RESTRICTED

CRASH COMMENT

DFS

FIRST QUARTER - 1953

ISSUED BY
DIRECTORATE OF FLIGHT SAFETY
R. C. A. F. HEADQUARTERS, OTTAWA, ONT.

FOREWORD

Materiel and maintenance failures resulting in crashes have been reduced 50% in the last year. This is a very commendable improvement and is due mainly to the conscientious efforts of those employed in the engineering branches throughout the Air Force.

This broad field includes Air Force Headquarters, Air Materiel Command and the staffs actually servicing the aircraft. These persons form part of a vital chain whose links include not only the field personnel, the inspectors, the engineering and supply staffs but all those responsible for the ground handling of the aircraft.

The responsibility stems from Air Force Headquarters which outlines policy in general terms and passes the task to Air Materiel Command to implement. AMC provides a quality control staff to ensure in the first instance that manufacturers are properly inspecting all airborne components. The engineering and supply staffs of AMC catalogue each component, determine the probable number of spares required and take provisioning action. Engineering orders are written at AMC to ensure the proper operation and maintenance of almost every piece of equipment in the RCAF.

The whole function of engineering, supply and maintenance is not a one shot device that is finished when the equipment reaches the field, but one that requires constant vigilance and modification. It is extremely important that this be continuous since unforeseen troubles almost always occur after the article is in use. When trouble does occur AMC's quality control staff, its test house, its engineers and its supply components co-ordinate rapidly and efficiently to correct the source of the difficulty. Few persons outside of AMTS division and AMC realize the vast effort required to ensure continuity of safety.

In this editorial I seize the opportunity of praising those overworked, patient and efficient engineering staffs that comprise the backbone of each flying unit. In the final analysis it is their efforts as much as any other that can reduce crashes caused by faulty materiel or maintenance. The servicing staffs are continually being pushed to produce more and more flying hours from each aircraft and it is to their credit that this is being done with a concurrent reduction in crashes attributable to their work.

(H.B. Godwin) A/V/M
Air Officer Commanding
Air Materiel Command

EDITORIAL

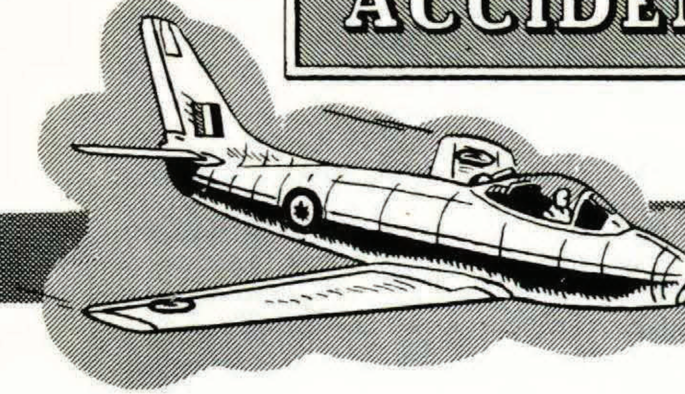
We were very pleased to observe from the statistics within the Annual Flying Accident Review for the fiscal year 1951-52, the great improvement in ''maintenance'' and ''materiel'' accident causes. We therefore consider ourselves very fortunate in obtaining a foreward to this issue from Air Vice Marshal H.B. Godwin, CBE, CD, the Air Officer Commanding, Air Materiel Command.

Many of us in the Air Force take for granted the airmen and the NCOs who handle the nuts and bolts in the supply section; who sketch on the drafting board; who run a bulldozer; who get the meals; who maintain our aircraft and its supporting ground services; or even those who sweep the floors or fly a desk. We are too prone to think of efficiency only as someone's ability to fly an aircraft, whereas the flight of an aircraft on its appointed mission is the outward and visible sign of teamwork.

The successful completion of any flying operation can only be accomplished by the support of all personnel of the Air Force, whose primary objective is service to the operator.

In this issue, therefore, we salute the airmen, the airwomen the NCOs, and the officers who provide these services.

ACCIDENT RESUMÉ



SABRE

NO. 1 - UNDERSHOOT VICTIM

The pilot while executing a tight circuit under poor visibility conditions, allowed his speed and height to fall dangerously low. The Sabre struck the airfield boundary fence while still turning onto the runway causing considerable damage to the port undercarriage and wing. The pilot touched down about 100 yards short of the runway. All pilots must be aware by now of the inherent danger of undershooting in jet aircraft. This boundary fence is being clearly marked for both day and night operations.

NO. 2 - PORPOISING

While flying at an altitude of 6500 feet at about 450 knots IAS using 90% thrust the Sabre suddenly nosed down. Then the aircraft proceeded to imitate a playful porpoise. The pilot reduced power and switched off the elevator trim suspecting trouble in the electrical trim switch on the control column. The violent porpoising continued for at least twenty oscillations down to a height of 2500 feet before it petered out. The pilot climbed to 6000 feet and on levelling off the porpoising recurred. The pilot released the control column and the porpoising gradually subsided. The accelerometer registered from +5 to -2 ''g'' as a result of the violent pitching.

Technical examination revealed the elevator cables to be slack. The elevator cables should have been checked for tension on the last periodic inspection which was completed on this Sabre one hour before the porpoising occurred. The cause of this accident, which could have been very serious, has been assessed as ''Maintenance''. Elevator cables on the Sabre are now checked and retensioned every 50 hours to ensure this potential accident hazard of slack control cables is eliminated.

(1)

NO. 3 -- FLAPS

On a practise overshoot the pilot allowed the airspeed to exceed 185 knots before raising the flaps. Damage resulted to the flap tracks and the trailing edge of the wing. This type of accident is due to sheer carelessness.

NO. 4 -- INCOMPLETE EXTERNAL CHECK

After an authorized training flight the pilot noticed that an inspection panel had blown off. Only two of the six Dzus fasteners securing the panel had been engaged. The primary cause of this accident has been assessed "Pilot Error" because the pilot did not check the positioning lines of the Dzus fasteners on this panel on his pre-flight external check. The secondary cause was "Maintenance" because the technician who removed the panel for the pre-flight inspection did not ensure the panel was securely returned.

NO. 5 -- 50 YARDS SHORT

The pilot was landing number two in a two-plane formation well spaced behind the leader. The pilot made a steep final turn and levelled off quite low. The pilot realized it would be doubtful if he would make the runway, but he neglected to increase power. The aircraft settled into 12 inches of snow, 50 yards short of the runway. The nosewheel collapsed and the Sabre finished the landing run on the airscoop causing "B" category damage. Due to the depth of the snow the runway control van was not in position, otherwise this accident could have been averted. Furthermore, the snow at both ends of the runway should have been compacted before flying commenced.

NO. 6 -- EVER HEAR OF DRAG?

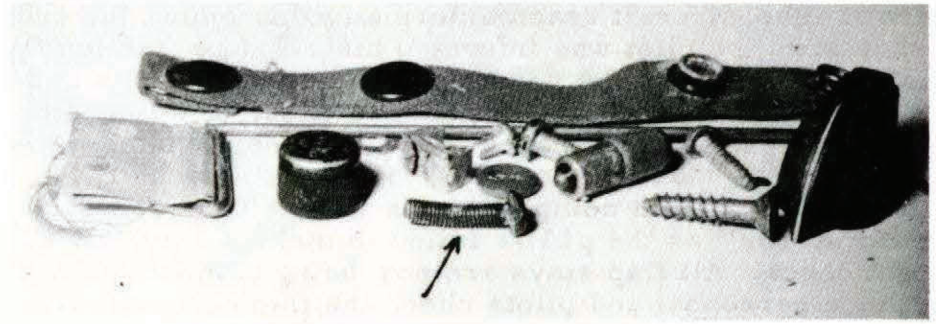
The pilot, who was acting as number two in a two-plane formation, could not understand why he required more power than his leader to stay in formation. He also noted his total fuel quantity was lower than the leader's. The post-flight external check revealed the flaps were stretched, buckled, and torn, and the flap jack forced out of position. It appears the pilot returned the flap lever to neutral

before the flaps were fully up. A visual check after raising the flaps to ensure their position, and a check for possible drag effects when falling behind in formation, would have saved one pair of flaps.

NO. 7 -- SEVERE VIBRATION

After retracing the undercarriage the pilot left the undercarriage lever in the "UP" position. While participating in a dogfight the pilot experienced severe vibration of the Sabre. He reduced power and on being informed by his section leader that his nosewheel door was missing, he returned to base. The pilot failed to return the undercarriage selector to the "Combat" position after becoming airborne. This did not de-energize the door micro switches. The micro switches for the Sabre undercarriage doors are energized during an "UP" or "DOWN" selection. When "g" forces were applied to this Sabre, the nosewheel door micro switch was momentarily activated. The nosewheel door opened and was torn off by the slipstream.

NO. 8 -- JAMMED CONTROLS



The pilot was making a routine engine air-test on a Sabre. During the air-test he noted that while inverted he could not get sufficient forward movement of the control column to hold up the nose. He rolled out and discovered the elevator controls were locked. The emergency trim was also locked but by continuous rocking of the control column the emergency trim resumed operation. The control column would still not move ahead of neutral. The pilot joined the circuit but was forced to overshoot when the elevator controls again locked solid. He again freed the controls and trim by rocking the stick. The pilot landed the aircraft without damage on his second attempt. On examination, numerous loose foreign objects were found under the cockpit flooring. One object (noted by the arrow in accompanying photo) was a one inch 10/32 inch screw. This screw was wedged between the control column bellcrank and the cockpit floor in such a manner as to restrict movement of the control column. A special inspection was made of all Sabre aircraft on the unit and every aircraft had some loose foreign articles somewhere in the aircraft. In one Sabre a pair of pliers was found lying above the aspirator section in close proximity to the elevator mechanism. The inherent danger in this type of situation is so obvious as to eliminate further discussion here.

CANUCK

NO. 9 -- INCOMPLETE EXTERNAL CHECK

On his pre-flight external check the pilot failed to notice that the flap jacks were not connected to the centre section flap. After starting the engines he operated the flap lever to the "UP" position and the flap position indicator moved from full down to full up. The pilot touched down once on take-off but he became airborne on the second try. The aircraft reacted normally throughout the exercise. After shut down the pilot was informed his centre section flap had been down on take-off. The wind force had blown the flap up and the jacks had pierced the flap. The primary cause of this accident has been assessed as "Maintenance", because the technician who disconnected the flap made no entry to that effect in the L.14, and he left the Canuck without completing his work. The secondary cause was "Pilot Error" as the pilot failed to make a complete external pre-flight check. All flap stays are now being painted red to ensure maintenance personnel and pilots check the flap connections.

NO. 10 -- STALL ON ROUND-OUT

While rounding out for landing the starboard wing dropped causing the starboard undercarriage to hit the runway. The starboard tire blew and there was considerable damage to the fairings and skin around the starboard wheel. This accident resulted from "Pilot Error" in that the pilot allowed the airspeed to drop too low causing a stall on round-out.

