FLIGHT COMMENT

MAY • JUNE 1973

Comments

After the Hercules got airborne someone in the crew remarked that the takeoff roll had been somewhat lengthy, however the small snow drifts on the unimproved strip seemed to account for it. So nothing more was thought about it until after the crew landed at destination, at which point they were surprised to have the aircraft decelerate rapidly and come to a complete stop on the runway, with the aid of moderate reverse thrust only. When the first officer applied power, more surprise — the aircraft didn't move. A check with the AC, confirming that he wasn't standing on the brakes, followed by quick troubleshooting, soon uncovered the problem — the parking brakes had not been released before takeoff! A seemingly impossible sequence of events had taken place more easily than was ever thought possible, and the experience was remarkably inexpensive. Damage consisted of large flat spots on all four MLG tires, but they were repairable.

Items of life support equipment used for practice purposes should measure up to the standard of that in regular use by aircrew. Employing equipment in emergency drills that has been allowed to deteriorate to the point where it no longer functions as originally designed is one way to give rise to lack of confidence in our equipment.

Inattention is a well established factor in many mishaps where people have become entangled in moving machinery. In one of the latest instances it led to a narrow brush with serious injury for a helicopter pilot when he inadvertently rested his hand on the tail rotor drive shaft while waiting for the main rotor of his helicopter to come to a stop. His hand was instantly pulled under the drive shaft and his glove was torn off. Loss of the glove was fortunate in that it freed his hand. Even so, the hand was immobilized for a week.

The *Flight Comment* feature, ROTORWASH, is prepared by DFS helicopter investigators, Capt A. Cooper and Capt R.A. Hall. (Tel. 613-992-1979).

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Education and analysis

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Investigation and prevention

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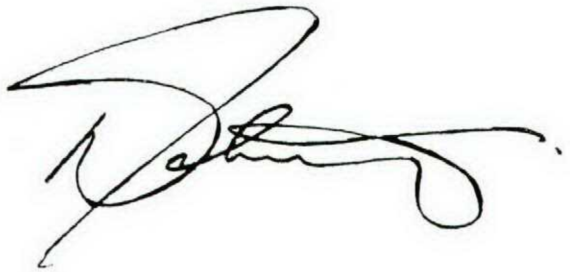
Close the Information Gap

It is that time of the year when most of our personnel changes take place and by the time this is in print many of you, your contemporaries, subordinates and supervisors will be on the move to a new tour of duty. Each year about one-third of us change jobs and the whole relearning process begins again. Every effort is made to maintain continuity by staggering changes of supervisory positions but too often these plans are negated by demands beyond the control of the personnel managers. The result is an information gap.

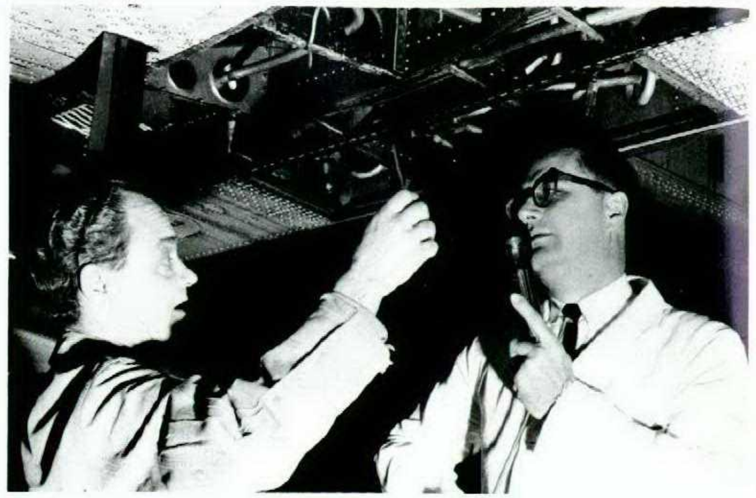
With personnel resources reduced to an absolute minimum the practice of double banking has become the exception rather than the rule. Not only does this make the new incumbent's job more difficult but all too often expensive lessons have to be learned the hard way again. This is especially true in the flying business. It could be argued that everything of a critical nature should be permanently recorded but let us be realistic and admit that this will just never be and in any case it is unlikely that the "newee" will be able to digest all of the written words before being forced to make decisions.

You can dismiss all of this as the "blindingly obvious" but why not give it a second thought! You who are leaving can make just a little extra effort to ensure that your replacement is helped over the rough spots by leaving him a list of things to watch for and even better, make someone responsible for briefing him on specific issues that might get overlooked in the shuffle. On the other hand, if you are the new arrival, demand such help and take note of those things that appear to deserve special attention; then check with your predecessor to see what he has to offer. At all costs don't let pride and independence contribute to the information gap.



COL R. D. SCHULTZ
DIRECTOR OF FLIGHT SAFETY

There are always items that are borderline in regards to servicability and the decision has to be made as to the most economical time for replacement. Mr. C.R. Gardner, IMP (Halifax) Production Manager, and WO John Essex, Argus Program Co-Ordinator, discuss the advantages of replacing worn bushings on a parking brake control assembly while it is disassembled for other work.



Sgt F. Colucci (401 TSD CAE Winnipeg) discussing necessity of repair to Dakota centre section with Mr. Ray Roscoe of CAE(W) Ltd.

Great Expectations and Reality

Major C. E. Copeland
NDHQ/DGAM

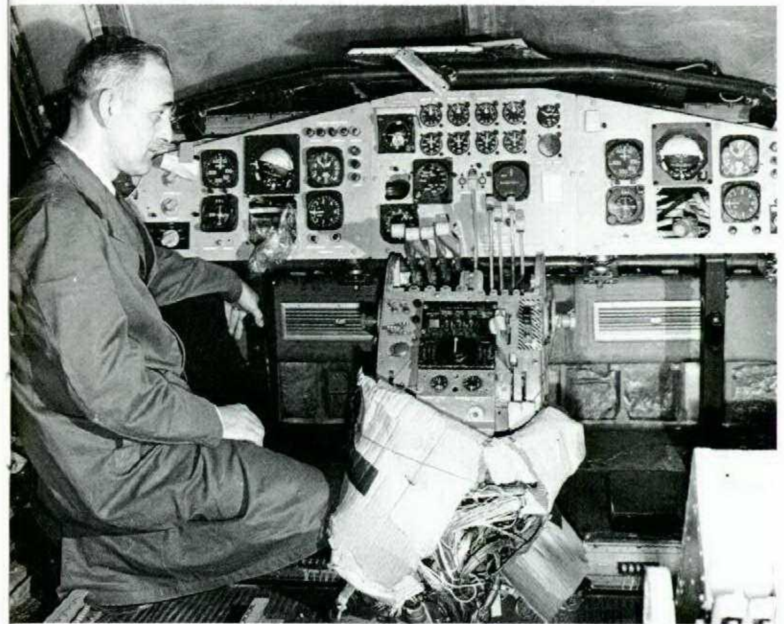
"We sent that aircraft to the depot to be refurbished, but it looks like it's aged a thousand hours", roars the boss of maintenance. "We've been had. Hardly anything has been restored to a new-like condition. They didn't even paint this crummy floor."

The quotation is from an article in the June 1972 issue of USAF *Aerospace Safety* which was aimed at pointing out that Depot Level Maintenance only goes as far as the program specification; there are no frills purely for their cosmetic affect. Work that is normally within unit capability does not get carried out by the contractor – if it does, it's extremely expensive. Now how does this relate to the methods we use?

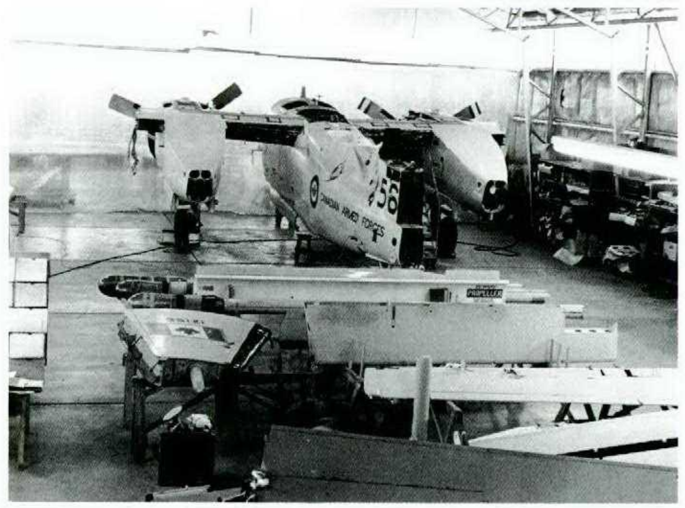
In the Canadian Forces, aircraft maintenance which is beyond base capability is known as Depot Level Maintenance (DLM). While DLM embraces several forms of contractor support, we will confine our discussion to aircraft overhaul.

Many years ago, we used to send aircraft into a contractor's plant for maintenance on a calendar basis, based on a prognosis of when an aircraft would be ready for a "good going over". The work package was based as much on gut feeling for what was required as it was on technical reports and surveys. The definition of just *what* the contractor was to do was pretty broad; it was also very expensive. The work package often included the repair of items which would normally be within the capability of a unit. There was, on occasion, a tendency at the units to "Put it in the minors, the aircraft is going for overhaul next month". The accumulated package of such snags, added to the already high costs of the program.

Under the old Calendar Aircraft Inspection and Repair (CAIR) program, the work definition to which a contractor performed was fairly broad. Often the CAIR package was subjective and relied upon the interpretation of the contractor. Because of the lack of definitive requirements, the DND representative on-site, had difficulty in determining *what* was required. The result as we have said was expensive; rectification included much gold plating; the results were pleasing to the eye but were frowned upon by the man with the purse strings. Generally, the old CAIR concept phased aircraft through a contractor's plant whether it "needed it or not". So much for the past.



Gold Plating? No, refurbishment of the flight crew compartment on the Argus – part of the work carried out on DLIR. Sgt. Ken O'Malley carries out a Quality Assurance check on instrument panel refurbishment at IMP Limited.



A view of IMP's number 2 hangar showing a Tracker aircraft dismantled for Depot Level Repair and Overhaul.

The situation described no longer obtains, and any work now carried out by a contractor is based upon a specific work package defined *before* the aircraft arrives at the plant. Let us then discuss the work specification which in affect spells out the work package.

Based on Unsatisfactory Condition Reports, Lead the Force programs, discussions with bases and commands, and lots of eyeballing, NDHQ maintenance staffs develop an Aircraft Sampling Inspection (ASI) program. One or two aircraft, usually high-time, are scheduled for a visit to a contractor's plant. The contractor is given direction to inspect specific areas and report in detail what he finds. Some areas will be found to be trouble free, however, other areas may highlight potential problem areas.

The results of the ASI are carefully reviewed. In some instances field level inspection or modification may result. Other areas may be beyond base-level capability and require contractor assistance. The contractor-level work that is necessary as a result of the ASI is then made into a Depot Level Inspection and Repair (DLIR) or a Depot Level Repair and Overhaul (DLRO) program. The real difference between DLIR and DLRO program is the scope. The DLRO is for specific actions such as modifications, while the DLIR requires inspection and repair of specific areas or items as defined in the work package. If items arise during the DLIR which are not within the work package, then the DND representative at the plant will carefully review the requirement and decide whether to rectify in-plant or leave as is. The costs of additional work are added to the firm price, and incidentally, the hourly labour rate is usually higher than the programmed work labour rate.

As we pointed out earlier, the ASI program provides us with an objective sample of aircraft condition. From the representative results of the ASI, a decision is made as to *when* we should phase in the DLIR package. The package itself tells the contractor *what* is required.

The defects found during DLIR are carefully analyzed, and a further sampling inspection of an aircraft will be scheduled in the future. In this way we get a continual update of the aircraft's durability, how well it is standing up, and what we need to do to maintain an effective weapons system. The ASI/DLIR combination is an on-going process of sampling and programmed rectification.

