comox on a formation practice mission. After a period of warmup formation flying in the local area, the formation returned to CFB Comox to fly a series of two practice airshows over the aerodrome.

Approximately 43 minutes into the flight, aircraft 101061, with the callsign Hawk 4, completed his final pass of the second practice show. This solo manoeuvre consisted of a low speed pass with gear and flaps down, and speed brakes out. The low speed pass was terminated by an afterburner climb to approximately 3,000 feet. Just prior to or upon reaching this altitude, Hawk 4 commenced a right-hand level 180 degree turn to a downwind position. On completion of the turn, Hawk 4 commenced a wings level descent at an approximately 10 degree nose down attitude. This flight path lasted approximately 20 seconds and terminated with water impact.

Because both aircrew members involved in the accident were killed and the wreckage lost in the sea, there was a scarcity of data to aid the Board of Inquiry in it's investigation. However, enough evidence was obtained to come to the following conclusions:

- The descent path was initiated by a positive action on the part of the pilot.
- On descent a nose down attitude of approximately 10°, with no rolls or gyrations, was maintained until impact.
- There was no radio communication indicating any distress prior to impact.
- There was no evidence of ejection by either crew member.
- There was no evidence of fire, explosion or in flight break up prior to impact.
- The aircraft had power when impact occurred.
- The aircraft impacted with approximately a 10° nose down attitude and a small degree of bank.

Any postulated cause for the accident must explain all the above known facts.

Only a disasterous sequence of aircraft system malfunctions would satisfy the above criteria. The liklihood of this eventuality occurring is so remote it can effectively be ruled out as a cause of the accident.

After much deliberation the Board of Inquiry concluded that there are only two possible sets of circumstances that could cause the accident to occur in the manner described.

Physical Incapacitation

In order for this to explain the sequence of events that transpired, many coincident happenings are necessary.

- A fit thirty-one year old man had to suffer a sudden incapacitating event.
- Incapacitation had to occur between initiation of descent and impact twenty to thirty seconds later.
- Either there was no vocalization or the event occurred too late in the descent to warn the navigator of the impending danger.

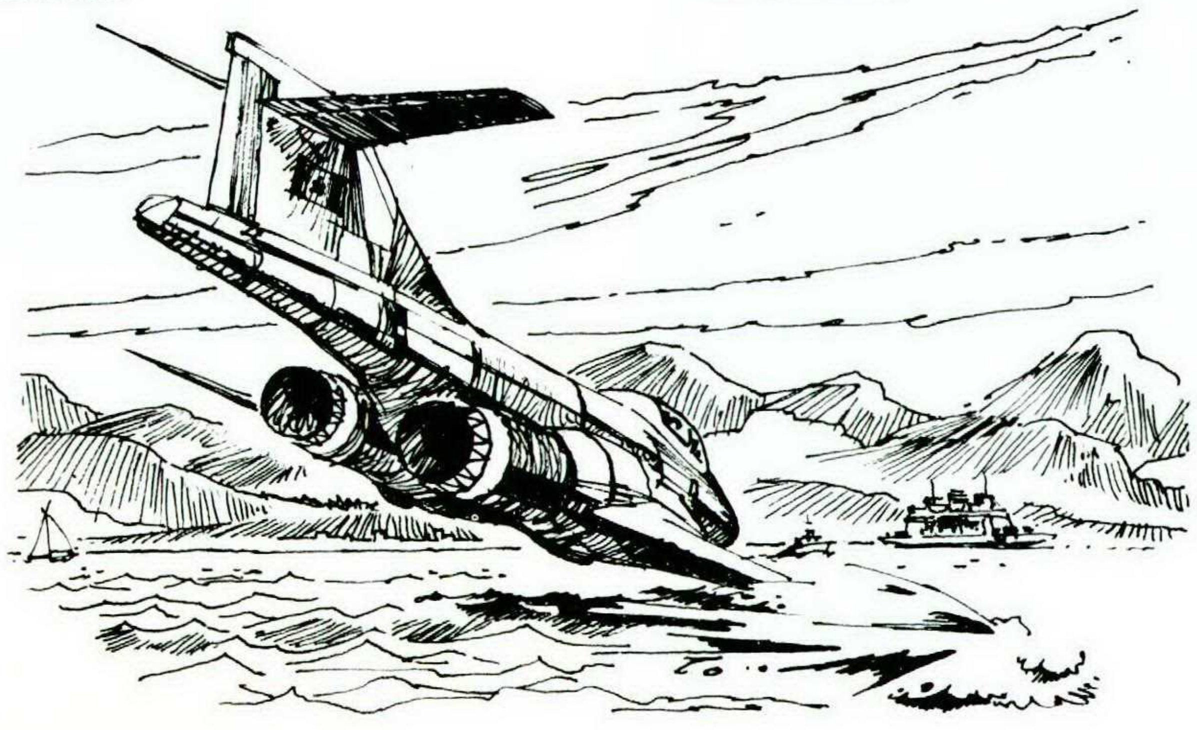
From the evidence we have, we cannot rule out incapacitation as a possibility, but the chances of the above happenings occurring coincidentally is unlikely.