Don't Gamble with SUMMER WEATHER

by

D.G. BLACK
Meteorological Advisor, Training Command Headquarters

What does it take to become a "crack" pilot in Canada's all weather Air Force? Unfortunately, there is an all too common misconception that an all weather unit is one whose aircraft are designed and equipped to meet any emergency and the skill and knowledge of the pilot assume little significance. This is pure folly for, although an all weather airplane is equipped with numerous mechanical and electronic devices, its effective operation is dependent upon a thoroughly trained ground unit and it is manned by a pilot who is trained to use with confidence every piece of equipment and information available. He knows when to use this equipment and he knows its limitations. He must be an authority on navigation and weather in order to plan the safest and most economical flight and make proper in-flight alterations to the original flight plan, when unforeseen developments occur.

It is believed that the development of an all weather pilot commences at the Flying Training School, where the first seeds of a confident approach to weather problems must be planted. First, let it be emphasized that the weather presents a variety of serious problems, all of which can be solved if attacked properly. The risks or hazards need be few if each problem is studied carefully and approached confidently with full realization of the limitations of the aircraft and the individual. Careful and confident flight planning is essential. It should be understood that the forecast is usually correct, except for details, and that it is the best estimate that a trained specialist can make. However, it can go wrong; infrequently in whole, but more often in part. When it does, the cause of the error must be determined by the pilot before corrective in-flight action can be taken. Early recognition of these factors is basic in the development of a proper approach to weather problems.

This article will be devoted to some of the problems of summer flying weather, with particular emphasis on those applicable to flying training.

THE THUNDERSTORM PROBLEM

A VFR pilot, with his aircraft low on fuel, reached his destination to find a thunderstorm in progress over the airport. He requested and received permission to fly to an alternate aerodrome, 100 miles distant, up wind. He flew through a series of thunderstorms all the way and was forced to make an emergency landing on arrival, as his fuel tanks were completely empty. This pilot was lucky to have survived with only a severe fright. Prior to his original take-off, on a "clear" day, he had checked only the weather reports and not the forecasts. Had he checked the forecast, he would have learned that "trigger" action, caused by day time heating, would set off thunderstorms at approximately the same time throughout a large section of the air mass. He would have learned that these storms would move with the upper winds, which exceeded 30 knots and which were blowing from the direction of the alternate he had chosen. He would have known that another suitable alternate existed 100 miles downwind. Moreover, despite the ominous appearance of the sky at his destination, he would have known that the thunderstorms were of the air mass variety. Therefore, the cell could be expected to pass over the field in a few minutes and the execution of an alternate procedure would be unnecessary.

Information Available at the Forecast Office

The forecaster has a wealth of surface and upper air data which enable him to foresee the developments of thunderstorm activity. Whenever thunderstorms are mentioned in the forecast, the alert pilot will seek the answers to numerous questions before he leaves

the ground: What time are they expected along my route? What will be the height of the bases? What will be the height of the tops? Will they be in a line (along a front) or scattered throughout an air mass? In what direction are they likely to move? The answers to these and many other questions can normally be provided by the forecaster.

"Weather briefing in progress. Selected items of information available, on display".

If the pilot does not encounter the thunderstorms, he will not condemn the forecaster; he will consider himself lucky. The meteorologist will be able to predict the occurrence of thunderstorms nine times out of ten from the basic data which is available to him. It is exceptionally difficult, however, to make a completely accurate prediction of the exact time or place that they will occur. An air mass may cover several hundred thousand square miles and, even when thunderstorms are very active, many areas will be missed.

Flight Through Thunderstorm Areas

What should a pilot do when he finds a thunderstorm lying across his route? The answer to that question can be made only by the individual as it will be dependent on the particular storm, the aircraft and the man at the controls. There are a number of alternatives at his disposal and there are definite techniques in thunderstorm flying. The key to success and safety lies in the ability of the pilot to make a thorough analysis of each situation encountered, and then to select the most appropriate flight procedure.

Circumnavigation

If feasible, it is always best to circumnavigate a storm encountered en route. Preferably, flight should be attempted around the rear as turbulence will generally be lighter in that area. As a guide, but not an infallible rule, the winds in the layer between 5 and 10 thousand feet will often give a good indication of the direction of motion of the individual storms.

When approaching a line of storms, it will usually be useless to fly along the line looking for a break. It may be possible to fly over the saddlebacks between cell centres. In such cases, the pilot should be certain that his aircraft can reach the altitude required to go over the top as the most severe conditions are to be expected in the upper portions of the clouds.

The weather wise pilot is not alarmed when circumnavigation becomes impossible. Careful planning will take all except light aircraft through the storm area, with reservation being made for flights over mountainous terrain.

Be Prepared for Turbulence

Turbulence is consistently the chief problem to be encountered in thunderstorm flying. In addition to the discomfort suffered by the passengers, it places structural stress on the airplane which, at least, will shorten its operational life.

The phenomenon may be experienced in the form of updrafts, downdrafts or gusts, all occurring in the same cloud. The drafts will cause a vertical displacement of the aircraft. The gusts or eddies, caused by shear between adjacent drafts moving with different velocities, may cause a pitching and rolling motion. An eddy, once formed may spin laterally for some distance before its energy is spent. Accordingly, throughout the cloud, an aircraft may be continually subjected to upward and downward displacements with a pitching and rolling motion superimposed. The intensity of the latter movement will usually be dependent upon the strength of the large scale drafts.

Aircraft of the U.S. Thunderstorm Project (1946-47), flying at 180 mph, amassed considerable interesting data regarding the size of thunderstorms and the nature of the turbulence within them.

Thunderstorms may consist of one or more cells and may cover an area ranging from 20 - 200 square miles. From this information, it can be seen that an aircraft flying at 150 mph could cross even a multi-cellular storm in less than 10 minutes. It is likely that an average storm could be crossed in less than half this time.

The width of updrafts most frequently encountered in Ohio storms was about 5000 feet and of downdrafts about 4000 feet. About one storm in 16 was found to have drafts with widths as great as 15,000 feet.

Updraft speeds of about 1200 feet per minute were common, although downdraft speeds were slightly slower. Pilots have reported updraft speeds as high as 6000 feet per minute but the maximum encountered during the project was about 5000 feet per minute while flying at 11,000 feet. One downdraft speed of 4700 feet per minute was encountered at an altitude of 25,000 feet.

Considering all the data, vertical displacements of 500 feet are to be expected by aircraft flying at 150 mph through an updraft or downdraft. Displacements of more than 2000 feet would be experienced only in severe storms or in very slow aircraft. The project airplanes reported upward displacements of more than 3000 feet in only 2% of all cases. The greatest downward displacement was about 1400 feet. Of course, a flight at 110 mph through the same downdraft would have been displaced about 2300 feet.

Choice of Altitude

It is important to select an altitude carefully. Turbulence will increase from the lower to the upper portions of the cloud. Flight near or just below the cloud base is usually recommended if satisfactory clearance of terrain is afforded. However, it should be remembered that other troublesome weather factors may be superimposed on the thunderstorm effects, invalidating this rule. For example, strong surface winds blowing over mountainous terrain, or convective turbulence caused by the passage of cold air over warm ground (at a cold front), may be superimposed on the vertical motions associated with the thunderstorm cell, in which case, flight in cloud above the surface friction layer might be more desirable.

Most experienced thunderstorm pilots recommend at least a 2000 foot clearance of terrain. An examination of the earlier deductions will indicate the logic in this safety rule.

An accurate altimeter reading is a necessity. When flying in thunderstorm weather, the altimeter setting should be repeatedly reset as broadcasts are received from radio range stations along the route. If such information is not available, it is recommended that the altimeter be set before take-off for the lowest pressure along the route.

Inside the Cloud - What Heading? What Airspeed? What Attitude?

Once an altitude has been selected, enter the storm through an opening or light spot, if at all possible. The storm centre should be avoided. Normally, it will appear darker than the remainder of the cloud and will be marked by heavy precipitation and lighting. Once inside, a straight heading should be maintained. Thunderstorms usually consist of several cells in varying stages of development and an alteration of heading could carry the aircraft into a more active storm.

Even the most experienced bad weather pilots will express alarm concerning the behaviour of the aircraft instruments in a Cumulonimbus cloud. The first alarming factor, on entering an updraft, will be the altimeter reading. It will indicate a climb of several hundred feet per minute even though the nose of the aircraft is down. They warn, however, that a violent attempt to correct for this motion may be dangerous as a dive may develop if the airplane passes suddenly into a downdraft. By the same token, a sudden correction for a downdraft may ultimately result in a stall.

Expert pilots recommend an airspeed which is about 40 mph above the normal stalling speed of the aircraft. Certainly, an airspeed which is slower than the normal cruising speed of the airplane is desirable. Turbulence is directly proportional to the airspeed and there is conclusive evidence to the effect that even a 15 or 20% decrease in cruising speed may lengthen the operational life of the aircraft considerably, although the degree will be dependant, to a certain extent, on aircraft design.

Many pilots suggest an attitude which will enable them to maintain constant airspeed. They warn against sudden corrective action, suggesting that the best policy is to ride the storm rather than fight it.

Lightning

A lightning strike may cause considerable damage, particularly to the radio and instruments. In various U.S. investigations, it has been learned that most strikes occurred at an altitude of about 15,000 feet. It is likely, however, that the altitude is incidental. It is more probable that strikes are associated with the freezing level which would normally be somewhat lower than 15,000 feet in Canada. At any rate, very few cases were reported at low levels.

Perhaps the most common danger from lightning, particularly during darkness, lies in its psychological and physical effect upon the crew. Often a strike is preceded by St. Elmo's fire which appears in the form of visible discharges around the propellors, wing tips, tail and other projecting objects. This has a frightening effect on an inexperienced crew member or passenger. Moreover, cases of temporary blindness have been caused by a bright flash.

Both of these problems may be minimized by turning on the cockpit lights. A change of altitude may reduce the probability of a strike and terminate the display of St. Elmo's fire.