Now you may ask "So What? " "What does it mean to the operator and maintainer in the field? ". Well let's keep in mind the opening quotation in the context of what we have said about CAIR, ASI and DLIR.

The contractor is tasked to inspect and repair only these items in the specified work package. If you allow an aircraft to go to the DLIR plant with pages of minor entries, you'll get it back in the same condition. Worse still, the aircraft could be transferred to another base! Remember too, that although the acceptance test flight carried out at DLIR is very thorough, if the snags don't affect flight safety or airworthiness, rectification may be delayed until the aircraft gets home.

In summary, DLM as we now know it has the following characteristics: The contractor performs a known work package. Only those items affecting flight safety or airworthiness will be added to the programmed package. Gold plating for cosmetic purpose is a "no-no". Depot Level Maintenance places emphasis on system serviceability rather than producing something "like new".

The problem the "boss of maintenance" had is really the difference between his expectations and the funds available.

Major Copeland joined the RCAF at London England in January 1956 as an aeronautical engineer. After aircraft maintenance tours at Gimli, Saskatoon and CEPE, Cold Lake, he spent two years as an instructor at the Aeronautical Engineering Officers' School, Centralia. A three year tour as Detachment Commander of 307 CFTSD De Havilland followed, after which Major Copeland attended the Canadian Forces Staff College in Toronto.

Major Copeland is currently a section head in the Director General Air Maintenance at NDHQ and is responsible for the maintenance of Argus, Tracker, 707 and Dakota aircraft.

The Analysis of Human Factors in Aircraft Accidents

by LCol W.D. Macnamara, Maj W.J. McArthur and Dr. P.J. Dean
DCIEM

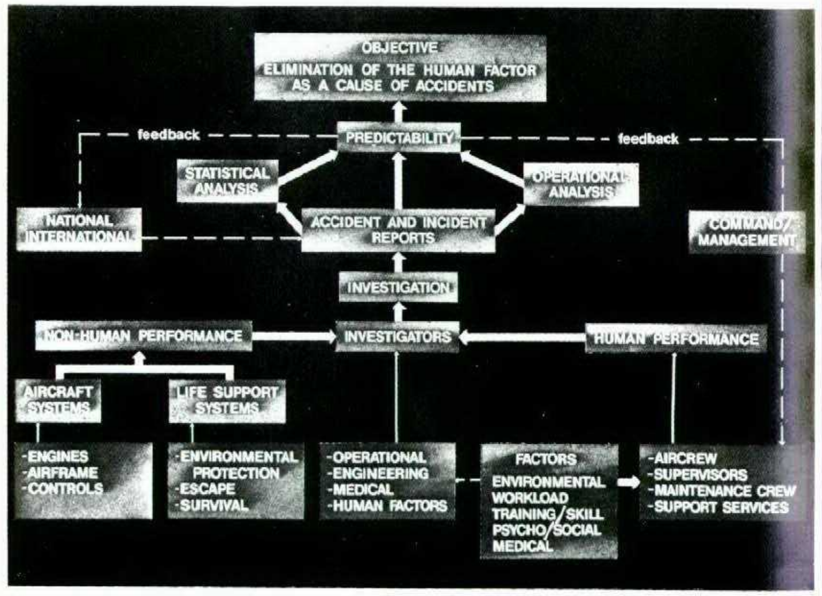


Figure 1

INTRODUCTION

Canada's new Defence and Civil Institute of Environmental Medicine (DCIEM) was formed in April 1971 from the former Canadian Forces Institute of Environmental Medicine and the Defence Research Establishment Toronto. The new Accident Investigation Group was then given the opportunity in July of that year to develop, from first principles, a systematic approach to the analysis of human factors in aircraft accidents. That systematic approach is best described by using a model (fig 1). The value of constructing a model of this type lies in its ability to present an overall picture of the analysis of human factors – a picture which shows how the components interact with one another. Our model, then, is one which attempts to consolidate and assimilate the knowledge and experience of all those people and agencies involved in aircraft accident investigation and prevention. This article is intended to communicate some of the thoughts which led to the development of our model. Let us first consider what we mean by the human factor in aircraft accidents.

The three elements of aviation, the man, the machine and the environment, are not easy to separate because Man is involved in all of them. Man designs and makes aircraft, services and repairs them and controls their flight. Man is responsible for predicting the weather and for deciding the relative favourability of conditions for flight. Clearly, the human factor, not the machine component or the environment, plays a predominant role.

In aircraft accident prevention, our prime concern has become the Man because today the largest percentage of all accidents are caused, in part at least, by so-called human factors.

Now, keeping one eye on our model diagram, let us follow the various components.

OBJECTIVE

The key point in the development of any model is a clear statement of the objective. We concluded that our objective must be the elimination of the human factor as a cause of aircraft accidents. We chose as our objective "elimination" as opposed to "reduction" to avoid any suggestion that the reduction of human factors causes – by whatever margin – would be an acceptable goal.

PREDICTABILITY

The best way to eliminate the human factor as a cause of aircraft accidents is to use the three E's of aviation safety, Education, Engineering and Enforcement. You can educate the operator better, engineer the aircraft better and enforce the rules and regulations better.

Each of these solutions, however, depends upon our knowledge of or our ability to predict aircraft accidents. Elimination of a particular factor as a cause of aircraft accidents depends upon predictability. If we can predict that when a certain factor is present, there is a high probability that an accident will occur, then we are in a position to do something about it.

ANALYSES

Predictability can be obtained in two basic ways. The first, *Statistical Analysis*, looks at many accidents or incidents over a period of years in an attempt to isolate critical problem areas. For example, statistical analysis of general aviation accidents might show that 80% of all accidents involved pilots who have had a minimum of *x* hours flying time in the previous six months. Statistical analysis also permits the identification of trends in minor accidents or incidents which may have the potential to cause a major accident.

The second method, which we have termed an *Operational Analysis*, is based on the thorough analysis by experienced professionals, of individual accidents. Such an analysis exposes faulty human engineering, improper operating procedures or medical factors that have potential to cause future accidents.

THE INVESTIGATION

The analysis of accident and incident data must be based upon accurate information. In the Canadian Forces, the first time all data related to a given accident are brought together is in the accident reports – Board of Inquiry, CF210, an Occurrence Report (CF215) or a Physiological Incident Report (CFMO 42.03). These reports form the basis of all future analyses, both statistical and operational.

The production of a good accident report presupposes a thorough investigation. An investigation could be completed in a mechanical fashion using a check-list, but an effective investigation depends upon trained *investigators* operating intelligently as a team. The investigators are the essential core of any accident analysis system. The investigation team invariably includes representatives of the operational, engineering and biomedical/human factors professions. Other specialists may also be added to a particular investigation when required. These investigators examine both human and non-human performance in an attempt to identify cause factors.

Non-human performance refers to engineering oriented components. These include aircraft systems, such as environmental protection, escape and survival systems.

Human performance that the investigators must examine includes factors affecting the activities of the aircrews, the supervisors, the maintenance crews and the support service staffs such as air traffic control, meterology and food services.

Discussions with accident investigators and analysts in the U.S., Europe and Canada have revealed the absence of a unified approach to the gathering and analysis of human factors accident data, and this is our prime area of concern at DCIEM. Just as an engineering investigation examines the operating condition of all aircraft components at the time of, and prior to the accident, in a thorough and systematic fashion, a human factors investigation must examine all relevant human activity and judge the performance quality in just as thorough and systematic a fashion. This examination must consider environmental factors, workload, human skills and training, as well as equipment design, operating procedures and the psycho-social and medical histories of the personnel involved.

The total investigation team, not just the biomedical specialists, must be familiar with the human factors and how they might have interacted with the other aspects of the accident. This will contribute to the ultimate quality of the investigation and the accident report.

There is an additional subtle reason why investigators must recognize the significance of specific human factors involved in an accident. That is, that these same factors often affect the quality of the investigation being conducted. An example of this was seen last year in the investigation of an accident that occurred in the Arctic, where environmental factors influenced the quality of the investigation. The same adverse weather which was a factor in the accident, also prevented the investigators from reaching the site for several days and the short day combined with the extreme cold prevented them from examining the wreckage as thoroughly as they might in a less hostile environment.

Training investigators in the importance and nature of human factors and how these factors may contribute to an accident is essential to the development of thorough investigations and reliable and comprehensive accident reports. Without this training, investigators cannot be expected to analyze human factors accurately. This could lead to overlooking relevant causes or to the assignment of invalid cause factors, and a reduction in our potential to predict future accidents.

FEEDBACK

When reliable predictability has been achieved, the information must be fed back into the accident prevention system. The feedback system must provide rapid and useful information to permit the management/command system to institute preventive measures.

The feedback system must also be able to relate to the experience of other investigating agencies both nationally and internationally. Such links would increase the statistical base of all accident analysis organizations. This is particularly important when dealing with new aircraft types in which there is limited accident experience.

WHERE TO FROM HERE?

The developing of this model has permitted us at DCIEM to look at the overall picture of the analysis of human factors in aircraft accidents and to determine where our efforts in support of accident prevention in Canada may best be directed.

In the course of developing this model, we felt that we could be most effective in the following ways:

First, a computerized information storage and retrieval system has been designed to support human factors investigators in the field, to assist DCIEM accident analysts in their review of accident reports, and as a research tool, to manipulate the large amounts of information necessary for statistical analyses. The implementation of this computer system is nearing completion.

Second, the development of improved and systematic techniques for a thorough human factors investigation is necessary and more investigators need to be trained. We are currently developing new analytical techniques and procedures and emphasizing their importance in Flight Surgeon and Flight Safety Officer training.

Finally, our feedback system needs to be exercised and monitored continually to ensure the best application of the collective experience of all those involved in accident analysis.

As a reader of this article, you have become part of the feedback system. Painless wasn't it? Can you assist us?

This article was presented as a paper at the meeting of the Aerospace Medical Association in Miami, Florida in May 1972.

Good Show

SGT R.W. TEMPLETON

Sgt Templeton, a Quality Assurance Inspector at a civilian contractor, observed an electrical spark set fire to a pool of highly inflammable paint remover under a CF101 which was undergoing depot level maintenance. He reacted immediately and was successful in extinguishing the fire before any damage occurred.

At the time of this incident there were seven aircraft parked in the immediate area. Sgt Templeton's quick response in the midst of initial confusion around the fire, ensured the safety of the aircraft and other expensive equipment in the building.

SGT K.H. ORPIN

Sgt Orpin was on duty as radar controller when a Musketeer pilot declared an emergency and advised that he was making a forced landing. Sgt Orpin established an accurate last known position on radar, and quickly vectored a search aircraft to the area. Subsequently, he handled all other traffic responding to the downed aircraft in a remarkably short time period. The pilot, uninjured, was returned to base soon after by a rescue helicopter.

Sgt Orpin's alertness in pinpointing the position of the aircraft was significant. Moderate snow falling in the area at the time and the nature of the terrain could otherwise have led to a lengthy search.

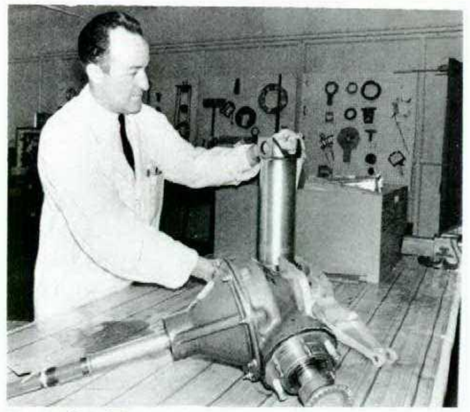
CPL S.B. DUNNETT

Cpl Dunnett was operating a 1000-gallon refuelling vehicle during the refuelling of a helicopter when a major fuel leak developed in the pumping system. Fuel under high pressure was being pumped vertically in a fountain through a 1 1/2-inch hole, completely drenching the entire rear of the vehicle, including the gasoline driven pumping engine.