Inattention

Pilot inattention is also a credible theory to explain the accident. At any time after commencement of descent, the pilot could have become preoccupied in the cockpit with a routine check or minor emergency, such as overheat in the cockpit. This preoccupation could limit the amount of time available for monitoring his descent. The combination of shallow descent and difficulty with altitude perception because of calm water would work in his disfavour in that neither would warn him of the impending impact.

One could postulate that the navigator did not eject because:

- He also was distracted by something in the cockpit; and/or
- He was not alarmed by the entirely normal descent path of the aircraft, a descent which could have been recovered from safely at altitudes as low as 50 feet above the water.



CRASH OF TUTOR 028 AT REGINA AIRPORT

As all of our readers will undoubtedly have heard, Tutor 028 crashed after takeoff from Regina last summer killing both occupants. It appears that the crash itself was caused by the ingestion of a bird into the engine. The crew of the aircraft apparently attempted to avoid a built up area of Regina and in so doing carried out a gliding turn back toward the airport intending after completing the turn either to eject or forced land.

The aircraft crew eventually ejected from their disabled Tutor at an approximate altitude of 50 feet in a nose down attitude and with a high rate of sink. Both ejections were well outside of the ejection seat envelope and both crewmembers were killed upon ground impact.

This accident highlighted several facts which may be of general interest.

First, investigation revealed that the Tutor relight/compressor stall clearing system could not have delivered a thrust adequate for flight in the time available even if engine damage had been minimal.

Second, it became obvious that we are possibly not devoting enough thought to the possibility of forced landing aircraft such as the Tutor. While we must remain ejection seat oriented we must not forget that in some circumstances it is preferable to stick with the aircraft.