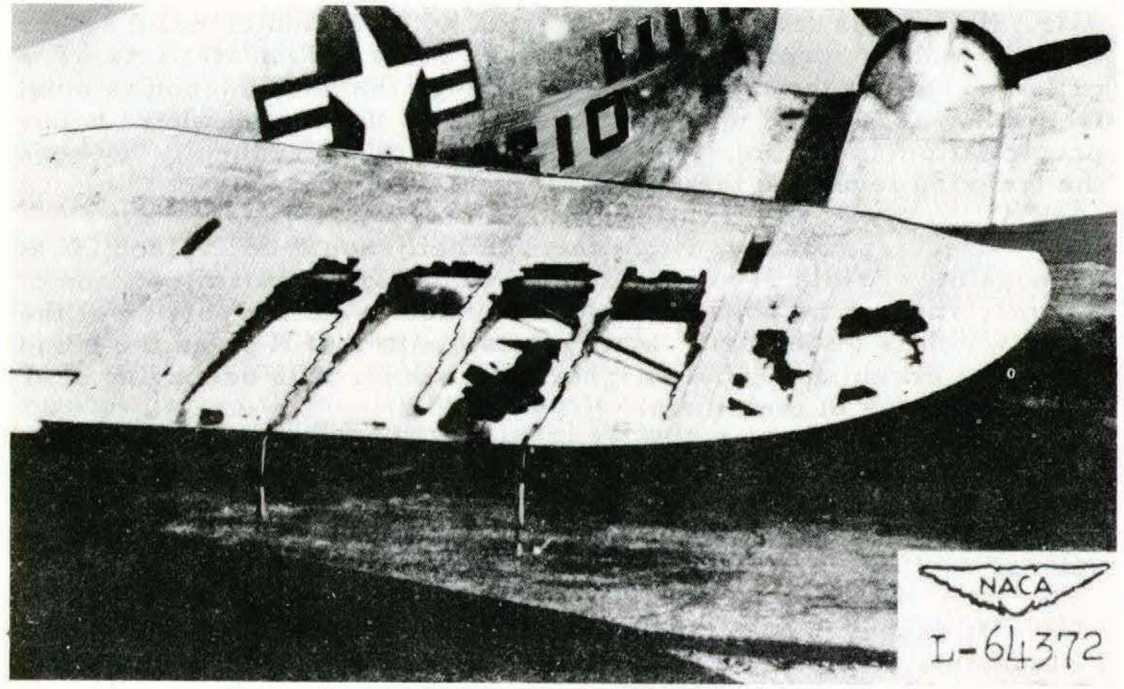
Hail

Heavy hail may cause serious structural damage to aircraft of any size. The United States National Advisory Committee for Aeronautics reports a case in which more than $25,000 was required to repair damage to a Douglas DC-6 aircraft, following a 60 second encounter with hailstones.

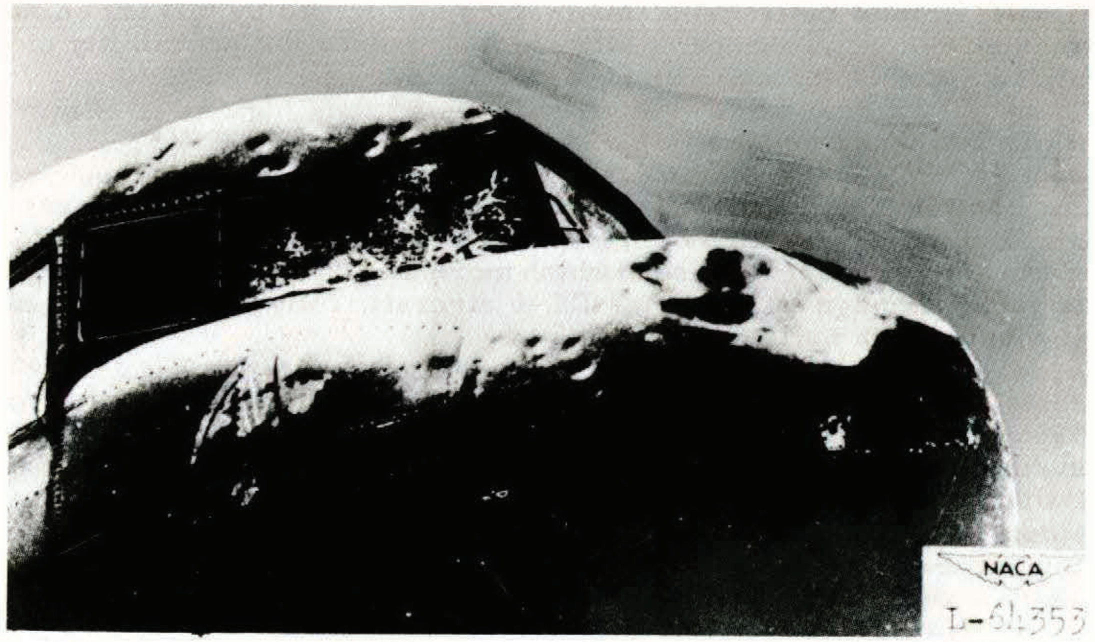
Research by the N.A.C.A. yielded conclusions that from 55 - 60% of all damaging hail was associated with cold front thunderstorms, the majority of which occurred between 1400 and 2200 hours L.S.T. About half as many cases were associated with air mass storms, almost all of which were encountered between 1400 and 1500 hours L.S.T.

Hail damage will be dependant upon the mass of the hailstones, the velocity of the impact and the material of which the aircraft is constructed.

N.A.C.A. photographs of two DC-3 aircraft, showing damage inflicted during brief encounters with hail, are shown as follows.



"Hail damage to DC-3 airplane. Right elevator. In hail short time, at 6500 feet, along edge of thunderstorm. TAS mph".



"Hail damage to DC-3 airplane. Nose section, windshield and top of fuselage. Time in hail 40 sec., just in or under cloud base. TAS 225 mph".

A definite flight procedure for hail has not been developed to date. Hailstones seem to be associated with particular cells rather than the whole storm. Encounters have occurred in all parts of a cell, and outside the cloud as well, although the phenomenon is most frequently associated with mature cells in the region where heavy precipitation is falling. It seems to occur most frequently between the freezing level and the upper portions of the clouds.

Needless to say, flight through hail should be avoided, if at all possible. While flying in clear air toward a storm, or line of storms, it may be possible to identify and avoid the portion of the cloud which is giving hail. Many pilots claim that it gives the cloud a distinct greenish or bluish-green hue when it is occurring near the outer edges of the storm.

Hail may be encountered while flying VFR from good weather into a storm area. When this happens, the recommended procedure is to make a 180 degree turn immediately upon encountering the first stones.

If caught in hail inadvertently, while conducting a flight on instruments, the proper evasive action must be judged by the pilot. The general weather situation, altitude of the aircraft, orientation of the flight path to the storm, nature of underlying terrain and the severity of other weather problems within the Cumulonimbus cloud,

will be important factors. If the flight path is parallel to the edge of the storm, and a lengthy flight through the hail is anticipated, an immediate turn, to fly out of the area, is recommended. If the position of the flight path, relative to the cloud, is unknown, there would appear to be no alternative but to ride it out, following a straight heading. The hail may last for only a few seconds and a change of heading could prolong the ordeal and increase the damage to the airplane. An immediate reduction in airspeed and descent to a lower altitude are highly advisable procedures unless maximum reductions have already been made to minimize turbulence.

Owing to the sudden infliction of damage which occurs when hail is encountered, unexpected incidents constitute the major cause for concern. Careful pre-flight weather planning, frequent in-flight weather checking and a constant awareness of the development of a potential hail situation will improve the judgment of the pilot who is required to fly in thunderstorm weather.

Without a doubt, the caution which should be practiced in planning cross country (training) exercises, over an area where thunderstorms are expected, should be intensified whenever a risk of hail appears in the forecast.

Icing

The freezing level in southern Canada in summer will normally be found between 11 and 14 thousand feet. Icing above these levels is possible and can be severe if flight in the Cumulonimbus cloud is conducted for more than a few minutes.

Problems of Landing and Take-Off

In a mature thunderstorm cell, the updraft which is feeding the storm may cause a gentle breeze to blow in the opposite direction to that toward which the storm in moving. As the cell passes over an airfield, the downpour of rain is accompanied or followed immediately by an outward gush of cold air which, in exceptionally heavy thunderstorms, may cause strong gusts exceeding 75 mph. The peak gusts will usually be encountered from 50 to 300 feet above the ground causing severe low level turbulence.

Such developments are always accompanied by lowering visibility in rain and by rapid pressure changes, with resultant altimeter errors. Discrepancies of as much as 150 feet above and below true altitude have been observed, even when using settings only a few minutes old. Errors of 50 - 60 feet are common.

The dangers inherent in such conditions are evident. Except in cases of emergency, landings or take-offs should not be attempted when a thunderstorm is advancing across a field. The entire cell will normally pass in less than one-half hour, at which time a much safer landing condition should exist. If there is a forecast office at the airport in question, an estimate of the time required for the storm centre to pass may be obtainable by radio from the control tower, following which a careful analysis of the problem can be made. This is the recommended procedure.

A pilot may find himself in the position of trying to beat the storm and land just prior to the associated weather deterioration. When conducting such a landing, the pilot should be constantly aware of the possibility of a windshift as great as 180 degrees, accompanied by strong gusts. He should not allow himself to be taken by surprise when this happens. Careful observation of the wind tee, wind sock, or other indication, will be necessary to ensure that an up wind landing is made. The caution should not be relaxed until taxiing has been completed.

As a final note, if a take-off is made a few minutes after the initial gust has passed, the airplane may climb into the downdraft of the cell. It may be preferable to wait until the storm has passed across the field.

Thunderstorms and Jet Aircraft

Jet aircraft will be able to fly above most thunderstorms encountered in Canada in summer as tops of the heavier variety will usually be between 35 and 45 thousand feet. However, thunderstorms over the Rockies have been observed with tops estimated as high as 60,000 feet. Such clouds will normally be isolated and it should be possible to circumnavigate them. If not, flight through them should be attempted with extreme caution as the orographic effects of air rushing up or down a mountainside will often intensify the drafts within the storm cell.

Conclusion

Although the problems described above are sufficiently imposing to discourage flight through Cumulonimbus clouds, it is pointed out that all investigations to date have found the worst conditions at medium and high levels. This is not to be misconstrued to mean that a safe and comfortable flight is always possible at low altitudes. In fact, the lower freezing levels and colder temperatures aloft would possibly cause the base of the layer of maximum intensity to be slightly lower in Canada.

Careful flight planning, a "cool head" and organized thinking will take the pilot safely through most thunderstorms. As forecasts can go wrong, an up-to-date knowledge of the current weather charts is of inestimable value to student and instrument pilots alike. Never forget that a thunderstorm encountered in flight presents a problem which demands good sound judgment.

THE TURBULENCE PROBLEM

Nobody enjoys a flight through rough air, yet turbulence is the weather problem most frequently underestimated. How many pilots have meticulously planned flights with regard to a layer of Stratocumulus cloud, at the same time completely disregarding turbulence? Many will admit having done so with the retort, "What are a few bumps"? Actually, personal discomfort is a minor consideration. Extreme turbulence may cause loss of control of the airplane or even structural failure. Turbulence in any degree will cause inaccuracies in the aircraft instruments, pilot fatigue, and will shorten the operational life of the airplane.

The structural stress placed on an aircraft in flight through turbulent air is almost unbelievable. The stress on a loaded aircraft will be greater than that on an empty one. Moreover, an airplane flying through turbulence eddies, or from updrafts to downdrafts, will undergo greater stress when flying at a high rate of speed than at a low rate of speed. For any one airplane, the degree of turbulence will be directly proportional to the airspeed. Doubling of the airspeed will double the turbulence effects. In the United States, the National Advisory Committee for Aeronautics made a study of the performances of three domestic airlines which flew DC-3 aircraft over comparable, turbulent, continental routes. One company had adopted the policy of operating through turbulent areas at airspeeds averaging 30 mph less than the other two. The operational life of its planes was found to be approximately ten times that of the two other lines. The difference has been attributed to the variation in airspeed. Most modern airplanes are built to withstand a sharp-edged gust of 30 - 50 feet per second when flying fully loaded and operating at maximum cruising speed. As free air gusts can, and often do, exceed these values, turbulence techniques in flying are of vital importance.