Realizing the possible catastrophic consequences of a bowser fire, Cpl Dunnett mounted the tail gate of the bowser and turned off the pumping engine ignition switch, thereby isolating the possible ignition source and stopping the fuel flow.

During the course of this action Cpl Dunnett was completely drenched with fuel, and subsequently required medical treatment to prevent eye damage. Had a fire developed, he was a primed torch.

Cpl Dunnett's immediate action in the face of grave personal danger was decisive in preventing a possible fire.



Sgt R.W. Templeton

Sgt K.H. Orpin

MCpl L.F. Quinlan

Sgt J.E. Theriault

SGT J.E. THERIAULT

During the pre-flight inspection of an Argus Sgt Theriault, the flight engineer, discovered that the securing nuts were loose on the propeller alternator junction box of number four engine. They were so loose in fact that with only a few hand turns he was able to remove them completely.

Sgt Theriault displayed a thorough inspection technique in this instance. The component itself is not specifically part of the flight engineer's pre-flight, and additionally, it is in an area difficult to inspect visually. Had the improperly secured junction box not been discovered, it could have resulted in an airborne propeller failure and possible airframe damage.

MCPL L.F. QUINLAN

MCpl Quinlan, an Argus flight engineer, was conducting a pre-flight inspection when he found a small crack on an inspection panel covering aileron components in the aircraft wing. He then decided to check the corresponding panel on the other wing and found that the entire panel was missing. Checking the general area he discovered that the retainer bolts were in the flap well adjacent to the aileron components. Subsequent investigation showed that technicians had failed to notice the missing panel on a number of previous pre- and post-flight inspections.

MCpl Quinlan's efforts in investigating the cracks in the inspection panel led to the discovery of a potentially dangerous situation – FOD in an area housing the flight controls. Alertness and perceptiveness on his part eliminated the possibility of the bolts causing an in-flight control problem.

CPL D.W. GRAHAM

During a supplementary inspection of number four engine of an Argus, Cpl Graham detected slight evidence of oil accumulation around the front insert of number 17 cylinder. On his own initiative, he removed the spark plug and inspected the cylinder internally with a boroscope. The inspection revealed two cracks running from the front spark plug to both valves. Further inspection revealed two cracks starting to radiate from the rear spark plug.

On another occasion, Cpl Graham had marshalled an Argus onto the ramp area. On engine shutdown he thought he heard a compression leak. He investigated and found that a cylinder on number two engine had a crack running from the front spark plug insert into the exhaust valve seat.

Cpl Graham's alertness and professionalism led to the discovery of two serious component failures that could have resulted in extensive damage to the engines and serious in-flight emergencies.

Cpl P.D.D. MacDonald

Cpl C.H. Creelman

Cpl. D.W. Graham

Cpl S.B. Dunnett

CPL P.D.D. MACDONALD

Cpl MacDonald, an engine technician, was performing a "B" Check on an Argus. While on the port wing checking the fuel load, he noticed discolouration on the upper cowling of number one engine. He opened the cowling and found that the exhaust pipe on number 18 cylinder was cracked approximately three-quarters of the circumference. There was no damage to any other components in the area. Cpl MacDonald replaced the exhaust pipe and the aircraft flew the next day.

Had Cpl MacDonald not been as observant or had he not investigated his observations, this aircraft would undoubtedly have flown with the fault, as there is no EO requirement on the "B" check for the cowlings to be opened or checked other than for security or damage. The consequences would have been the emission of hot exhaust gases which could have easily melted the adjacent components and caused an in-flight fire hazard.

CPL C.H. CREELMAN

Cpl Creelman, an AE Technician, was performing minor repairs on a Dakota which had just returned from a deployment. The right engine had been changed during the deployment, so he decided to check the engine closely. His inspection revealed that the propeller was loose and was rocking in the engine. This led to the engine being changed again and when a contractor's repair party removed the nose section of the engine they found that the outer race of the reduction gear and the propeller shaft roller bearing had not been installed during its last overhaul.

By inspecting beyond the requirements of his job, Cpl Creelman prevented a catastrophic failure of the engine reduction gearing which would have resulted in severe engine, and most probably airframe damage.

Dark Night Takeoff Bashes

For more than 25 years, the term "dark night takeoff accident" has been associated with mishaps following takeoff over "textureless" terrain in conditions of extreme darkness but good visibility. Under these conditions, you may be induced to divert your attention from the flight instruments to the outside. Typically, after a relatively short climb-out (and with the aircraft functioning normally) you enter a shallow dive which continues until you hit the unseen land or water.

The cause of the problem is an illusion which, briefly summarized, works like this: In the absence of visual pitch information, a pilot under substantial forward linear acceleration will perceive an apparent change in body position as though he were being tilted backwards. An illusion of excessive pitch-up may occur and, obviously, if we were to correct for this illusion, he would dive the aircraft. The magnitude of the illusion increases with reduced external visual reference; during daylight operations the illusion would be minimal, but during night and weather operations, it would

cont'd on page 21

Murphied Messages

Most will agree that there is a certain art involved in message writing. Having mastered it however, the drafter still can't be sure how his message will look at the other end, for he is harassed by those same gremlins who bedevil typographers. Not unsimilar are the problems that confront those tasked with recording minutes of committee meetings, conferences and so on. Herewith the latest examples to come to our attention. If you have any you would like to share with our readers, send them along.

"The desiccant had been placed in the carburettor intake when the aircraft was placed in short term storage in order to absorb moisture..."

"All pilots should have a copy of the article concerning flying while tired caused by too many hours of continuous duty."

"**Chairman**: I wonder if you could wait until a man gets to you with a microphone, to ensure not a pearl is lost?"
"Previous Speaker (now with microphone): What I said was that we beat this one around and I'm afraid that at the moment we've got the best we can out of the system and, as I say, although it goes against my personal feelings I have had, and still have, I made this – well, *I didn't, we did* – this decision, I mean. That's a very unsatisfactory answer, although I've answered the question.
(Secretary's translation): The answer was: a. no; b. yes; or c. maybe?"

"Aircraft touched down in overshoot area for runway 06 which was covered in approx two feet of snow."

"Messages were read concerning:

a. hazards of ground accidents at regular time intervals;
b. wearing of boards with face masks;
c. ground accidents – danger of drifts on runways;
d. sharp edges on doors"

"The brake seals on all aircraft are being replaced by the same seals."

"**Delegate A**: Now in S&R operations this again becomes prevalent, of detached operations, where the same technician, and again greatly reduced in numbers, you can't think of the base concept, to back up the operation and we're under constant pressure to continue to reduce these people on detached operations because of monies, because of space available, and we are talking about training people to that level, which is not on our original submission. **Delegate B** *(in all seriousness)*: You cut the rug right out from what I was going to say..."

"All air traffic control personnel should at this time of year, refresh their momory..."

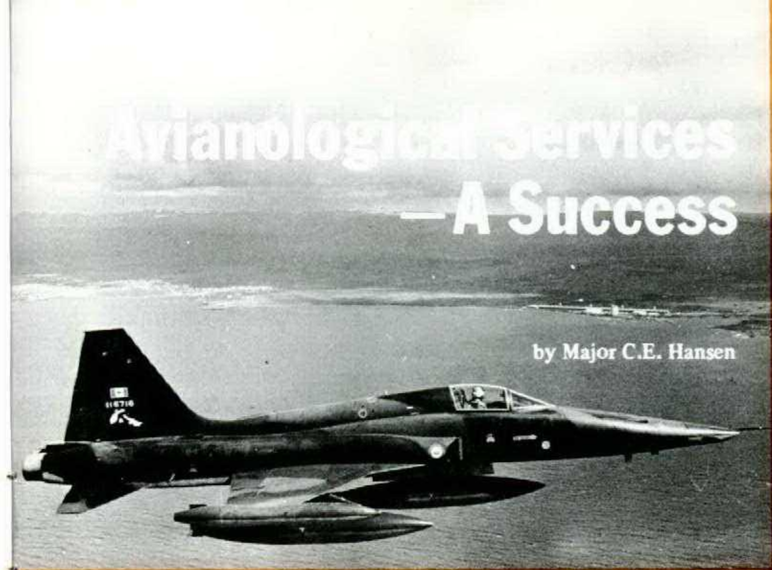
"Pilo indvertently faild to exercise due care and attention during rudde apication"

"Loose or missing panels, check them all!"

Q. Disregarding Article 525 of CFP 100 (oxygen requirements), how does a helicopter's operational ceiling differ from that of a fixed wing aircraft?

A. A helicopter has two ceilings, a hovering ceiling and a ceiling in forward flight. The hovering ceiling is that altitude where the sum of the profile and induced power required, equals the power available. In hovering flight more parasite power is required. As altitude increases, power available and profile power will decrease, but induced power will increase. The ceiling in forward flight is higher than the hovering ceiling because less power is required for forward flight.

Avianological Services —A Success



by Major C.E. Hansen

Studies in bird hazard forecasting began at CFB Cold Lake in 1965 and by 1970 the system was yielding useful data, enabling bird hazard warning information to be provided to the squadrons at the base. A review of the effectiveness of the service has recently been completed, highlights of which are presented here.

The review indicates that the bird hazard for (high-speed) aircraft operating in the low level role in the Cold Lake area has been significantly reduced. CF104 losses due to birds were reduced to zero and the birdstrike rate dropped by one-third. Similar results were achieved with the CF5.

Today's birdstrike record is a far cry from the toll in the mid-sixties. In those days the destruction of a CF104 due to a birdstrike was an annual event at Cold Lake; it occurred once each year from 1966 to 1969 inclusive. Also there were two probables in 1964. During 1970, '71 and '72 when bird hazard forecasting was in effect, none of the four CF104 air accidents attributed to birdstrikes resulted in loss of the aircraft. In the case of the CF5, the only birdstrike air accident experienced to date occurred in 1969, prior to useful bird hazard forecasting. For both types of aircraft, the apparent improvement in the birdstrike situation coincided with the availability of bird hazard forecasting services.

The changes in the overall birdstrike rate is also impressive. In the three years prior to the introduction of the forecasting service, the CF104 rate was 3.0 per 10,000 flying hours. With the warning system in operation there was a 30 per cent reduction to 2.0. Similarly, the CF5 rate which was 2.2 in 1969, dropped to 1.4 after the warning service became available.

The survey concludes that the remarkable decrease in the number of CF104s destroyed and the significant decrease in the birdstrike rate of both the CF104 and CF5 following the commencement of the bird hazard warning service, is no mere coincidence, rather it is proof of the effectiveness of the system.

The reasons for the success involves system compatibility to the military low level role and general acceptance of the system by all aviation personnel at Cold Lake. The bird hazard forecasting and warning service became the vehicle to highlight the hazard on a routine basis and the information became an integral flight planning consideration. In other words, the right system with a cooperative effort by all concerned can reduce the birdstrike hazard.

The Case of The Surplus Knots

by D.J. Webster
D Met Oc

Have you been surplus a few knots of wind and shy a bit of fuel lately? Recently, a west-bound pilot flight planned for 120 kts on the nose using forecast winds which MET obtained from the upper level prognostic charts. Lo and behold, when he reached altitude, his ground speed checks showed that the headwind was actually 180 kts. This unexpected event resulted in some fast flight plan changes and an unscheduled enroute stop.

Hold it! Before you start mumbling about 'bust forecasts' let's examine the problem. The winds were extracted correctly from the progs. Well then, where were the other sixty knots?

Actually, this is a built-in problem with the MET computer. Both the upper level prognostic charts and the "FD" winds are computer produced. The computer processes raw data (such as upper air ascents) and comes up with teletype spot winds for designated "grid points" (currently 200 miles apart) over the forecast area. These spot winds reflect the average forecast wind over the grid distance (200 mi). This means that strong winds in jet stream cores (which are less than 200 miles wide) are not properly forecast, as the computer simply averages the wind speed over the grid distance. This averaging means that the maximum speeds in the core are forecast low, and the core will appear to be broadened on the upper level chart. Conversely, speeds on the edge of the core will be too high.