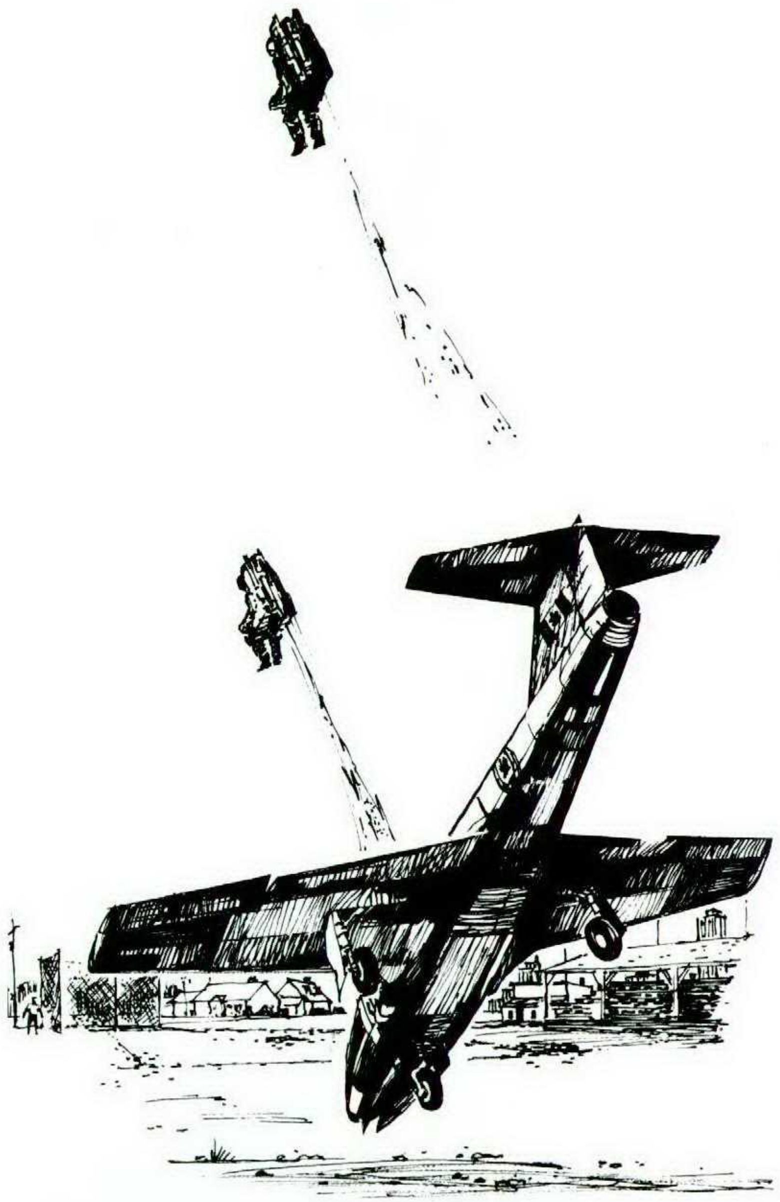
Third, contrasting with that point is the possibility that the ejection decision was unduly delayed, and that the deceased aircrew might have saved themselves had they ejected immediately upon sensing their problem.

The outside factor of course which complicates the whole affair is the matter of the presence of a built up area of a city in the flightpath of the disabled aircraft. Gone was the obvious choice of forced landing straight ahead, and inserted was the natural (and commendable) human tendency to avoid plunking a fuel-laden aircraft into a residential area. It is possible in fact that the crew consciously or unconsciously sacrificed themselves to avoid creating a greater disaster.

This unfortunately is not the first unsuccessful low level ejection in the Tutor aircraft. Another last minute try a few years ago produced some parallel results and we think it is worthwhile mentioning. If a Tutor is gliding at low airspeed and is trimmed to maintain this altitude as best it can, the pilot is still required to maintain a little back pressure on the stick to hold the nose up. Release this pressure to grab the ejection handles and the nose pitches down—which doesn't help the ejection vectors a bit. Couple this with the loss of the canopy (itself a lift producer) and you may get quite a nose down movement.

Possibly one should consider keeping one hand on the stick and using the other on the seat.

And then of course there will be those who suggest we're begging the question—since the problem was created by the presence of a bird. Well, we're working on that too.



Comments

Page counters will probably already have observed that this edition of Flight Comment is several pages longer than previous editions—in each language. So, in three bilingual editions we have run the gamut from shorter than average to average to longer than average,—but there is an explanation.

At first we simply didn't have enough French material. Then we managed to achieve a balance between French and English—but it took too long to produce. Finally I decided that the only way to get back on schedule was to drop one edition entirely and make up for it by adding extra pages to the next few editions. So this will be the last 1976 edition, but the first few editions of 1977 will be extra long to make up for the missing edition number six.

As we pointed out in our first bilingual effort, no additional resources have been provided to us to aid in our doubled efforts. We still have one artist, one secretary/office manager and one editor, so you'll just have to bear with us if we sometimes fall a little behind schedule or make arbitrary changes.

Incidentally, we can still use more articles from the field. We have been fortunate in receiving a few unsolicited submissions recently which have been a real help—but there is plenty of room for more. Furthermore, it is interesting to note that we have never received a submission of any sort in French. It really should be a two way street—with articles being translated in both directions. We look forward to articles from Valcartier and Bagotville in the very near future now that this point has been stated.

Incidentally, there are two other subjects which we'd like to touch on briefly—article sources and Air Cadets.