Recommended Techniques

It is wise to avoid flight through turbulent air if at all possible. Usually, the phenomenon can be overcome by flying above the surface friction layer. During mid afternoon in summer, convection will normally extend as high as 8 - 12 thousand feet above the ground. Over the Prairies it often exceeds 10 thousand feet and has been of sufficient intensity, on occasion, to justify the cancellation of basic flying training, except during the early morning and late afternoon.

The forecaster can always give an indication of the extent of the surface turbulence layer and convection. He may be out a thousand feet or so as the information cannot be read with 100 percent accuracy from the tephigram. So, if turbulence does not cease at the expected altitude it is likely that a further ascent of one or two thousand feet will bring the desired result.

Often it is possible to avoid areas where turbulence is likely to be encountered. For example, convective and mechanical effects will be more marked over rocky than over wooded terrain. Over relatively cool water in summer, smooth flight may be expected. Accordingly, it would be foolhardy to fly a route a few miles inland from a large lake if flight a short distance off course, over the water, would be smoother.

If flight through rough air cannot be avoided, it is wise to operate at a reduced cruising speed. If the air is very bumpy, reduction to a safety figure of 40 mph above normal stalling speed is recommended by many pilots. Operation at more than twice the stalling speed is said to be dangerous for a heavily loaded aircraft flying in very bumpy air.

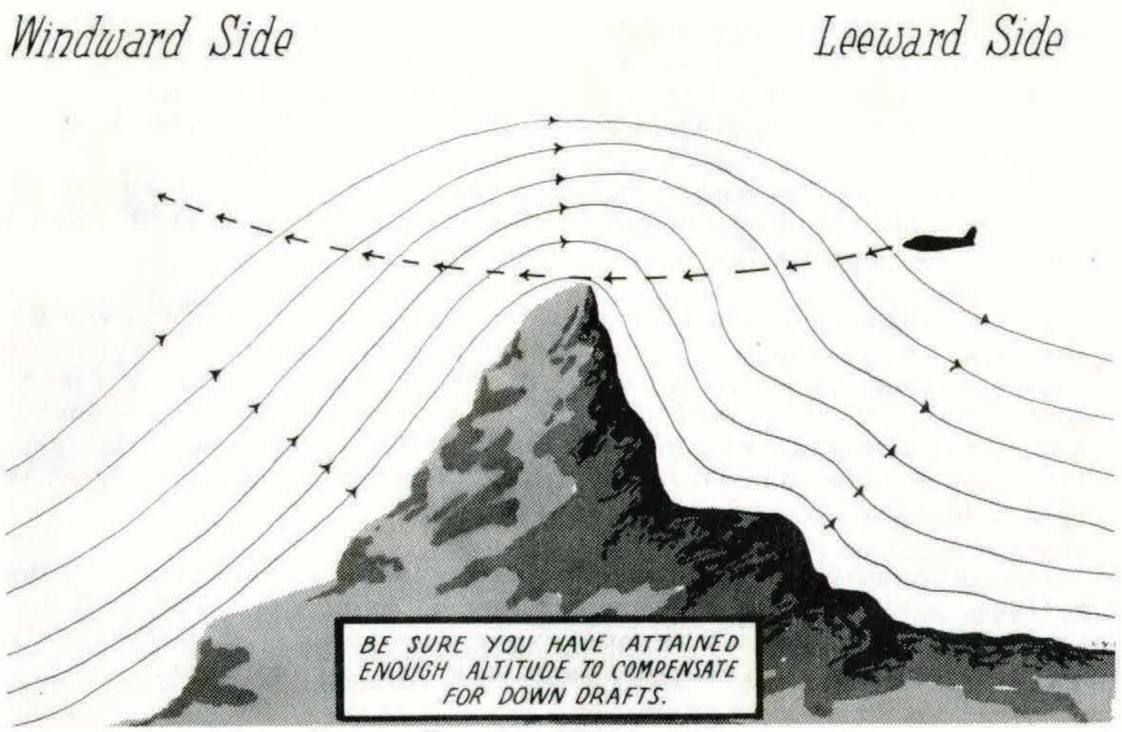
Experienced pilots advise against attempts to correct for each gust as it hits the aircraft. They say to ride the turbulence with sufficient control to maintain airspeed and attitude only. Vertical displacements caused by updrafts and downdrafts should average out, so altitude problems may be minimized, as long as safe clearance of terrain is being maintained.

It is always advisable to maintain a clearance of at least 2000 feet above the highest ground along the route. A considerably greater clearance may be desirable during flight over mountains. The pilot should remember, however, that the height of peaks cannot be judged from a distance. The desired altitude should be decided upon and should be attained before the mountain is reached.

When entering an area where moderate or heavy turbulence is occurring or is expected to occur, safety belts should always be tightened and loose objects should be fastened down. This is a particularly desirable procedure when operating near thunderstorms. An airlines plane, enjoying an otherwise smooth flight, reported a severe bump in clear air at a distance of five miles from a thunderstorm. Passengers were thrown about and many injured their heads. The pilots were held down, by their seat belts only, and were able to continue on a safe and comfortable flight, despite the confusion which developed temporarily.

Flight in Mountainous Regions

In addition to gustiness, large scale updrafts and downdrafts will exist in air flowing over mountain ranges. When approaching a mountain upwind it is advisable to fly at an altitude which will compensate for any displacement by downdrafts on the leeward side. If the air is unstable, and thunderstorms are occurring in the vicinity, somewhat more than a 2000 foot clearance may be necessary for safety.



Flight in valleys should be conducted with extreme caution. Downdrafts are always present and, although it may be possible to maintain level flight, a steep bank or 180 degree turn may be necessary on reaching a dead end. A steep turn in downdrafts may be dangerous.

The slope of the valley floor is another important consideration. When flying VFR along a valley which slopes upward, underneath a layer of low type cloud, the pilot may run out of ceiling and be unable to maintain visual flight.

As a third factor, valley winds will almost always blow parallel to its sides and may be much stronger than the values to be encountered above the valley.

Turbulence in Landing

There is no doubt that turbulence is a contributing factor in many landing accidents.

Often the effects of stability and surface friction in the layers just above the ground will give rise to calm or light variable winds. Strong winds may be prevalent a few hundred feet above the surface. Let us suppose that an aircraft on final approach is encountering a strong headwind. Although normal airspeed is being maintained, the ground speed may approximate or even become less than the stalling speed of the plane. A few seconds later, on continuing descent, the wind speed has suddenly become negligible and the pilot may be unable to maintain sufficient air speed to prevent a stall.

When the tower is reporting very light or calm winds at the surface, a pilot landing upwind, relative to a strong wind aloft, should use a higher approach speed than normal.

Another problem is associated with gusty conditions over the runway. Let us suppose that a pilot is making a gradual approach compensating for an average wind speed. At the instant of touchdown, the aircraft is met by a gust at a considerably higher speed. Additional lifting forces come into play and the touchdown is delayed. The gust is then followed by a lull. The bottom drops out, so to speak, and the aircraft drops heavily.

Accordingly, when strong gusty winds are occurring at the surface, a slightly higher approach speed, using partial flap, is the procedure recommended by most experienced pilots. A tail-up landing is safer than a three-point landing in these conditions.

Of course, marked changes in wind direction may be superimposed on the wind speed variations, and cross winds may cause gusts to strike the airplane at an angle. Such complications add to the seriousness of the problem. Each individual situation will present its own difficulties and the judgment of the pilot will make the difference between a safe landing and an accident. Constant alertness to the existence of these troublesome factors is of the utmost importance.

Conclusion

Turbulence is a very real weather problem. It can often be avoided by careful flight planning or by making in-flight alterations to the original plan. The pilot should never disregard it. On the other hand, he should never fight it. Like the skilled boxer, he should roll with the punches while carrying out flying techniques which will minimize the stress on his airplane and reduce the fatigue and discomfort imposed upon its occupants.

THE FOG PROBLEM

A detail of four airplanes departed on a night cross country from an east coast base. Sea fog was forming along the coast and crews were briefed to return by 0100 hours, at which time fog was expected to close the airport. They returned one-half hour late to find the fog advancing across the field. The south end of the airport was enveloped by low Stratus cloud, although the north end of the runway in use was visible. The pilot of the first aircraft chose to land but, in the excitement and haste, he stalled his aircraft while lining up with the runway. It crashed, killing all occupants. The pilot of the second aircraft refused to proceed to an alternate airport as directed from the control tower. He attempted a landing and crashed on the field. Miraculously no one was killed in the second accident, although the aircraft was completely wrecked. The other pilots were diverted to an alternate aerodrome and landed safely.

The psychological shock of arriving at a closed airport or one at which the weather is deteriorating is often accompanied by a mistrust of conditions at the chosen alternate, a complete lack of confidence in the forecast and a desire to get on the ground as quickly as possible. It constitutes one of the greatest problems in fog flying.

Advection Fog

The high frequency of occurrence of advection fog in the Maritimes in summer necessitates careful pre-flight weather planning on the part of the pilot operating in that area. Whenever there is any chance of advection fog, caused by the movement of warm air over relatively cold water, at least one, and preferably two, inland alternates is a necessity.

All coastal forecast offices have developed methods of forecasting the times of these formations to a high degree of accuracy. Forecasters err more frequently on the time that fogs will clear at coastal airports. With an extensive fog bank along the coast, aerodromes may be expected to clear only briefly during the afternoon, when diurnal heating is at a maximum. The presence of a layer of medium or low cloud above the fog will usually prevent even temporary clearing. Often a patch of cloud, moving across the field at low or middle altitudes, will be accompanied by the movement of the fog bank back over the field. Ocean fog banks will usually disappear only on a change of air mass (at a cold front). Cold fronts are prone to slow down or move aloft causing a delay of several hours in the expected time of clearing. Unfortunately, such developments are difficult to forecast.

Inland alternates will not be subject to these problems to nearly the same extent and can be used with considerable confidence.

Radiation Fog

Radiation fog in the early morning hours is the main type to be expected at inland aerodromes in summer. As this type is patchy, it is not always possible for the forecaster to predict its actual occurrence at a particular field although the general situation over an area will be evident. Therefore, a safe alternate should be kept in mind whenever an early morning flight is being planned and a risk of fog is forecast.

Upslope Fog

Upslope fog and low Stratus conditions, caused by expansion cooling as moist air moves up a slope, are most common at aerodromes in Alberta, Saskatchewan, Northern British Columbia and the Yukon. Each aerodrome may have its own local upslope effects. For example, an easterly wind blows upslope at Calgary but slightly downslope at Claresholm. Sometimes Claresholm airport is open when an easterly circulation of moist air is causing low ceilings and visibilities in the Calgary region.

An extensive upslope condition will always be associated with well recognized weather situations. A general easterly circulation of moist air across the Prairies may cause persistent low stratus and fog over a wide area. Considerable caution must be exercised when planning exercises in an area when such developments are taking place.