Aha! You know a solution – make the grid smaller! We're going to, but this requires a larger computer, a change in program, money, and time! Well anyway, it's up to MET to ensure that the speeds are correct. Right, but without accurate information to update charts and FD winds it pretty difficult. That's where you, as aircrew, come in by ensuring that if you encounter winds which are different from the forecast, you let MET know. If you report such occurences enroute and again after the trip, then MET can make the adjustments. There are other sources of raw data, but one of the best and sometimes the hardest to get is a PIREP. Remember, raw data doesn't grow on trees.

What's the moral of the story? If you are self-briefing from the charts, keep in mind that forecast problem. If MET indicates that a jet stream lies along your route, remember that speeds may be higher in the core than on the chart. And lastly, ask MET if there have been any PIREPS.

Maintenance —A Precise Science

Sgt. C. R. Haynes
AETE
CFB Cold Lake

Some people think that maintaining an automobile in proper running order requires a lot of time, money and trouble. Most would agree that this is true, but suppose that your car had to be maintained like a modern military jet fighter or transport aircraft. Compared to the modern aircraft an automobile is a relatively uncomplicated vehicle and where the automobile manual recommends an oil change and filter replacement say every 5000 miles, it normally does not make much difference if the servicing is completed within a few hundred or even a thousand miles of the recommended limit.

This is certainly not the case with a modern aircraft, all critical parts have a time life computed in hours-in-the-air. The life of the part is set after extensive testing by the manufacturer and the user. The life usually consists of the proven normal life less a generous safety margin. When the life of any part has expired the part is replaced and returned to a contractor for overhaul, even though the part may be in good condition and perfect working order. This means that component life must be anticipated in order that the life of a part will not expire before the aircraft reaches the next maintenance point.

Consider the thousands of parts which make up a modern aircraft and multiply that by the number of aircraft in service. Then compound it by the fact that our aircraft travel thousands of miles in a day and may start the following day's flying from a base which lacks the necessary special equipment that would be required if extensive maintenance were required before flight. Operational commitments must be met, aircraft must be ready to fly in support of a wide range of tasks, whether it be rescue missions, or on peace keeping or the fighter aircraft in support of NATO or NORAD. Transport and Maritime aircraft deploy to all parts of the world in support of the Canadian Forces. The rescue and mercy flight is required when least expected, adding to an already complex maintenance schedule.

Routine maintenance and part replacement is normally scheduled for periods when the aircraft is between flights or overnight after the day's flying has ceased. The aircraft is usually ready to go again at the start of the next day's flying, but before it is declared fully serviceable it must be put through a Daily Inspection (DI) by the personnel in the servicing section.

The DI can take from one to ten or more man-hours, depending on the type of aircraft, plus time to rectify any problems found during the inspection. Before and after each flight the aircraft is put through a ramp check by the ground crew. Fuel and oil must be replenished before the next flight. Airborne, the flight crew is constantly on the alert for any variation from the normal patterns. In addition to the other checks and inspections on a routine and time-life basis, the aircraft must be cleaned inside and out.

Special Inspections (S.I.) are issued periodically if a fault is suspected. If the fault is found to be present in a large number of aircraft it must be corrected in the entire fleet, and if the fault creates a flight hazard, the modification must be carried out as soon as possible.

To bring the necessary personnel, parts and aircraft together at the right time and in the correct place, and to perform the required maintenance procedures, takes teamwork and down-to-the-minute timing. Because the aircraft are always in demand, maintenance must be scheduled for times when they are on the ground or when it will least disrupt the system.

To perform this maintenance requires a team of highly skilled and trained specialists in the field of hydraulics, electronics, avionics, pneumatics, engine mechanics and other related sciences. These personnel must be trained specially for each type of aircraft that they are required to work on, and they must frequently attend courses in order to keep current on modifications and changes which occur constantly.

To co-ordinate this complex maintenance orchestration requires close liaison between the air maintenance officer, flight operation and the supervisor of technical records. Each man must have an input in order that the aircraft be available at the best possible time for all concerned.

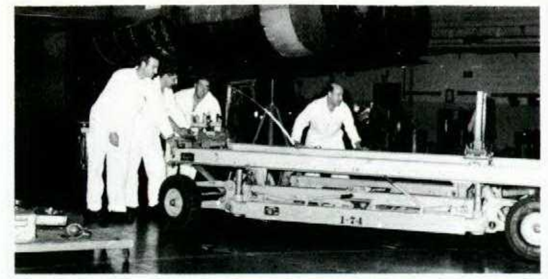
To back up the technical personnel the Canadian Forces must maintain an elaborate store of spare parts costing many millions of dollars. The store must contain everything from a common half-inch bolt to a complete jet engine ready for service. In addition the maintenance section must carry a complete stock of special tools, equipment and testing instruments.

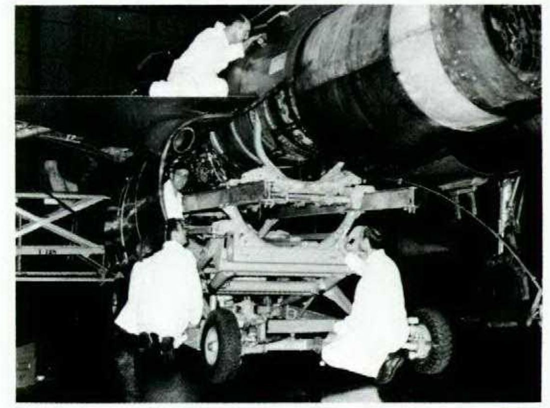
Sgt Haynes joined the RCAF in 1951. After Basic Training and the Airframe Tech course he was attached to 103 Rescue Unit on Lancaster and Canso aircraft at Greenwood and later with 107 Rescue Unit at Torbay. In 1956 he joined the Weapons Practice Unit (CF100s) at Cold Lake. Tours at 2 Wing (F86) and 4 Wing (CF104) followed and on returning to Canada in 1965 he was posted to 101 Communication Flight at Shearwater. He has been at Cold Lake since 1968 and is presently NCO i/c airframe snags for CF100, CF104, CF5, T33 and Tutor aircraft at AETE.

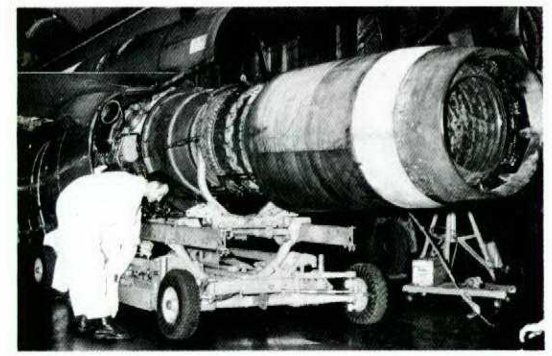
To provide the necessary technical data for the maintenance personnel, the maintenance section of each unit must have its own library. The library contains hundreds of volumes of technical material, covering most parts of every aircraft on unit strength. This technical material must be constantly catalogued and up-dated. In addition, the library must be accessible to all the technical personnel who may be required to use it.

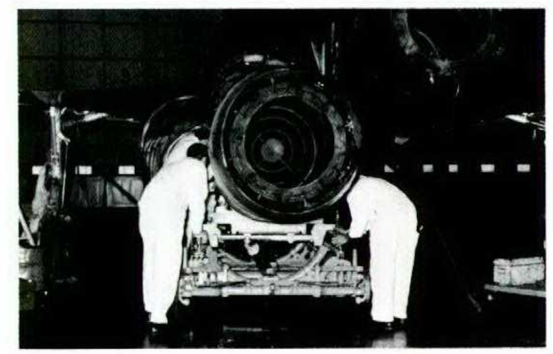
Adding support to the maintenance section are many specialty shops where many necessary, but behind the scenes tasks are performed. A few of these are the sheet metal shop, welding shop, paint shop, electronics shop and component shop.

In 1920 the rule was, don't take the machine into the air unless you are satisfied it will fly. Just as the seat of the pants flying of those days has been transformed into a highly specialized skill, so the maintenance of aircraft has progressed to a technically precise science. ■









The Flight Safety Survey

by Capt D.J. Batcock

Flight Safety Survey at De Havilland Canada. L to R: G. Neal, Flight Operations, DHC; Capt D.J. Batcock, DFS; Capt V.R. Cottrell, 3CFTSA/HQ; A. Downey, Quality Assurance Mgr, DHC; Bill Cabell, Production, DHC; Capt K. Stratford, NDHQ/DAM(TM); Maj. A.C. Hincke, DFS; Maj R. Beers, DC 307 TSD; G.E. Nugent, 307 TSD.

An integral part of the Canadian Forces Flight Safety program is the "Flight Safety Survey", an independent review of a unit's Flight Safety program by selected members of the CF Flight Safety organization. Unfortunately, there is a tendency among some to look on the survey as a kind of spying operation, but this is not the case and indeed has never been. A survey is an investigative technique used to reveal potential hazards, unsatisfactory conditions or problem areas to responsible management personnel. These hazards can then be rectified – before they lead to an aircraft accident or incident.

In addition to accident prevention, the survey also serves as an education program for the Operational and Flight Safety organizations. Operational staffs are made aware of latest developments and aids available in the field of accident prevention and investigation, and the philosophy and policy of Flight Safety can be discussed. For their part, the Flight Safety Staff obtain first hand knowledge of a unit's operating conditions, facilities and capabilities, thereby keeping abreast of the latest 'sharp-end' conditions. Operational commands carry out formal surveys of their own units, using the guidelines in CFP 135(B) suitably amended to meet the command operational requirements. DFS is tasked to complete surveys at civilian contractors who repair and overhaul Canadian Forces aircraft, at selected NDHQ units such as AETE and the AMDU, and when requested will assist other organizations.

To be meaningfull and effective the survey must, without exception, be well planned and executed in a professional manner. The unit being surveyed is responsible for ensuring that all appropriate staff are aware of the impending survey, as well as learning who the team members are and their specialty or profession, and the purpose of the visit. Upon the arrival at a unit the survey team outlines the terms of reference, proposed method of survey and areas to be covered. At the conclusion of the survey, a debriefing notes all deficiencies and makes recommendations for rectification. A formal written report serves as appropriate guidance for management regarding items of major importance as well as action to be taken by the survey team on its return to headquarters.

As stated earlier, a good survey requires good planning. The following factors require consideration, regardless of the type of unit or facility being surveyed:

Timing The survey should not disrupt the unit activity nor conflict with inspections such as TAC EVAL, AMIT visits and Quality Assurance visits to a contractor, and it should always allow sufficient time to do a thorough job and listen to the views of the operator.

Team composition Too many people are hard to control and will usually duplicate each other's work. On the other hand, a one man survey is not practical either. Accordingly, a team should be composed of just the right mix of people, usually pilots and technical members, including a specific specialist if appropriate such as Armament or Quality assurance.

Check lists or guidelines CFP 135, chapter 5, contains a suggested guide for surveys. A survey can be based upon this and modified as required – experience indicates that guide sheets are valuable for ensuring all areas are covered, and providing ready reference at debriefing time.

Photography A camera, such as the polaroid "Land" camera which provides instant prints can be most useful, particularly at debriefing. It should be made clear to everyone concerned that any photographs taken are for the purposes of Flight Safety only and no other reason.

Debriefing An honest, factual debriefing supported by good sound recommendations is welcomed by management. Professional presentation enhances the credibility of the team, as does the formal written report which should follow the visits as soon as practical.