Who is eligible to write for Flight Comment? Anyone. That includes (in case you wondered) wives, children, pilots, groundcrew, weathermen, you name it. We would love to hear from the ladies who fly or who wait up for we who do.

Air Cadets are an important source of Air Element personnel. We hope shortly to do an article about some of their activities, and are glad in the meantime to hear that many of them enjoy our publication. The time to develop the right attitudes about flying is when you're just beginning—so read on.

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Don't short change the system

The continued effectiveness of our flight safety system depends on timely, candid and detailed occurrence reporting more than most people realize. There are many other aspects involved in accident prevention, such as every day supervision and surveys however these have a limited influence on the whole program because they usually apply to a specific unit or a phase of the operation. On the other hand, occurrence reporting makes the whole system dynamic because there is active involvement at all levels and with wide dissemination of reports an increased awareness across the board.

There is increasing support for our reporting philosophy as evidenced by the recent seminar of airline aviation safety specialists held in London, England in December 1976. Well over one hundred delegates representing twenty-five countries were involved in this "Hazard Alerting Seminar" and it appears that there is universal agreement on the need for a comprehensive incident reporting system: provided there is a guarantee of protection for those involved.

Our flight safety reporting system has been in effect for over ten years and there is growing evidence that some people think there is too much emphasis on detail and not enough flexibility in what should or should not be reported. Don't believe it. The stated purpose of our reporting system is "to promptly bring to the attention of all concerned those circumstances which could lead to, or have resulted in, aircraft accidents or injuries to personnel so that timely and appropriate preventive measures can be implemented". This system works, we have the protection guarantee and our air accident record is proof positive that we are getting the desired results. Let's not tamper with success, keep the reports coming and don't short change the system by leaving out the detail or rationalizing the circumstances.

COL R. D. SCHULTZ
DIRECTOR OF FLIGHT SAFETY

NE COURT-CIRCUITEZ PAS LE PROGRAMME

L'efficacité soutenue de la sécurité des vols dépend, plus qu'on ne le pense, de l'envoi dans les délais de comptes rendus francs et détaillés. La prévention des accidents implique de nombreux autres aspects, notamment une surveillance quotidienne et des inspections, bien que ceux-ci n'aient qu'une influence restreinte sur l'ensemble de programme, étant donné qu'ils ne s'appliquent habituellement qu'à une unité particulière ou à une phase d'utilisation. Par ailleurs, l'implication active de tous les paliers de responsabilité rend le programme dynamique et la vaste diffusion de ces rapports entraîne une prise de conscience générale.

Le dernier séminaire regroupant des spécialistes de la sécurité des vols du transport de ligne, qui s'est tenu à Londres (Angleterre) en décembre 1976, démontre que l'on appuie de plus en plus cette politique du compte rendu. Bien au-delà d'une centaine de délégués, représentant ving-cinq pays, participaient à ce "Hazard Alerting Seminar". Il apparaît que tous reconnaissent la nécessité d'un programme complet et détaillé de comptes rendus d'incident, à la condition qu'on garantisse la protection des personnes concernées.

Notre programme existe depuis plus de dix ans et il semble de plus en plus que les opinions sont divergentes. En effet, certaines personnes considèrent qu'on insiste trop sur les détails et nous accusent de manquer de souplesse quant à ce qui devrait ou ne devrait pas être signalé. N'en croyez pas un mot; notre programme vise principalement "à attirer l'attention de tous les intéressés sur les circonstances qui pourraient causer ou qui ont causé, des accidents d'aéronefs ou des blessures corporelles et ce afin d'implanter, à temps, les mesures préventives qui s'imposent". Ca marche! Nous garantissons l'immunité nécessaire et nos statistiques d'accidents aériens sont bien la preuve que nous obtenons les résultats souhaités. Ne nous endormons pas pour autant sur nos lauriers. Continuez à nous faire parvenir vos comptes rendus et ne court-circuitez pas le programme en supprimant les détails ou en rationalisant les circonstances.

COL R. D. SCHULTZ
DIRECTEUR DE LA SÉCURITÉ DU VOL