Conclusion

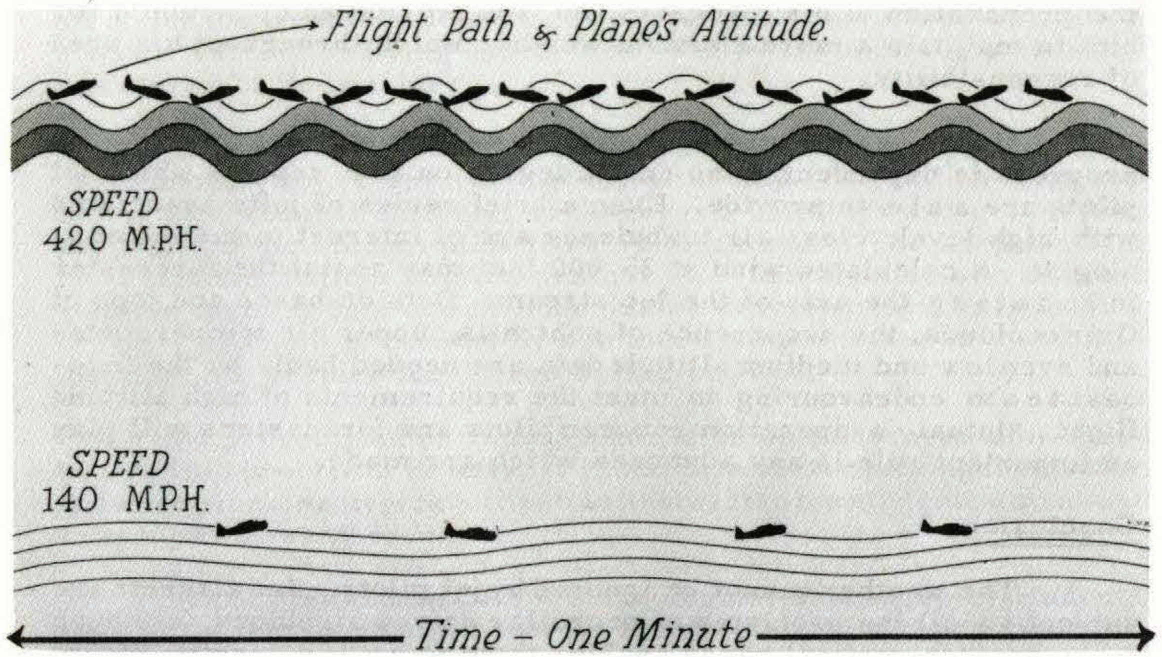
From the foregoing, it can be seen that flight planning for fog requires a careful choice of alternates prior to flight and constant checking of weather conditions during flight. When it becomes evident that the destination will be closed on arrival, the pilot should never take a chance on the fog lifting but should proceed to an alternate base at once.

THE HI-SPEED - HI-LEVEL FLIGHT PROBLEM

Are weather problems eliminated with the advent of jet aircraft flying at high levels? The answer is an unqualified "not yet". Bearing in mind the (incorrect) hypothesis that jet aircraft can fly above all weather, there is still the necessity of ascending and descending through it. The major problems are associated with landing. The jet pilot must use all his weather knowledge in landing under conditions of low ceilings and visibilities. Icing may be a problem. Other factors experienced by piston type aircraft are always present. The greatest factor is the human, psychological one. Failure to control emotions during a difficult instrument landing, whether or not the aircraft is controlled from the ground, can be dangerous.

Low level, clear air turbulence may become a serious problem. Air which is no more than moderately rough to a slow flying airplane may cause severe jolts to an aircraft flying at high speed. A dive from a high to a low altitude, when turbulent air is present at low levels, could, conceivably, cause loss of control of a jet airplane.

High level, clear air turbulence, although often as severe as low level turbulence, is not such a serious problem as it can usually be avoided by changing altitude a few thousand feet.



"Turbulence relative to slow flying and jet aircraft".

Fuel consumption is an important consideration always. In Canada, where airports may be separated by 200-300 miles, it may not be possible to reach an alternate even though a jet is able to glide from 80 - 100 miles while descending from 30,000 feet. For short flights, the problem is minimized, but for long range flights the most careful type of flight planning is essential.

Terminal forecasts for destination, alternates and point of departure must be studied carefully and should be checked frequently for departures from actual conditions and for possible broadcast revisions. The practice of "flying weather reports" or planning flights entirely on existing weather prior to take-off is especially dangerous for long range flights.

On the ground, forecasters will prepare and transmit revised terminal forecasts whenever significant changes become evident, keeping in mind the fact that even 15 minutes can be vital to an aircraft operating close to its maximum range.

The Meteorological Service is keeping abreast of increasing requirements. With the installation of the Canadian Weather Facsimile System during the next year, weather maps will be prepared by one Central Analysis Office (at Montreal, Que.) which will have this commitment as a major function. These maps will be disseminated throughout Canada leaving the busy forecaster more time to spend in the preparation of his forecasts and will provide an opportunity for him to maintain a more constant weather watch throughout his area of responsibility.

Upper level meteorological research is in its infancy. Its progress is dependent to no small degree on the reports which jet pilots are able to provide. Even a brief series of jolts associated with high level, clear air turbulence are of interest to the meteorologist. A calculated wind at 35,000 feet may assist the forecaster in locating the axis of the jet stream. Data on bases and tops of Cirrus clouds, the occurrence of contrails, upper air temperatures and even low and medium altitude data are needed badly by the forecast team endeavouring to meet the requirements of high altitude flight. Mutual co-operation between pilots and forecasters will play an important role in any advances which are made.

Conclusion

The weather cannot be ignored by jet pilots. Jet aircraft are subject to all the problems of propellor driven airplanes, although their greater vertical range enables them to avoid lengthy flights through bad weather areas. On the other hand, hi-speed, hi-level flight presents its own problems, one of these being rapid fuel consumption. Because of the latter, careful flight planning for long range flights is a necessity. Finally, the meteorologist is interested in every bit of information concerning the upper troposphere and stratosphere that pilots can provide. Such reports will assist considerably in obtaining a better understanding of the obscure problems of the upper air.

THE PSYCHOLOGICAL PROBLEM

A pilot conducting an uneventful flight may suddenly be subjected to an unexpected violent, or at least troublesome, weather problem. When this happens, he will normally suffer a psychological shock to a degree dependent upon the emotional stability of the person, the extent of his bad weather flying experience and the apparent seriousness of the weather development. The student pilot encountering such a problem for the first time may undergo, at least temporarily, a period of indecision and confusion, during which he fails to apply most of his previous instruction. If the phenomenon has not been forecast, the initial shock will be more intense as the cause of the development is not evident. Undoubtedly, many cases of pilot error are traceable to the sudden corrective (or over-corrective) action which is taken at this time.

This shock will seldom be evident in the experienced instrument pilot who has carefully planned his flight, who properly interprets variations between forecast and observed weather, who has confidence in his aircraft, his own actions and his own revised analysis of the weather situation. One gains such confidence only after a wide variety of flying experiences and by maintaining a constant awareness of the weather.

It is not easy to be alert to weather when subjected to the monotonously hot, clear variety day after day. There is a tendency to forget about it entirely, to disregard briefings and get on with the job. To the student pilot this is disastrous. The adoption of a lackadaisical attitude toward weather for four months at a critical stage in training is a most undesirable development. This is the greatest problem presented by summer flying weather in the building of an all weather Air Force in this country.

At present, there would appear to be only one method of combatting this problem. Briefly, it is the duty of every flying instructor and every meteorological officer to instill into his students a constant awareness of weather.

Daily attendance at meteorological briefings, by students and staff alike, is recommended. The teacher should practice what he preaches and therein only will the practice become a habit.

It is the accepted responsibility of every forecaster to provide his audience with a complete and interesting development of the weather significant to the operations planned for the day. Reference to basic data has considerable training value but such reference need not become prolonged and boring. Briefings lose their interest value if drawn out for the sole purpose of filling in the time allotted on the schedule.

It is important that briefings be delivered by the forecaster. It is his job to meet the needs of the aircrews and all his training has been directed toward this end. He has benefited from the reported experiences of a great many aircrew, all of which have been related to particular weather situations, giving him a better insight into the weather problems associated with specific meteorological developments. Moreover, he is the only person in a position to discuss the various alternative situations which become apparent when there is doubt concerning the reliability of a particular forecast. These alternatives cannot be covered in the official forecast, which is merely the forecaster's estimate of the most likely development, prepared after a careful analysis of a great deal of data.

Confidence in a forecast is a very desirable feature in minimizing the psychological factors stressed above. Pilots have much more confidence in a known forecaster than in a stranger. The daily briefing gives the forecaster his chance to meet and know the pilots and share their problems. On the other hand, many improvements in meteorological science are dependant to a large extent on assistance provided by flying personnel. The pilot can share the problems of the meteorologist too and he is in an enviable position to help him solve them. The importance of this bond of mutual assistance and confidence, which will develop, is not to be under-emphasized.

The Weather Wise Approach

The pilot should never leave the briefing room or forecast office until he has a clear picture of the weather map firmly imprinted on his mind. He should never take off with any misgivings regarding the forecast or with any question left unanswered. Any flight not planned confidently should not be flown.

A genuine inquiring manner and weather wise attitude will not come quickly. The program of development must be continuous and should not be relaxed in summer or in winter.

The "all weather" pilots of to-day learned their early lessons by bitter experience. Most of the "all weather" pilots of tomorrow will learn the same way, but the early and sustained development of the proper psychological approach to weather problems will result in a great saving of life and property.

CHIPMUNK

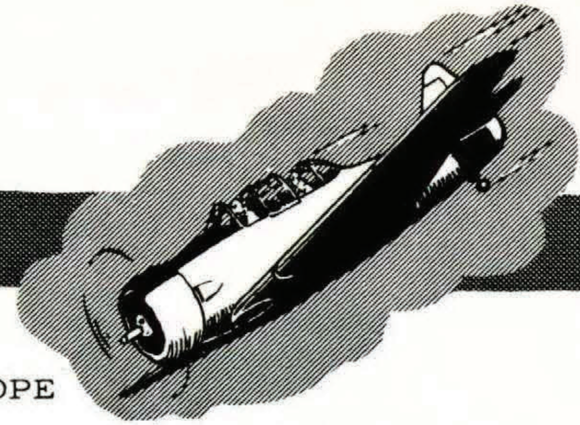
NO. 11 -- TAXI ACCIDENT

After completing an air test the pilot returned to the ramp for parking. The pilot noticed patches of ice on the apron so he decided to park on the tarmac. A groundcrew marshaller signalled the pilot to park in a confined space in the line. When the pilot began his turn the port wheel hit a patch of ice and this fact, aggravated by a strong gusty beam wind, caused the Chipmunk to slide out of control into another Chipmunk in the line. The starboard and port wings of each aircraft were extensively damaged. The primary cause of this accident has been assessed as "Pilot Error". A secondary assessment of "Ground" has been levied against Flying Control for failing to sand the icy tarmac and against the Tarmac Personnel for signalling the pilot to park in a confined space under hazardous conditions of icy surface and high wind. Pilots are again reminded that they are entirely responsible for the safety of their aircraft. If any doubt exists as to the amount of space and/or slippery ground conditions when manoeuvring close to other objects, the aircraft should be shut down and left for the tarmac personnel to park.