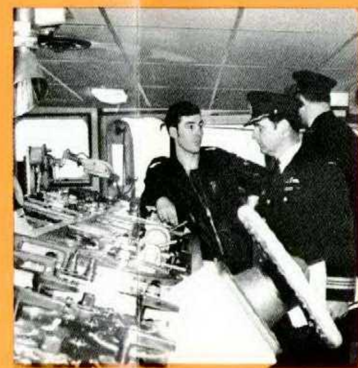
The Director of Flight Safety (as FSO to the Associate A.D.M. Mat.) has a special area of responsibility and is charged with Flight Safety Surveys at civilian contractors. Twenty such surveys have been conducted during the past two years and twelve are planned for the current year.

The survey team usually consists of two DFS staff members (an aircraft maintenance officer and a pilot) technical representatives from DGAM and the local TSA, and where test flying is involved, the Flight Test authority from AETE. Surveys usually take two to three days to complete and conclude with a debriefing to top management of the contractor.

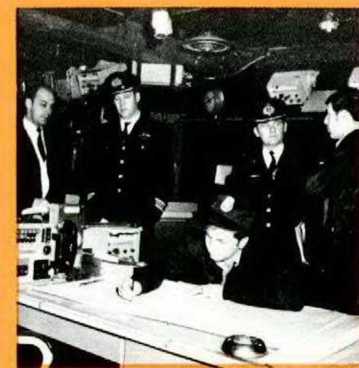
The involvement of the aerospace industry in the Flight Safety program through the work of the survey is another step towards achieving the widest possible promotion of Flight Safety awareness among people associated with CF flying. ■

At Sea – English Channel

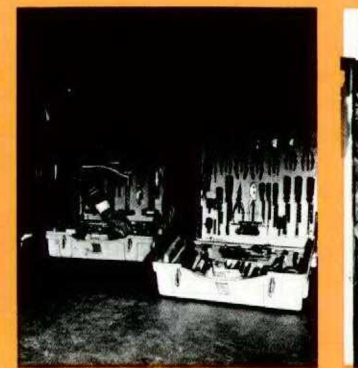
. . . Aboard HMCS Protecteur



Bridge



Operations



Tool Control

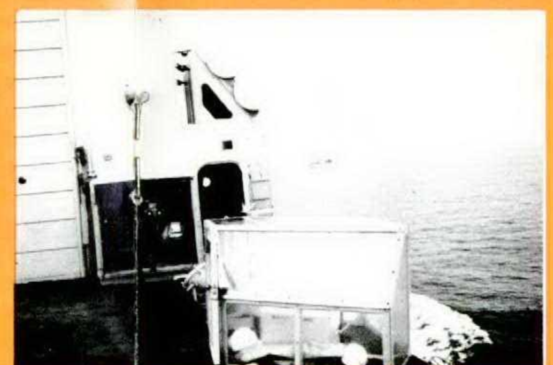
Fire Fighters

Ship's Surgeon

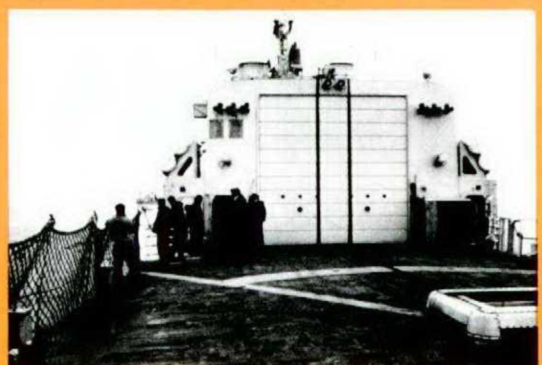
. . . Aboard HMCS Margaree

Inspecting in-flight refuelling hose

Inspecting ship-to-air refuelling kit



"Flyco" position and fuel dispenser cabinet



Flight deck hangar and bear trap –

Flight deck HMCS Margaree

canadian forces...

Aviation Fuel Quality Control

Canadian Environment

The extreme changes in the Canadian environmental conditions necessitate a strict surveillance requirement on the handling, dispensing and quality control of aviation POL products. For instance in the Northern areas where Arctic conditions exist, minus 60°F to minus 70°F temperatures are very common and up to minus 80°F under extreme conditions are also periodically experienced. These are now becoming normal operational conditions with the expansion of the CF Arctic operations. In the mid west, ambient temperatures of minus 40° to minus 65°F accompanied by an extremely dry environment are also normal occurrences during the winter months, and the handling and dispensing of aviation fuels under these conditions necessitates additional precautions due to the build up of static electrical charges. In the summer months ambient temperatures of plus 90°F with very high humidity are experienced in certain areas.

At National Defence Headquarters the Director of Aeronautical Engineering is the design authority for all aviation POL products, he is also design authority for ground filtration equipment and dispensing equipment as far as the product quality is concerned, and is also responsible for the quality surveillance of all aviation POL products at command, base and ship levels.

The integrated system has eliminated the many controversies, particularly from an aviation POL products point of view, that existed when the three elements, air, land and sea were operating independently.

Types of Aviation Fuels in Use by the CF

The main aviation fuels that are used by the CF in Canada are Canadian Government Specification Board (CGSB) 3-GP-22 (NATO F-40) and (NATO F-18) (100/130 Avgas). ASTM turbine fuel specifications Jet A, A1 and B are also used when some "into-plane" contracts are awarded to Canadian refineries. The standardized fuel for all CF turbine engine aircraft is CGSB 3-GP-22 (NATO F-40) (JP4) and all commercial turbine fuels and NATO standardized turbine fuels have also been approved for use in CF aircraft with specific instructions concerning fuel freezing points and additive and inhibitor requirements. D.Eng.RD. 2453 (NATO F-34) and D.Eng.RD. 2494 (NATO F-35) fuels are occasionally used by the CF in Germany during European deployment exercises.

There are also inhibitor and additive requirements for fuels delivered into the CF supply system in Canada. All CGSB 3-GP-22 (JP4) fuels are required to contain Fuel System Icing Inhibitor CGSB 3-GP-526 (NATO S-748) and Static Dissipator Additive which is the Shell ASA 3 additive, a proprietory product. Corrosion Inhibitors are not used by the CF in Canada since we do not have any extensive pipeline systems. As a matter of interest, these inhibitors and additives are not called up in the Canadian fuel specifications as mandatory requirements but at the purchasers' option for fuels other than the NATO standardized products. This is to satisfy commercial users who may or may not require the various inhibitors and additives.

The CF had experienced some years ago, a number of fires and explosions in refuelling vehicles being operated in the extremely cold and dry environment. The explosions were attributed to the build up of static electrical charges during fuel handling and pumping. This prompted the CF to initiate an extensive test program to evaluate the use of the Shell ASA 3 static dissipator additive and its compatibility with engine components and filtration equipment.

The evaluation and testing was carried out by the CF and the National Research Council of Canada and the results of this evaluation and testing proved that the ASA 3 additive when added to the fuel in specific proportions would reduce the fire and explosion hazards associated with static electrical charges during fuel handling and pumping. This test program also indicated that the efficiency of the filter coalescer elements was not affected by the use of the additive. The mandatory requirement for the addition of static dissipator additive in the CGSB 3-GP-22 (JP4) fuels for the CF has now been in effect for approximately 10 years. Additionally, a satisfactory CF test and evaluation program has been carried out with the use of Static Dissipator Additive (ASA 3) in 80/87 and 100/130 octane aviation gasoline.

CF Aviation Fluids Quality Control System

The CF Aviation Fluids Quality Control System involves two specific areas, quality control of the products prior to receipt and quality control after receipt by the CF which is basically the same for all major military organizations.

The Department of National Defence laboratories are used primarily for quality control testing and product qualification testing. The National Research Council laboratories which are not part of the Department of National Defence are used for research and development and verification testing, and any special projects of a non routine nature. Filter/Separator element testing and qualification is included in this category.

Quality control prior to receipt is administered by the Director General Quality Assurance to ensure that the contractor meets the requirements of the Department of National Defence Specification 1018. This specification requires that a contractor controls the quality of his product, not only during manufacture, but at subsequent stages of handling to the final point of delivery. Therefore a contractor's system of quality control must extend to facilities and activities such as storage and "into-plane" delivery, and the Director General Quality Assurance evaluation and approval of his system must include these facilities and activities.

Under the control of the Director General Quality Assurance are various Canadian Forces Technical Services Detachments (CFTSDs) which are responsible for the approval of the contractor's facility, inspection and quality control organization. The TSDs are also responsible for the subsequent quality surveillance of the refinery processes, procedures and CF "into-plane" fuel contracts.

The TSDs are the military links as far as quality is concerned between the refineries and National Defence Headquarters Aviation Petroleum Products Design Authority. They are also responsible through the Director General Quality Assurance for notifying the design authority of any potential problem areas and changes in refinery processes and procedures that could eventually affect the end use of the products.

The responsibility for aviation fuel quality control is transferred from the TSD to the Base Commander or Ship's Captain when the fuel reaches the base or ship receiving terminal. This responsibility is then exercised by the base or ships Aviation Fluids Services Officer.

The Aviation Fluids Services Officer is normally an officer or NCO with an aeronautical or marine engineering background. An Aviation Fluids Services Officer is appointed at National Defence Headquarters and each Command headquarters and at each base and ship that dispenses aviation POL products, and the duties of these officers are detailed in Canadian Forces Administrative Order 4-7.

Basically the Aviation Fluids Services Officer is responsible for ensuring that the quality and identity of aviation POL products is preserved and that the storage, dispensing systems and equipment continue to maintain the desired quality standard of these products. He also coordinates the responsibilities of the various CF sections associated with the handling of these products and ensures that the responsible personnel are fully trained. Inspections of the base and ship aviation fuel and other aviation POL products storage and dispensing facilities are carried out periodically and reports are submitted to National Defence Headquarters on a quarterly basis. The Aviation Fluids Services Officer concept was introduced into the CF many years ago when it was realized that the responsibilities of the various sections required some coordination, as we all know the maintenance of the original quality of aviation POL products depends on the efforts of many sections of a military organization.

Test Procedures and Methods

There are four field checks that are carried out on a normal routine basis, namely particulate matter contamination, water contamination, static dissipator additive content and fuel system icing inhibitor content.

A field test kit using Millipore membranes is used for the particulate matter contamination checks at CF bases and ships. However this method is unsatisfactory for shipboard use since the membrane monitors have to be precision weighed in a laboratory. The CF carried out an evaluation of the AEL Mk III Particulate Matter Contamination Detector for shipboard use, and all CF operational support ships will be equipped with this detector.

The check for undissolved water in aviation fuel is carried out with the Shell water detector and the Esso hydro kit. The Aqua Glo Series II detector has been evaluated and may be adopted for field use in the CF.

The static dissipator additive content is checked in accordance with ASTM Method D2624 using the Maihak Conductivity indicator.

The fuel system icing inhibitor content is checked periodically by the submission of fuel samples to a laboratory. However NDHQ have evaluated a colorimetric method developed by the National Research Council for possible field use, for the determination of the fuel system icing inhibitor content in aviation turbine fuels. The adoption of this method for general field use is being considered.

The CF also have many aviation fuel caches in the Northern regions of Canada which are used by search and rescue aircraft and other aircraft involved in northern surveillance. Many of these caches consist of drummed products and in some areas small bulk storage tanks are used. The quality surveillance of the products in these areas is carried out by the Director General Quality Assurance approximately every 18 months.

The aviation fuel costs to a military organization takes a major slice out of the defence budget and a fairly high percentage of these costs are expended on the quality control of the products.

It is therefore, only by continual cooperation between the Industry and the Military, and the continual surveillance and updating of our quality control procedures and techniques that we can be assured that the quality of the products entering the tanks of our multi-million dollar weapons systems will not jeopardize flight safety or the operational efficiency of the systems.

More Laws by Murphy

In any field of scientific endeavour, anything that can go wrong will go wrong.

Left to themselves, things always go from bad to worse.

If there is a possibility of several things going wrong, the one that will go wrong, is the one that will do the most damage.

Nature always sides with the hidden flaw.

If everything seems to be going well, you have obviously overlooked something.