NO. 12 -- OBEY THOSE CHECKS

On completion of a landing the student pilot turned off the runway and then disregarded the first point in his post-landing check. He began to raise the flaps before the aircraft had stopped, became confused looking for the "UP" position, applied harsh brake to stop the aircraft, which caused the tail to raise and propeller tips to strike the runway. It is difficult to understand anyone misinterpreting the meaning of STOP as the first action in the post-landing check. Furthermore, extreme caution must be exercised when using brake on such light aircraft as the Chipmunk.

HARVARD



NO. 13 -- YE OLDE GROUNDLOOPE

The "Yellow Peril" swung to the left on landing. The student applied right brake too harshly and the Harvard groundlooped to the right. It left the runway and nosed up in the soft mud.

It seems the RCAF will never become immune to the groundloop plague. If it isn't undercorrection in stopping a swing its overcorrection generating a new swing.

THE SCORE FOR JAN - APR 53

33

GROUNDLOOPS
CAUSED BY PILOT ERROR

NO. 14 -- MIGHTY LUCKY

Two student pilots were practising solo exercises in the same area. As one pilot completed a steep gliding turn to the port and began to climb, his starboard wing was struck by the port wing of the second aircraft whose pilot was making a steep gliding turn to starboard. Fortunately both pilots regained control after the mid-air collision and made safe landings at their base. Neither pilot saw the other before the collision. Both pilots had been previously warned about their poor look-out. Their guardian angels must be working overtime because such cases of insufficient look-out are usually rewarded with death. After such a scare we trust their heads will be on a 360 degree swivel.

NO. 15 -- STAY AWAKE DURING LECTURES

This particular space cadet was convinced that after 125 hours total flying time he had all the answers. As a result his CO and APO had to remind him to pay attention during lectures concerning the elimination of stupid taxi accidents. You have already guessed the end of this story. The student pilot was doing his pre-take-off check when the runway was changed. Four aircraft were ahead of him waiting take-off clearance. He saw three taxi to the new runway and believed his path was clear. By applying harsh brake he avoided hitting the aircraft ahead of him but his own Harvard went up on its nose. It is hoped the CO's award of a reprimand and $75.00 fine will assure this pilot that "look-out" is a vital check and not just so many words.

NO. 16 -- WHEELS-UP LANDING

The student pilot was doing solo circuits and bumps for the first time at night. On the third circuit the landing bump became a crunching grind. The pilot failed to make a complete downwind or crosswind check and landed with the WHEELS-UP. We recall a doubtful honour that is awarded to such intrepid aviators -- the H.O.I.F.!!!

NO. 17 -- INVERTED TAXIING?

The pilot landed half-way down the runway under light wind conditions without using flaps. He failed to overshoot even when he saw he would run off the end of the runway. Instead, he applied harsh brake and kept the brakes on after the aircraft ran off the runway into four to six inches of snow which caused the Harvard to flip over on its back.

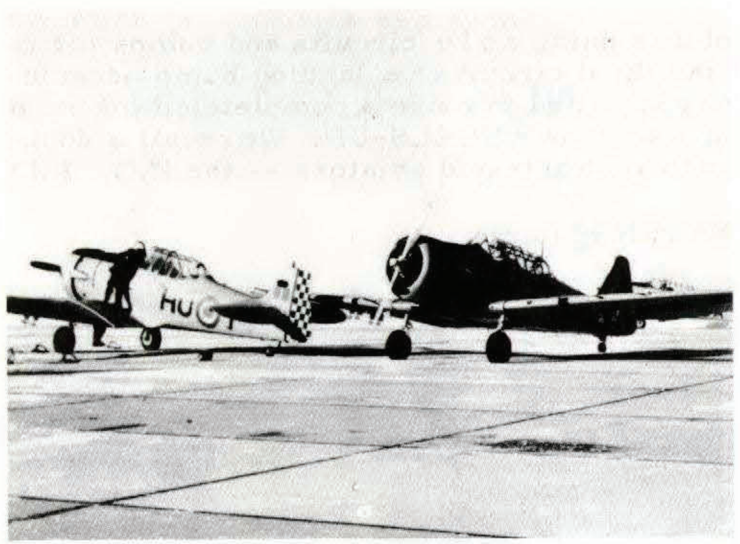
NO. 18 -- TO HELP HIS MEMORY

The pilot encountered radio trouble while practising night circuits. He used landing lights to signal the tower for landing clearance. In his confusion the pilot forgot to lower the undercarriage and landed wheels-up. He failed to make a downwind check and only completed a partial crosswind check. The pilot stated he did not realize his undercarriage was up until he heard that shameful scraping sound. To help the pilot remember that vital word

CHECK

he received a severe reprimand plus a $75.00 fine.

NO. 19 -- TAXI ACCIDENT



The pilot taxied out of the line and rammed a parked Harvard approximately 100 feet directly ahead. His starboard wing collided with the rudder of the parked Harvard causing replaceable damage to the rudder. This needless accident was caused by "Pilot Error". The pilot failed to note obstructions to his taxi path before entering the aircraft, and he did not maintain sufficient look-around while taxiing.

NO. 20 -- ASLEEP IN THE CIRCUIT

The pilot was on a night cross-country flight with a touch landing at a busy airfield. He entered the circuit on the downwind leg following an Expeditor. The pilot was forced to throttle fully back and enlarge his circuit to stay behind the Expeditor, yet he did not make his complete downwind or crosswind checks nor did he hear the undercarriage horn blaring. He landed WHEELS-UP on the runway causing "C" category damage to the Harvard. This was the student pilot's first solo night landing, coupled with the fact he landed at a strange field using the rectangular circuit pattern rather than the 360^{o} overhead approach circuit to which he was accustomed.

NO. 21 -- RED FLARES MEAN OVERSHOOT

Shortly after becoming airborne the pilot noticed oil flowing over the top engine cowling and onto the windscreen. The oil flow was accompanied by smoke causing the pilot to suspect fire. He made a low circuit and declared an emergency and landed -- WHEELS-UP -- on the runway. The control tender fired two red flares but the pilot ignored these despite the fact he stated seeing no other aircraft in the circuit. The primary cause of this accident has been assessed "Pilot Error" due to negligence of the pilot in failing to lower his undercarriage. The secondary cause has been assessed as "Materiel" because the engine failure was due to a weak spring in the oil dilution switch. This allowed the switch to remain in the "ON" position, and consequently, dilute the oil to such an extent that the engine failed. Action has been taken to rectify the weak spring conditions in Harvard IV aircraft.

NO. 22 -- STALL ON LANDING

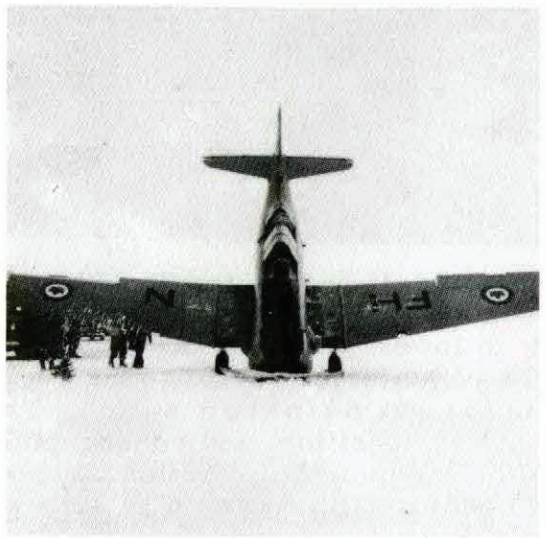
The student and his instructor were returning from a night navigational exercise. The tower advised them of a crosswind, nevertheless, the student lowered full flap, cut the power and rounded out high at 80 knots.

The port wing stalled. The instructor took control and applied power but he was far too late in taking control. The port wing struck the runway causing the Harvard to groundloop to the left with subsequent damage to the starboard wing and undercarriage. The accident was assessed as "Pilot Error - Student and Instructor".

NO. 23 -- GROUNDLOOP DE LUXE

The student made a wheel landing but as he had his feet on the brake pedals during the approach and landing, the Harvard swung to the right on touchdown. The pilot was slow in correcting the swing so he didn't straighten the aircraft out until it had swung 130 degrees to the runway. It is believed that confusion then took control because despite all instructions the pilot applied full power to attempt a take-off. The muddy infield fortunately prevented the take-off as the Harvard was heading directly towards the parked aircraft on the tarmac. The moral of this accident is: (1) do not land with feet on the brakes, (2) anticipate a swing and correct immediately, and (3) do not attempt a take-off after a groundloop, especially when heading towards the control tower.

NO. 24 -- LAND IN THE CENTRE

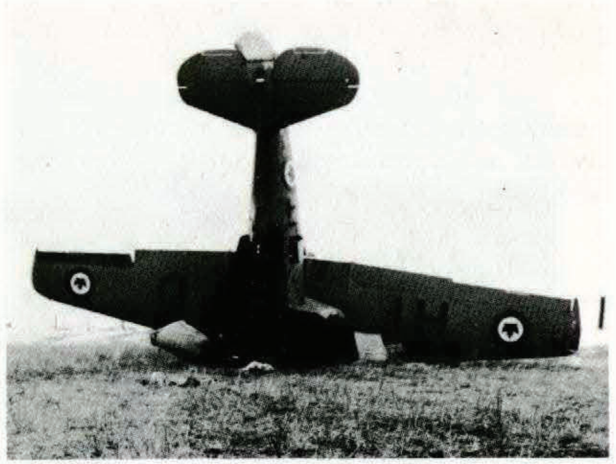


The student made a wheel landing to the left of a narrow runway. As the tail came down the Harvard veered to the left. The port wheel edged into soft snow at the side of the runway with a further dragging action into deeper snow. Due to the icy conditions of the runway in use, plus a fresh snow fall, the instructor was unable to bring the aircraft back onto the runway. The Harvard nosed up in the snow with resulting damage to propeller and engine. The instructor in this accident was at fault in allowing the student to touch-down close to the runway edge under the existing surface conditions.

NO. 25 -- WHO HAD CONTROL?

An inexperienced instructor was giving dual instruction on circuits and landings. After touchdown the Harvard developed a swing to the right. The student applied half rudder, then brake. The aircraft straightened, then developed a swing to the left. The instructor applied right brake but he discovered the student was still applying left brake. By the time the instructor gained brake control the aircraft had groundlooped to the left. The moral of the story is that only ONE pilot must have control of the aircraft. "Pilot Error" has been assessed against student and instructor.

NO. 26 -- TOO LOW AND TOO SLOW



The instructor and student were authorized to carry out dual instrument and low flying sequences. On completion of the instrument sequence the instructor took control at 4,000 feet ASL and descended to demonstrate low, slow flying. Near a farm home he descended to a very low altitude, lowered 45 degrees flap and proceeded to circle the farm home. During this demonstration the pilot allowed his airspeed to fall to 55 knots. On the third circling of the home the pilot applied power and pulled back on the control column to clear a barbed-wire fence. The engine coughed and failed to develop immediate power because the pilot either applied power harshly, or experienced carburettor icing, or had the mixture too lean. The Harvard mushed, then did a full flick stall and crashed in an inverted position. The engine snapped back into the front cockpit killing the instructor. The student, in the rear cockpit, suffered mild shock and minor injuries. The cause of this accident was loss of control following a stall at a very low altitude. The stall was caused solely by "Pilot Error". The instructor violated Unit Flying Orders in that he was flying outside the designated solo flying area and he was demonstrating low flying outside the low flying area. He also violated CAP 100 in that he flew at a height of less than fifty feet above all obstacles. This latter error, coupled with his poor airmanship in using full flaps at an extremely low airspeed with no power, caused his death.

NO. 27 -- CARBURETTOR FIRE

On starting the Harvard the pilot over-primed the engine causing a carburettor fire. He made his second inexcusable error by not immediately utilizing the engine fire extinguisher. Instead, the pilot tried to extinguish the flame with a hand-held extinguisher. Considerable damage was done to the engine before the fire was put out.

NO. 28 -- OVERWORKED GUARDIAN ANGEL

While practising night circuits and bumps the pilot overshot from a bad landing. He climbed straight ahead to 2,000 feet and began turning onto the downwind leg. The control tower had warned him of a Nordo aircraft approaching the airfield so the student's attention to his instruments was hampered by his lookout. The pilot lost so much height in his turn to port that the Harvard struck the ground and was almost completely destroyed by impact and fire. The pilot received first and second degree burns about his head and ears because he was not wearing his helmet and goggles. Contrary to orders stated in CAP 100 and Unit Flying Orders this pilot was wearing a headset and throat mike. He was an extremely fortunate boy to escape through the emergency exit before suffering more extensive burns. The pilot is at a loss to explain how he lost 2,000 feet in his turn onto the downwind leg. The measured ceiling at the time was 3,500 feet overcast with a visibility of six miles in snow flurries.

NO. 29 -- LANDING BACKWARDS?

This student pilot was returning from a night navigation exercise. He touched down on the main wheels and bounced, so he attempted a wheel landing. The Harvard swung to the left so he applied right brake, but with the tail in the air he overcorrected. The aircraft swung violently through 180 degrees without leaving the runway. The student erred in making a wheel landing instead of a three-point landing under light wind conditions, and he misused the brakes in using a harsh application of brakes while the tail was still in the air.

NO. 30 -- BEWARE OF WIND GRADIENT

The student pilot and his instructor were making a practise precautionary landing under strong, gusty wind conditions. The student approached too high and cut the throttle to effect the landing. The airspeed dropped rapidly to the point of stall. The instructor waited for the student to apply power but he neglected to do so. The engine momentarily misfired when the instructor applied power which resulted in an abnormally heavy landing. The aircraft received "C" category damage. This is another case of an instructor misjudging the fine line of when to take control from the student.

NO. 31 -- SIZE 13's?

On landing the aircraft swung to the right and the pilot corrected with left brake but he overcorrected and the Harvard groundlooped to the left. The swing to port could not be stopped by applying right brake because the pilot's flight boot was wedged in the left rudder pedal so that left brake was being continually applied after the initial swing correction. Special caution must be exercised when positioning the feet on Harvard brake pedals because there have been several similar accidents caused primarily by flight boots jamming in the rudder pedals.

NO. 32 -- UNMARKED DITCH

The student pilot had completed a night landing and was taxiing along a narrow taxi strip to the tarmac. The instructor was preoccupied with unserviceable identification lights and did not notice the student taxiing too close to the edge of the runway. The port wheel fell into an unlighted drainage ditch causing damage to the port undercarriage and propeller. The primary cause of this accident has been assessed against "Flying Control" because the drainage ditch at the side of the taxi strip was not marked as a hazard, and the secondary cause as "Pilot Error" because the student and instructor both failed to maintain an adequate lookout.

NO. 33 -- DEFACING THE TARMAC

When doing his pre-flight engine check the pilot misused his control column, pitch control, and throttle, which caused the tail of the aircraft to raise and the propeller to strike the tarmac. Eye witnesses saw the tailwheel come up twice and settle back down as power was increased before the propeller struck the tarmac with the final burst of power, which indicates the control column was not held fully back. The student pilot opened the throttle without first increasing the RPM, then when he noticed his error he increased the RPM without easing off the throttle.

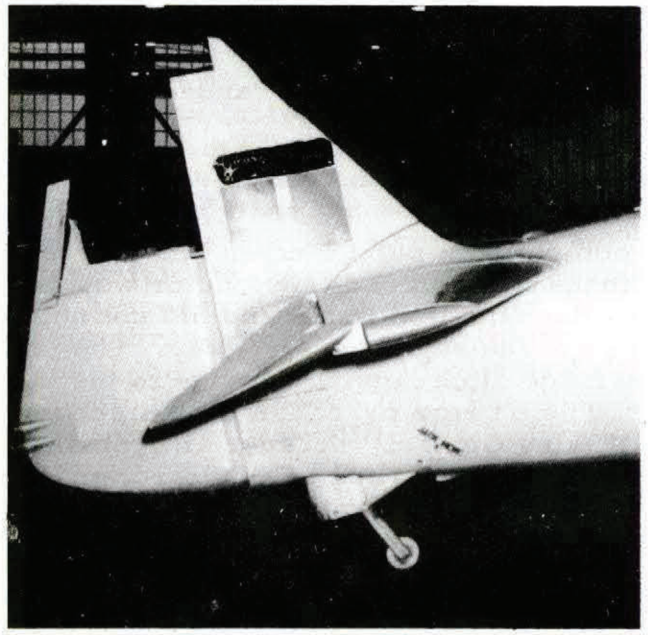
NO. 34 -- FAST TAXIING

After the student completed an above average approach and landing, the "Yellow Hazard" developed four swings to the port and starboard before the instructor took control to prevent running off the runway. The instructor decided to give the student some fast taxiing directional control practice. The student was given control when the Harvard was taxiing so fast the tail was in the air. A violent swing to the starboard developed and the aircraft ran off the runway into deep snow and nosed up. It is considered the instructor showed very poor judgement in expecting a student with only 15 hours total flying time to take control at a high ground speed and maintain direction.

NO. 35 -- 20 - 20 VISION?

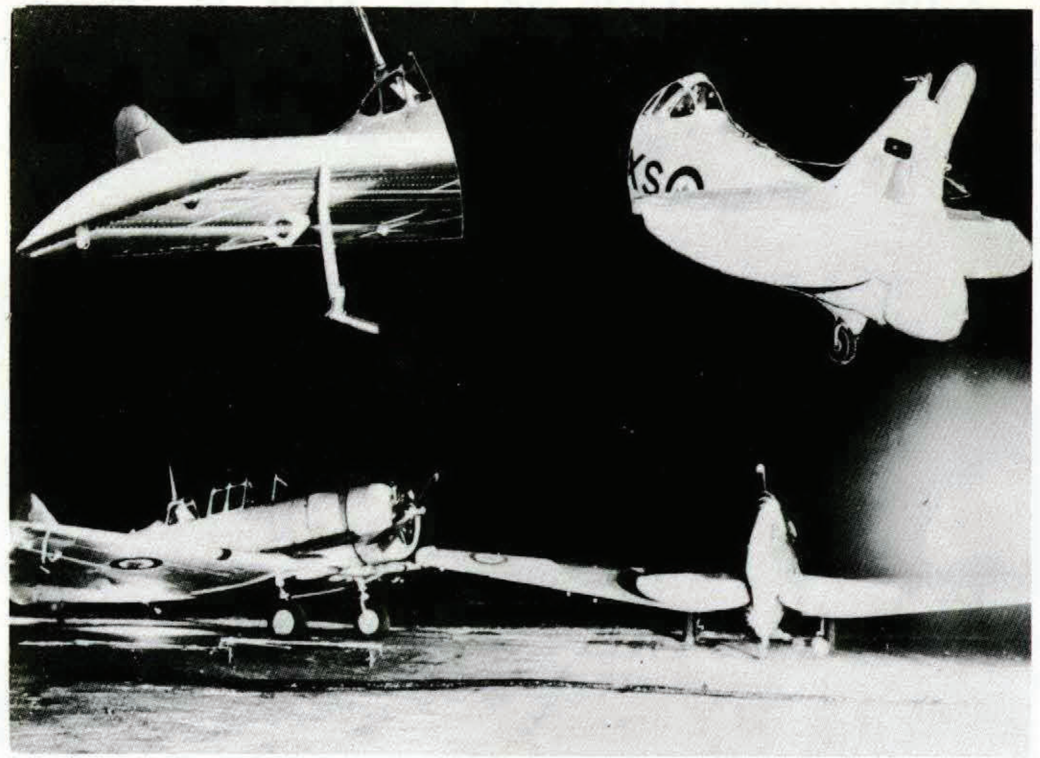
While taxiing in to the ramp the port wing of the Harvard collided with an energizer. Neither the instructor nor the qualified pilot under instruction saw the energizer. The port wing had to be replaced.

NO. 36 -- EXPENSIVE STUPIDITY



The pilot was authorized to air test the radio in this Harvard and if serviceable, he was to land and allow the Telecom Technician to get out, then take-off and practice aerobatics. On completion of the air test the pilot disobeyed instructions and indulged in unauthorized low flying.. He made an extremely low pass at a house and attempted to fly under some power lines. One of the cables damaged the propeller, the VHF mast, the fin, and sheared off the upper portion of the rudder. This lucky individual, landed safely at base. For his disobedience of orders he was given a severe reprimand and a $100.00 fine.