O'toole's Law: Murphy was an optimist.

Flash-back

A Personal Experience

Many years ago when I was employed as a flight engineer on multi-engine aircraft, an incident occurred which proved to me that it pays to stay awake in ground school. That chance statement by an instructor, although possibly trivial sounding at the time, could prove to be a life saver later on.

After a 10-hour day at 20,000', were were returning to base with enough fuel to make our destination and the alternate. Some 30 miles from base we finally made radio contact, and were advised that weather conditions had deteriorated badly in the last hour, but that a GCA might just be possible. So we flew the GCA, but were unable to pick up the runway environment at minimum altitude. The aircraft captain carried out a missed approach and we proceeded to our alternate, where weather conditions were reported to be somewhat better. The navigator passed the heading and ETA, while I recalculated fuel available. We had enough – plus ten minute's fuel to spare.

Conditions enroute to our alternate were not encouraging; we were IFR and the weather appeared to be getting worse, but having no other choices, we continued. Then, just as we reached the half-way point, we experienced a massive electrical failure which resulted in the loss of our main communication system and all compass systems except the standby compass. Now we were really getting into a bind.

We continued, using the standby compass for guidance. The navigator was confident we were on track, but when the ETA elapsed, we found ourselves in extremely bad weather conditions with no sign visual or otherwise, of the alternate. Electrical failure, low fuel, a very fatigued crew, and lost, we were in a bind, no question about it. As if things weren't bad enough already, the navigator then panicked; we were lost, it was his fault, no navigation aids, no ground or star references and a critical fuel situation.

The aircraft captain then decided that if we did not make some sort of communication contact shortly we would have no other choice but to abandon the aircraft. Another crisis then developed – one crew member had lost his parachute! I suddenly realized I was very scared, but I did not relish the idea of abandoning the aircraft in the middle of the night, over unknown land or water and possibly hundreds of miles from civilization. At that point a thought crossed my mind: in training school an instructor once said, "If you ever run out of fuel, you can gain endurance at the expense of airspeed by shutting down two engines. Each situation will be different and you will have to adapt your own to suit". We were in just that situation! We needed time to become oriented and somehow obtain a fix. I discussed the situation with the captain and we decided to shut down two engines, reduce airspeed to 10 kts above stalling speed, set up a square pattern and transmit "blind", hoping someone somewhere would hear us. In the meantime I used all the tricks I knew to lean out the engine mixture to gain 'air miles per gallon'. Some fifteen minutes had elapsed when the 2nd navigator said "I think I've got something, steer 090° and descend to 1000'." We followed his instructions and shortly, off in the distance, we saw an aerodrome.

As we re-started the engines I thought to myself of the importance of paying attention during classes. Those chance remarks made by an instructor could save your life – and the lives of your crewmembers.

GET INVOLVED WITH THE MAID*

The MAID format has been revised in an attempt to make it more readable. Some of the major revisions:

- **Fewer abbreviations.**
- **More complete narrative.**
- **Grouping of aircraft into four major categories: Piston, Jet, Turboprop and**
- **Helicopters.**
- **An index to help you to locate aircraft types.**
- **A reduction in the number of pages by minimizing wasted space.**

*Monthly Accident Incident Digest

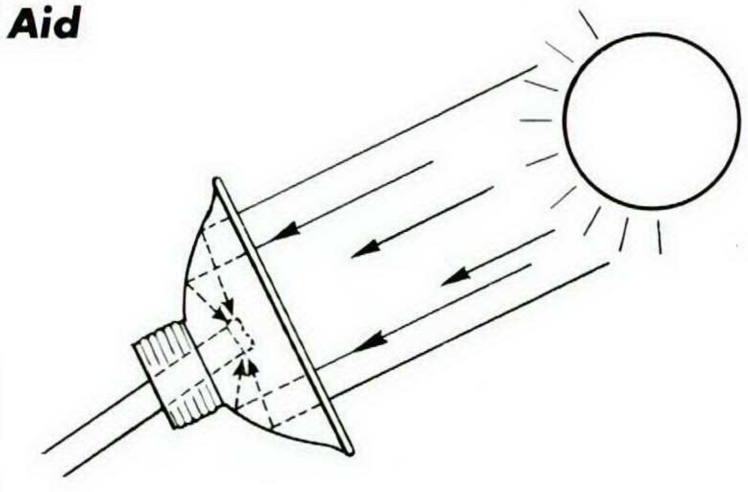
WHAT DOES MAID CONTAIN?

MAID includes a short narrative of the available information on accidents and incidents that occurred in the month being reported upon. Some cases may not be finalized when the publication goes to press, but your FSO can get you information on these through Flight Safety channels.

HOW CAN IT HELP YOU?

It can allow you to come to terms with problems that others have faced in the past – problems that you may have to face in the future. By vividly imagining your reaction to the problem (correct we hope) you will be taking a major step toward preparing yourself for a similar occurrence.

Survival Aid



An emergency method of lighting a fire is by means of a flashlight reflector. The two cell flashlight with a two-inch reflector is suitable. Any flashlight with a larger reflector is better, any smaller makes success more difficult.

Remove the reflector and insert the item to be ignited through the bulb opening and point the reflector toward the sun. The focal point of the reflector can be located by reference to the filament position of the bulb normally fitted. Correct orientation toward the sun can be gauged by observing the rings of light which appear in the reflector, they should be concentric with the reflector's axis. For greatest concentration of heat, hold the tip of the item to be ignited at the focal point.

The skeptical can only go ahead and try it, with a suitable, shiny, reflector it works well.

RAAF Flight Digest

"Oh, My Aching Back"

What causes back trouble, particularly as it relates to pilots, and what can be done to prevent it? Could it be from long hours of sitting at the controls? These are some of the questions which prompted this article. In addition to the points discussed in the article, obesity and prolonged sitting or standing in one position are important predispositions to backache. Probably the most common cause of acute back strain and severe backache is rotational stress. That is, an awkward movement twisting to reach even a very light object is more conducive to back trauma than lifting a very heavy load properly.

Poorly designed seats in aircraft are also a significant cause of backache, especially on long missions.

Figure 1

"Oh, my aching back" is one of the most frequent complaints heard by doctors. But despite the fact that millions of people suffer from low back pain, it can in most instances be prevented.

The lower portion of the spine is a complicated system of vertebrae, muscles and nerves. It must not only support the weight of the upper body, but must be able to bend and twist in any direction. Consequently, it is more susceptible to strain and fatigue than other areas of the body.

When viewed from the side, the lower back in its normal position is not straight, but curved inward. Most "back trouble" occurs when the curve becomes more pronounced than normal. Trouble can usually be prevented by simply keeping the back from becoming hyper-extended, that is, over-arched.

Most over-arching occurs as a result of three things: improper lifting, poor posture; and weak supportive muscles. If you correct these, you will likely prevent most low back pain.

Careful lifting In addition to using plain common sense when lifting, there are two very important rules for safe lifting that most people don't know about. First, when lifting, *never bend forward without bending the knees.* If your knees are straight while you bend forward, as you straighten up the pelvis tends to tilt forward, causing the lower back to arch (Figure 1). Thus, picking up what would normally be considered a safe load, such as lifting a baby from its crib, or a sack of groceries from the car trunk, can cause a severe strain to the lower back.

Second, *never lift anything above the level of the elbows.* It is impossible to lift an object higher than the waist without arching the back (Figure 2). The hips must rotate forward to maintain balance, and when they do, the back arches, and a painful strain can occur.

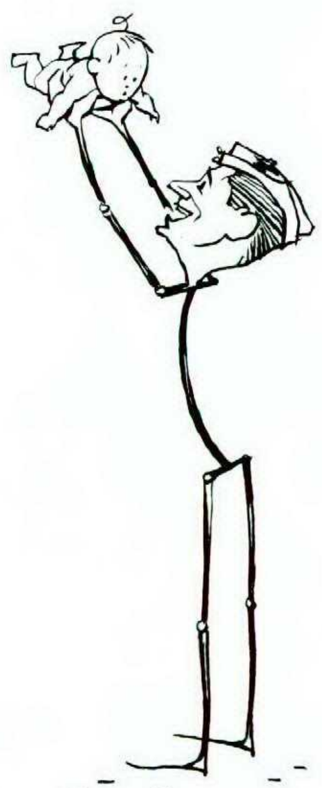


Figure 2

Good posture Poor posture results not only in strain to the low back but chronic fatigue as well. Poor posture can be corrected by following several rules regarding standing, sitting, and sleeping.

Ordinary standing is particularly hard on the back. As one becomes tired, the hips begin to sag forward, and again cause an arch in the back. High heels further increase the arching. This can easily be corrected by slightly elevating one foot (Figure 3). The Romans had the right idea when they debated on the steps of the Senate. When one foot is raised, the arch is taken out of the back. Housewives can do this by having a low stool in the kitchen.

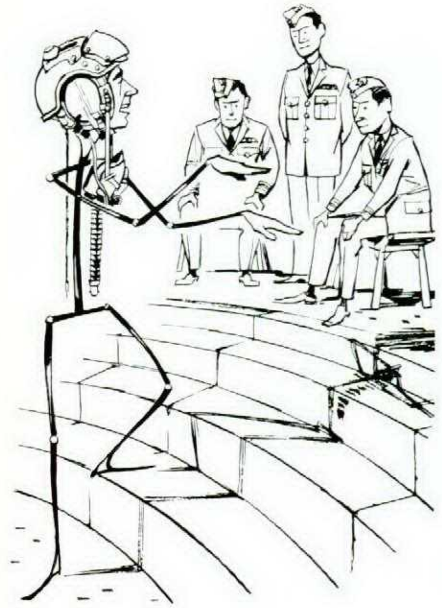


Figure 3

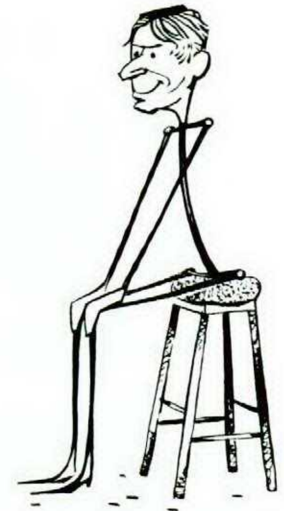


Figure 4

Poor posture that can cause backache frequently occurs while sitting. Whenever you sit, your knees should be higher than your hips. The back is arched whenever the knees are lower than the hips (Figure 4). By sitting in a lower chair, or by placing a stool under your feet, the arch is eliminated. When flying, the seat should be as close to the controls as is practical (Figures 5 & 5A). The same holds for driving an automobile.

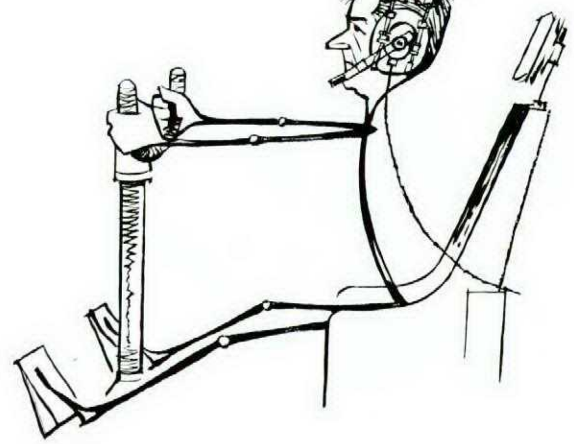


Figure 5

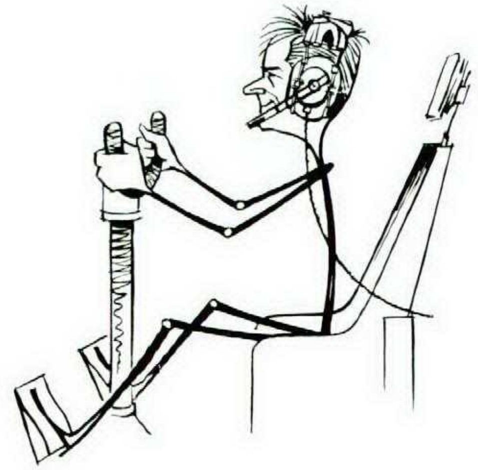


Figure 5A

Incorrect sleeping habits can also cause low back pain. Sleeping on the abdomen causes the back to arch, even on a firm mattress (Figure 6). Even sleeping on the back causes arching when the backs of the knees are in contact with the mattress (Figure 7). Two correct ways to sleep are lying on your side with your hips and knees bent and your head supported by a pillow (Figure 8), and lying on your back with a pillow under your knees (Figure 9).

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Figure 6

Figure 7

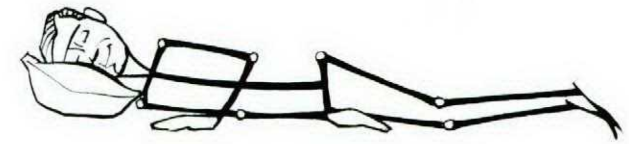

Figure 8

Figure 9

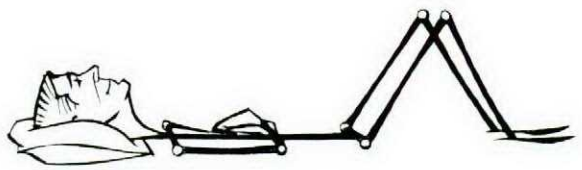

Figure 10

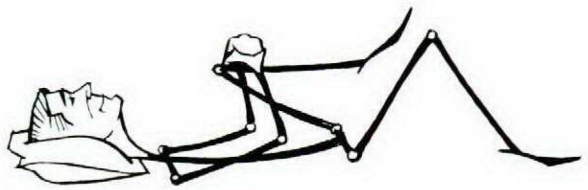

Figure 11

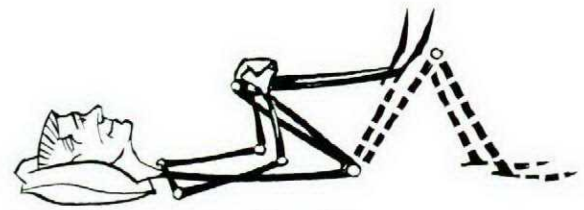

Figure 12

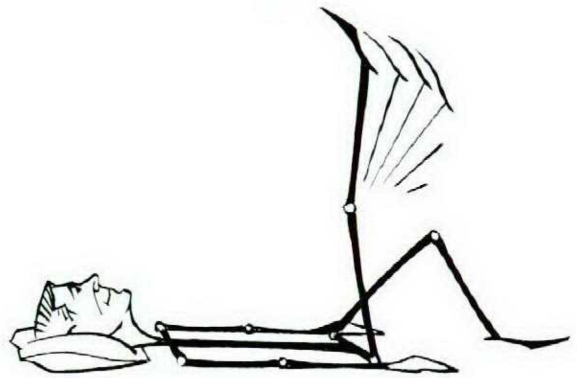

Figure 13

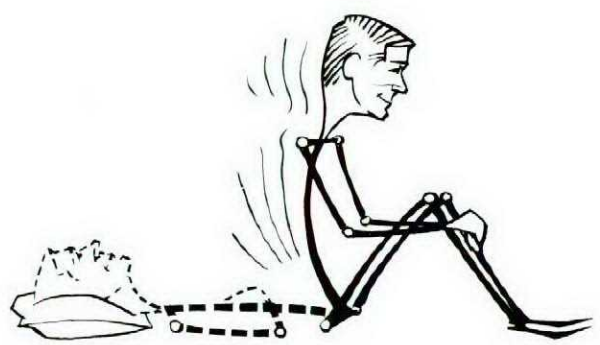

Figure 14

Weak Supportive Muscles Proper support of the back is maintained primarily by the abdominal muscles. If they become weak through lack of exercise, posture suffers. As a result the hips rotate forward, the back arches, and the muscles become shortened.

We have, therefore, selected several exercises to strengthen the abdominal muscles and stretch the contracted back muscles. Start off slowly, doing what you can comfortably do. Gradually increase the number of repetitions of each exercise. The routine should be done two to three times a day.

All exercises should be started with feet flat on the floor, neck comfortably supported (Figure 10).

Exercise 1 Draw one knee up to the chest. Pull on the shin with the hands until the buttock is lifted (Figure 11). Return to the starting position and do the same with the other leg. Repeat 10-20 times.

Exercise 2 Draw both knees up to the chest. Grasp the knees with the hands and pull them as close to the chest as possible (Figure 12). Hold this position for several seconds. Repeat 8-10 times.

Exercise 3 Draw one knee up to the chest. Then, straighten the leg as much as possible (Figure 13). Repeat 10-20 times with each leg.

Exercise 4 With feet held in position, curve up to a sitting position (Figure 14) and then roll back down. Do not do this exercise with the knees straight. Repeat this as many times as you comfortably can.

In conclusion, it should be noted that these exercises are presented to help you keep from having back trouble. If you already have it, it is wise to seek the advice of an orthopedic surgeon. There are conditions in which exercise may be detrimental, hence professional advice should be sought before doing any exercises.

AVIATION MEDICAL BULLETIN

Eye bone connected to the ear bone...

It was emphasized that the loss of hearing while wearing helmets on the flight line can be counteracted by extra eyeballing.

The Flight Safety Committee

On the Dials

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

NORDO Procedures

We recently received a letter from one of the bases which informed us of a possibly confusing situation. The situation concerns arrival of NORDO aircraft at an airport and the procedure that tower personnel expect to see. The confusion is caused by four different published procedures. The intent of this article is to explain the four procedures and how to apply them.

The following list explains the procedures and indicates the source:

1. "Join the circuit in the approved pattern and fly across the aerodrome in the direction of the intended landing at a height not exceeding 1000 feet AGL, rocking the wings laterally". (Reference: CFP 100 Article 655.2)
2. "Fly the aircraft past the tower, if possible alongside the runway parallel to the landing direction at a height of 500 feet with all available lights flashing, slowly rocking the wings until the up-wind end of the runway is reached. Climb and turn down-wind checking for a light or pyrotechnic from the tower or mobile control (if available)". (Reference: GPH 205 Page B-70)
3. "Arriving NORDO aircraft will join the traffic pattern and conform to the traffic pattern without being given any signal. Only authorized visual signals are to be employed". i.e. standard light signals. (Reference: MOT Air Traffic Control Manual of Operations)
4. "The pilot shall approach the traffic circuit from the up-wind side of the runway, enter cross-wind at circuit height abeam a point approximately midway between each end of the runway and join the circuit on the down-wind leg. If it is necessary for a flight to cross the aerodrome prior to entering cross-wind, this shall be done well above circuit height and descent to circuit height should be made in the up-wind area of the active runway". (Reference: MOT Flight Information Manual Article 6.32).

The pilot, at first glance would think he had to choose one of the four procedures, depending on the situation. In reality he has only to choose one of two procedures, the determining factor being the agency that controls the traffic pattern. If the controlling agency is DND then procedures 1 and 2 apply. If the controlling agency is MOT, 3 and 4 apply. The basic differences between MOT and DND are the altitude to fly alongside the runway and when to turn cross-wind.

Although 1 and 2 are worded differently, the intent is the same. Enter initial, fly over the runway (parallel if possible) at an altitude not exceeding 1000 feet, preferably 500 feet above ground, rocking the wings. At the far end of the runway turn and climb to a down-wind leg and watch for a light signal. See figure 1 (all patterns left hand).

If landing NORDO at an MOT controlled aerodrome see figure 2.

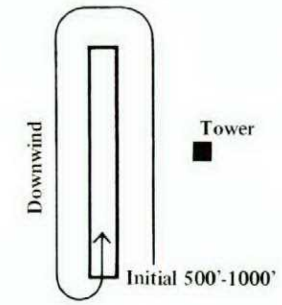

FIG 1 DND

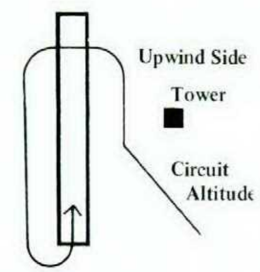

FIG 2 MOT

Enter and fly alongside the runway at ***circuit height*** and on the up-wind side. Turn cross-wind midway between each end of the runway and join down-wind. Again watch for light signals.

Hopefully this has clarified this situation. In addition we are attempting to re-word the publications to avoid any further confusion.

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be maximal. The onset of the illusion is 30 to 60 seconds after the stimulus; the illusion remains during constant stimulation and ends immediately on cessation of the stimulus; therefore, reorientation should occur immediately on cessation of the flight manoeuvre.

The dark night takeoff illusion has caused many accidents, and "dark night takeoff accidents" continue to occur both in military and civil aviation. Perhaps the accident record is some indication of inadequate understanding of the phenomenon at the training, operational, and accident investigation levels.

It is difficult to demonstrate this illusion in trainers or simulators since the essential element of the "dark night takeoff accident" is pilot inattention to flight instruments in conditions which tempt the pilot to "fly visual". Whether a well-designed attitude instrument will suppress this illusion to the same magnitude as a pilot well indoctrinated in flight instruments is open to conjecture. If there is a general lesson to be learned from study of "dark night takeoff accidents" it is this: Long pilot experience is no certain protection. Instead, the answer is a pilot who has an awareness of conditions conducive to disorientation and is well disciplined in instrument flight.

The MAC Flyer

Gen from Two-Ten

T33, MAX BRAKING – BLOWN TIRE The flight, a back seat check-out, concluded with a practice minimum roll, full-stop landing. As the back seat pilot was applying maximum braking, the left tire blew, damaging various parts of the wheel assembly.

The mishap again focussed attention on the philosophy subscribed to by some operators that maximum training benefits can only be achieved by actually practising the complete emergency procedure. The contrary of this view has been implemented in basic training for a number of years, an example being the method employed in teaching minimum roll landings in the Tutor. In essence, the Tutor "How-To-Fly Book" says, emergency procedures are to be used only under actual conditions. For practice purposes the after-landing technique will be stated rather than performed.

Concern has been expressed in many instances in the past that practising the complete emergency procedure often has accident potential far outweighing the training benefits. Maximum braking during practice minimum roll landings is a case in point.

T33, CANOPY JETTISON Shortly after the aircraft cleared the runway following a cross-country student training flight, one of the tower controllers informed the instructor that there was smoke coming from the rear of the aircraft, a fact the instructor was able to confirm visually. All instrument readings were normal but when a further check with the tower revealed the continued presence of smoke, the instructor shut down and directed his student to abandon the aircraft.

An additional problem now confronted them; they were unable to raise the canopy. Repeated selections of the locking mechanism brought no response; the electrical selector seemed inoperative. Thus, with the apparent urgency of the situation precluding the time consuming operation of the manual cranking system, the instructor jettisoned the canopy using the alternate jettison handle. The canopy struck the rear of the

aircraft during its flight causing considerable damage, but the crew escaped uninjured.

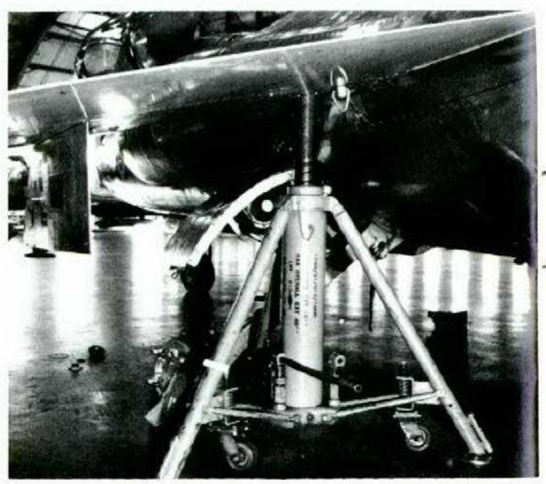
Investigation into the cause of the smoke led to a Ground Test Selector Valve which had failed in flight, permitting hydraulic fluid to pass into the emergency system where it caused the emergency reservoir to overflow. The vented fluid accumulated in the aft section, became heated and created the smoke.

The apparent failure of the canopy to unlock and raise electrically could not be duplicated; all parts of the system checked serviceable. However the investigation did zero in on the fact that it was common practice for T33 instructors to operate the canopy *lock/unlock* handle from the back seat by using the canopy latching linkage, rather than the stowed handle provided. The T33 canopy handle when rotated to *unlock*, operates the latching mechanism from the *fully closed*, to a *detent* position, to the *fully open* position. The canopy warning light is energized with the latch mechanism in the *detent* position, however in this position the canopy cannot be raised electrically because the canopy raise circuit is not energized. The investigation concluded that the instructor in the rear cockpit, in attempting to open the canopy using the latching linkage, actually placed the mechanism in the detent position. As a result the mechanism was not fully unlocked and the canopy could not be raised electrically necessitating the jettison of the canopy.

CF104, WING PUNCTURE The aircraft had been towed into the hangar for a brake change, a job the technician began by jacking the left side using a wing jack. He then positioned an axle jack at the jacking point on the left main wheel to raise the wheel clear of the floor. Next, he removed the wheel, and was in the process of taking bolts out of the brake when the aircraft suddenly lurched, the axle jack skidded out from under the oleo, and the wing jack slipped off the jacking post, puncturing the wing as the aircraft dropped on it.

By employing the wing jack (a non-standard procedure) the technician had endeavoured to add an additional safety factor to compensate for the full fuel load (23,000 lbs) carried by the aircraft. What he didn't account for was the fact that the aircraft had undergone a significant temperature change, having been towed in from the -10°F flight line about an hour earlier. The 85°F temperature change eventually led to a sudden extension of the liquid spring in the left oleo which in turn dislodged the jacks.

This accident is an example of how easily one can get caught out using non-standard procedures, despite one's best intentions.



MUSKETEER, WING DING Following an engine run-up the Musketeer was towed into the hangar and because access to the parking bay was blocked by other equipment, the towing crew parked the aircraft just inside the hangar door. They then shut down the towing mule, set the park brake and proceeded to close the hangar doors. Meanwhile, an aircraft lifting operation being carried out nearby to test the Musketeer recovery trailer had just been completed and a member of the lifting crew was instructed to move the recovery trailer when a mule became available. He selected the one which had been used to pull the Musketeer into the hangar and drove off to the recovery trailer – with the Musketeer in tow! With the windows on the mule closed and the heater on full, it was next to impossible for the driver to hear warning shouts by the other towing crew. He finally became aware of the aircraft behind him when its left wing crunched into a metal locker along the hangar wall shattering the wingtip and buckling skin approximately 10" in from the tip.

This marked the second time in little more than a year that a towing vehicle was driven off with something inadvertently in tow (in the previous instance the driver knew he had a hydraulic test stand in tow; what he didn't know was that a CF104, behind closed hangar doors, was attached to the hydraulic unit). In both instances the cause was very basic to say the least, as consequently, were the preventive measures implemented in the aftermath:

- Written instructions now require operators of towing vehicles to inspect towing hitches for either proper coupling or detachment prior to moving off.
- Mules are now parked in an area of the hangar marked "uncoupled".

FALCON, LANDING GEAR COLLAPSE Following takeoff the landing gear was selected up, but the left main gear continued to indicate down and locked. The sequencing of the other gear to the up and locked position appeared normal so the pilot recycled the gear, but the results were the same with the left main showing down and locked throughout the cycling. The captain then decided to return to base.

The final down selection appeared to sequence normally and the cockpit indications showed three wheels down and locked. The touchdown was smooth, then almost immediately the left wing began to drop and the left landing gear folded. The aircraft came to a stop on the runway with no injuries to passengers or

crew and some damage to the left wing and landing gear components.

Subsequent examination of the left MLG downlock switch show that it was corroded and contained moisture. Tests proved that the switch would not return to the off position when subjected to below freezing temperatures. Malfunction of the switch caused hydraulic pressure to the left landing gear to be cut off before the gear was locked into position. The net result for the crew was that a down and locked indication appeared on the cockpit indicator when the gear was not locked down.

A Service Bulletin dated 28 Mar 69 had recommended filling all downlock microswitches with silicon-base grease to improve cold weather resistance. Although implementation had been recommended by the Command, it had not yet been actioned at NDHQ. The instructions of the Service Bulletin have since been implemented.

T33, ARMAMENT DOOR – AGAIN Shortly after takeoff from Gander as the aircraft was climbing through 6000 feet, a loud bang startled the crew and the captain immediately noted the left armament door lift about three inches at the rear. He selected speed brakes out, reduced speed to 180K and declared an emergency. A short time later

he landed safely without having encountered any abnormal flying characteristics.

Reconstruction of the events leading up to this incident revealed that the pilot had encountered a series of frustrations which had extended over a period of three days. He had flown in two days previously to deliver a safety systems tech who was required to pack two CF101 drag chutes. His plan was to do a quick turnaround and RTB, however he lost normal UHF inbound to Gander.

Another T33 was then dispatched from the squadron, this one carrying a telecom tech. After the tech had repaired the radios the pilot prepared to return to base, (he was authorized to return in formation if the radios could not be repaired) but now the aircraft failed to start. After two unsuccessful start attempts he discovered that the wrong type of starting unit was being employed. Darkness was approaching when at last he got the bird fired up, but the radios were again unserviceable, and since he was not authorized for night formation, the return had to be cancelled until next day.

Next morning after the technician did some more work on the radios in the nose area and the pilot did another external, the flight got underway, but somehow two unlocked fasteners on the armament door escaped detection during the pre-flight.

The moral of this episode is that when things have started to go wrong and delays lead to frustration, watch out! That set of circumstances is almost guaranteed to lead to an interrupted procedures mix-up.

Comments to the editor

Next Year

Due to unforeseen circumstances, the 416 AW(F) Squadron Colours cannot be made available by the date selected for the Reunion and Colours Presentation. Regretfully, it has been decided that in view of Squadron commitments, this event must be postponed from the spring of 1973 for a period of approximately one year.

LCol J.W. Twambley
C.O. 416 Sqn
CFB Chatham

Fudge Factor? –

I was mildly surprised as I read the Close Call article (Jan-Feb '73 issue), in which the aircrew involved had delayed takeoff because of a 700' AGL ceiling and reduced visibility in light rain and fog. Everyone has their own limits, I thought, and I looked to see who the author was. Goodness – an OC Flying Standards and the BFSO. I was even more surprised when I reached the first of the "lessons to be learned" which, while it is quite correct, does not differ much from the old adage about increasing flight safety by keeping 'em in the barn.

When Flight Safety and Mission Accomplishment go hand-in-hand, minima must be met but, unless there is other information available, no allowances should be added on to compensate for possible in-flight equipment failures, etc.

Surely CFP 100 deals with this subject adequately?

Capt J.C. Blair
ADC Headquarters
CFB North Bay

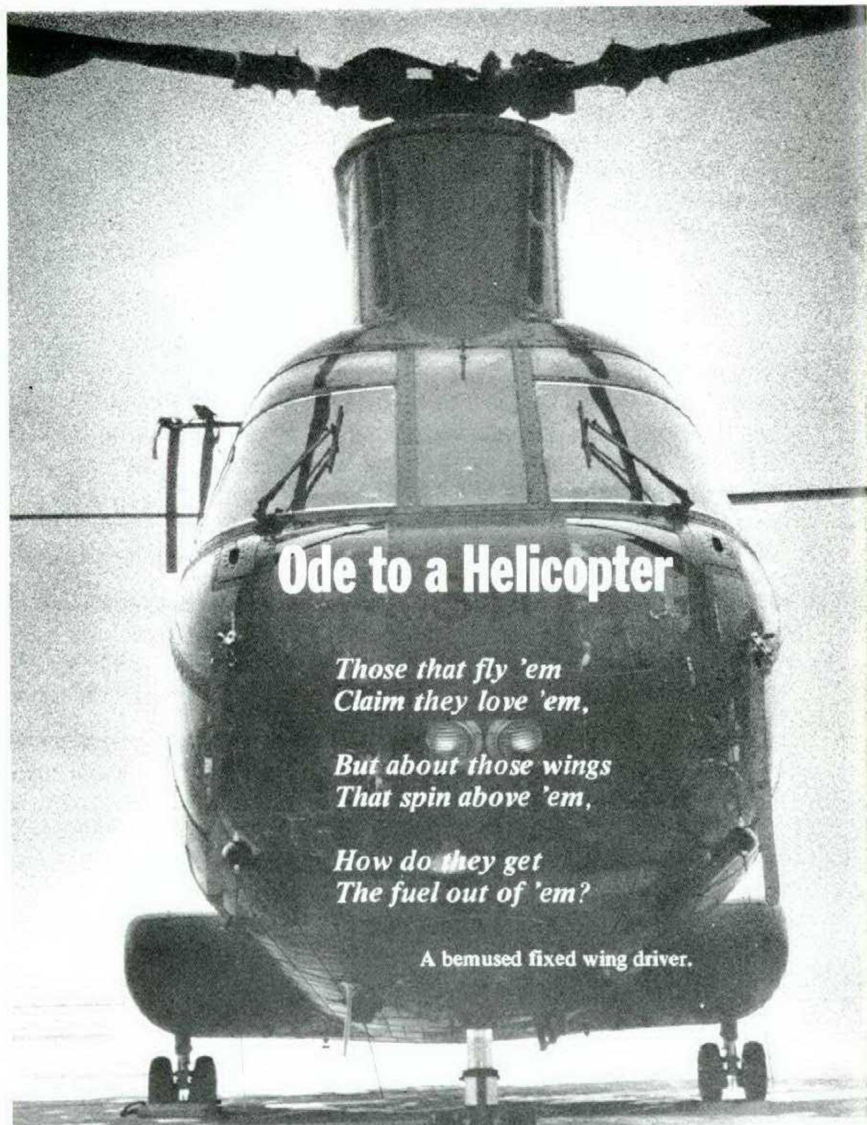
The major weather problem confronting the two pilots that morning was poor visibility, a point not clearly specified in the article. Until near noon it fluctuated from 1/4 to 1/3 to 1/2 mile.

Wand Failure – What to do

The Marshalling Signals Charts (CF748 – All Aircraft, and CF749 – Rotary Wing Aircraft) which appeared on the back cover of the Nov-Dec and Jan-Feb issues of Flight Comment omit an important point in night-time marshalling procedures. The point is, what to do when one wand fails? The answer can be found in AMO-00-10-2; the marshaller extinguishes the serviceable wand and the pilot stops taxiing.

I feel that this should be included on the Marshalling Signals Charts as it is an important point in marshalling procedures. A wand failure could lead to serious consequences if a marshaller continued marshalling with the serviceable one.

Cpl W.C. Abbott
CFB Chatham



BIRD WATCHERS' CORNER

FLYING FIDDLER

If you don't know what it does, don't fool with it goes the saying. But behold a non-believer, a birdland curiosity of renown whose dominant characteristic is an apparently uncontrollable addiction to airborne trouble shooting. Many birdwatchers attribute this character trait to a secret belief held by Fiddlers that they are a sub-species of the family *Testpilotus*. Thus, though well meaning, their attempts to apply airborne fixes to every malfunction, frequently lead them to situations beyond their capability—sometimes with spectacular attention-getting results which destroy evidence that might have aided professional ground-bound fixers. In the aftermath rises the Fiddlers' undaunted call;

RADIO-RADAR-AUTOPILOT-BIFFY WE-CAN-FIX-IT-IN-A-JIFFY

TOOL CONTROL

How Does Your Unit Fare?