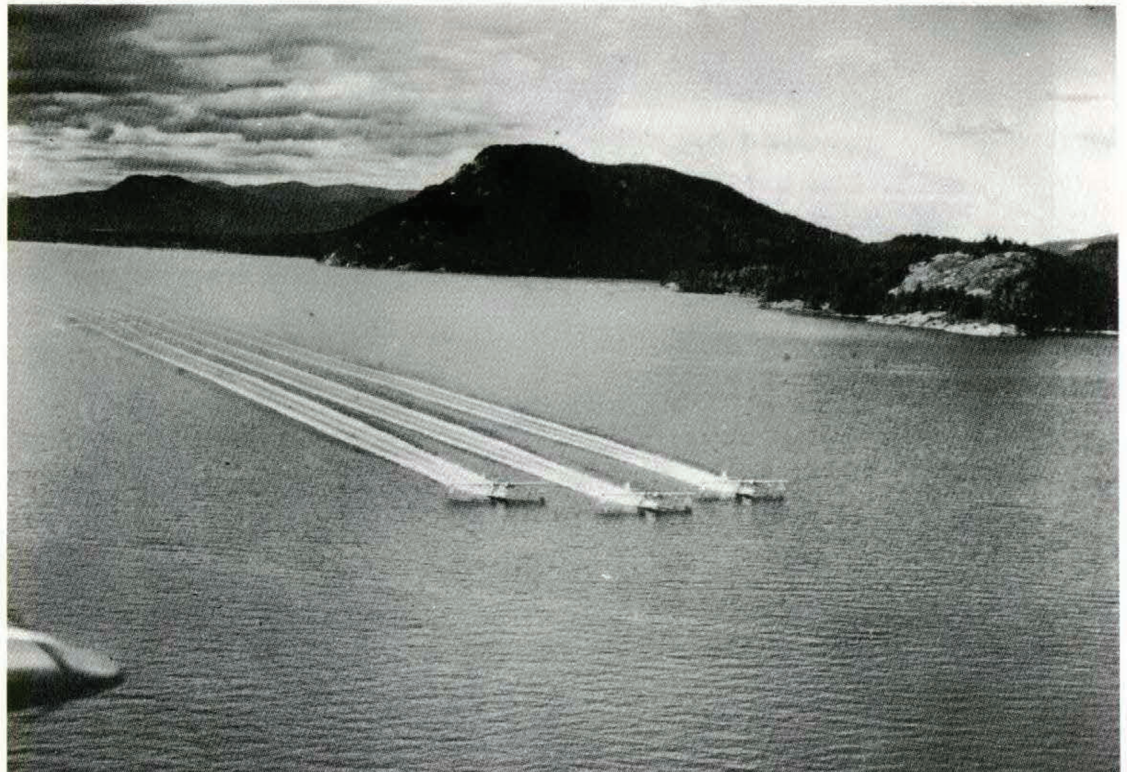
NO. 37 -- COSTLY ASSUMPTION



The student pilot was proceeding on a solo night navigation exercise. He noticed an aircraft in front of him while taxiing out for his run up. When he lost sight of this aircraft he assumed it had turned off the taxi strip and the way was clear. While taxiing at an excessive speed the pilot's starboard wing rammed the fin and rudder of another Harvard whose pilot was completing his pre-take-off check at the button. The fin and rudder of the rammed aircraft had to be replaced and the starboard wing and pitot head of the ramming Harvard were severely damaged. The pilot displayed poor airmanship in assuming his taxi path was clear along with his neglect of look-out and fast taxiing at night.

During the first quarter 53 there have been 32 careless taxiing accidents.

ARE YOU TAKING TO THE WATER?



With the coming of summer a certain number of RCAF aircraft will "take to the water". With Canada's vast Northland and limited airfields there is still a requirement for flying boats. Unfortunately, each year of operation results in needless accidents at great cost and, in some instances, loss of life.

✱ Flying off water is deceptively easy. Under normal conditions, with moderate winds and just a slight chop on the water, flying a flying boat is almost automatic. In many cases unlimited expanses of water for manoeuvring almost eliminate the need for precision spot landings.

✱ It is a relatively simple matter for those with little water experience to be lulled into a feeling of overconfidence after a few take-offs and landings. This is specially true for those who have never had any small-boat experience. In handling a flying boat on the water, it must be remembered that you are operating a boat subject to certain requirements in the way of seamanship that cannot be picked up overnight.

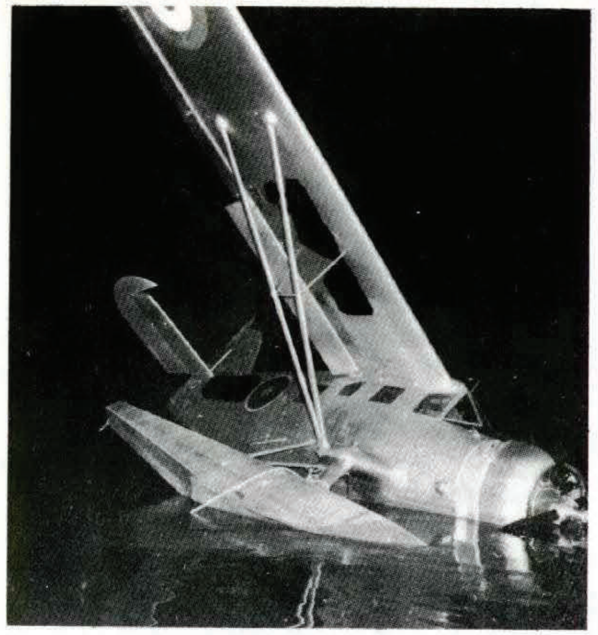
Before reviewing the elements of seamanship that contribute to safe waterborne flying, let us briefly examine the record of accidents of the past few years. The majority have occurred during either landing, taxiing or docking.

RESULT OF A WATERLOOP

Landing in a nose-down attitude which brings about a violent swing has been the most common failure. One attempt to land under glassy water conditions caused the flying boat to flip over on its back and sink. Submerged rocks and reefs made a major contribution to damaged hulls and floats under the control of unwary pilots. The vagaries of wind and current out-foxed a number of pilots who lost control of their aircraft while docking causing the usual damage to floats when a dock is rammed. To avoid accidents of this nature seaplane and boat pilots must give attention to the special features of water operations.

✱ Taxiing

Before taxiing an intimate knowledge of the water base is essential. Surface conditions, tides, currents and floating obstacles to be expected should be ascertained. Floating logs and particularly "dead heads" with but an inch or two showing above the surface are quite frequently encountered in our lakes and rivers. Taxi time



A SUBMERGED "DEAD HEAD" CAUSED THIS ACCIDENT

during the warm up period can be used to good advantage by surveying the take-off path for floating obstacles. Water depths in the manoeuvring area is of prime importance. The position of submerged rocks and sand bars must be predetermined. Where possible get a briefing from pilots familiar with the base and neglect no opportunity to make a close examination from the air. For coastal operations variations in the depth of water due to the tide must be considered. An area which is safe at high tide may well have shallow water and obstructions at low tide. With adequate knowledge of water depths, surface and submerged obstacles, an appreciation of the effects of wind and tide, a pilot with the exercise of skill and care can avoid those collision accidents.

Take-Offs

Under ideal conditions the take-off presents no undue difficulty. Long stretches of water, normally available, have advantages not found when operating from the restricted lengths of land runways. Special technique is required, however, when faced with heavy swells, rough water or crosswind conditions.

Swells and Currents

If there is a heavy ground swell several feet high and little or no wind, the take-off should be made parallel to the swells, preferably along the crest, but by no means across them, regardless of the wind direction. Striking one of these head-on at a little less than flying speed may prove disastrous.

If there is a strong current and absolutely no wind, the take-off will be a shade easier if made with the current. However, if there is enough wind to make the ship weather cock, a light current should be neglected and the take-off made into wind.

Rough Water

There is a definite take-off method for rough water. To begin with, the throttle should be opened (with controls hard back) as the nose is rising on a wave. This will allow less water to be thrown on the windshield and keep water out of the propellers.

After planing has begun (but before flying speed has been reached), the ship will begin to bounce from crest to crest of the waves, and each time it bounces the nose will go up. If nothing is done to correct this, each successive wave will be struck with a more severe impact. As the nose goes up, the controls should be pushed ahead in order to prevent the stall, and pulled back again just before striking the next wave. This pulling back at the proper instant is important, otherwise the bows may be pushed under the water.

Crosswind Take-Offs

There are times when circumstances make it necessary to take-off crosswind. In a very strong wind, it may be found that the aircraft heels over dangerously when the nose comes up prior to going on the step. Under such circumstances it is essential to put the flying boat on the step headed into the wind and then gradually turn more and more as flying speed is approached. Little, if any, space is lost by doing this, for if the wind is strong enough to heel the aircraft, it is strong enough to put it on the step very quickly.

Landing

The majority of water landings are made without the help or advice of flying control. A close survey of the landing and docking area is, therefore, essential. A hasty approach without at least one circuit is inviting trouble. Having determined the wind, the selection of the landing run will depend on the configuration of the water area, the depth of water, the location of submerged and floating obstacles, the conditions of the water surface and the location of the dock, beach or buoy. Before committing himself to a landing at a strange base an experienced pilot will carefully assess its suitability for the subsequent take-off. Having selected the landing run, surface conditions may suggest a special landing technique.

Landing in Rough Water

Landings may be made in water much too rough for a take-off if the power-stall is used. The power-stall landing consists of putting the aeroplane in the proper attitude for a landing at some distance above the water and maintaining, by the use of the engine, just enough speed to allow a gradual rate of sink. Care must be taken not to let the speed get too low, as the usual consequences of a stall will result.

* Landing in Glassy Water

The most hazardous condition frequently encountered by seaplane and boat pilots in Canada is that due to glassy water. The condition is well known and all qualified water-borne pilots will have had instruction on the technique to be employed. The problem then is to determine when the condition exists. Should there be doubt, assume

CONSEQUENCE OF A GLASSY WATER LANDING

glassy water and approach accordingly. Difficulty frequently arises under marginal conditions when the pilot thinks that he can see the surface and changes to a normal landing technique. That's where the trouble starts. At best, one escapes with a violent reminder that all is not well with the landing technique. Alternatively, survivors may have some unpleasant under-water experiences to relate to the board of inquiry.

Crosswind Landings

It is sometimes necessary to make a crosswind landing on water. Skill and practice is required. The best method with a flying boat, because of the wing tip floats, is to hold the wings level and skid to windward by use of rudder on the lee or downwind side. This tends to eliminate the drift and at the same time points the aircraft in the direction it is actually moving. It is well to come in with a little extra speed, because there is more time after the aircraft is levelled out to judge the drift, and also because a higher speed at the time of contact lessens the amount of drift proportionately. The rudder should be applied just before contact is made with the water, so that the aircraft will not have time actually to begin a normal turn. It will be necessary to hold a little opposite aileron. As soon as the aircraft slows down it will endeavour to weathercock and unless additional downwind rudder is applied it may result in the aircraft capsizing.

Swells

There are two kinds of swells - the long, slow, ground swell, which usually occurs more commonly in calm water, and the swell thrown up by a boat. Neither looks as bad from the air as it actually is, and the ground swell in calm water is exceptionally hard to see.

In a heavy ground swell the landing, just as the take-off, should be made parallel to the swells and preferably along the crest.

* Securing

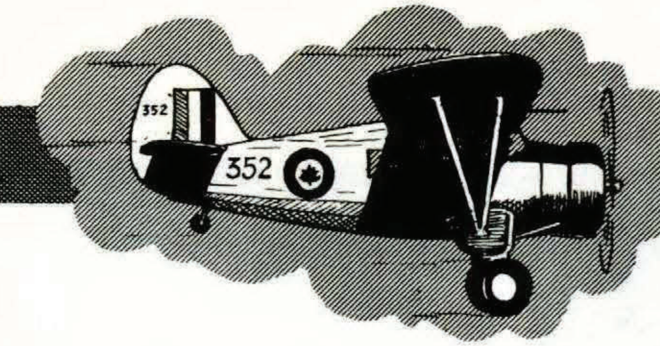
Unlike flying from a land base where a smooth landing to all intents completes an operation, the seaplane or boat pilot has an additional and sometimes tricky chore to secure his aircraft. The type of dock, the beach or buoy, in relation to the current wind will indicate the method of approach. The water characteristics of aircraft will affect the technique to be used. The combination of forethought, good seamanship and a well trained crew properly briefed for the manoeuvre is essential. Having secured the aircraft, responsibility for its safety

SAFELY SECURED

must be established by the captain. High winds and waves must be anticipated and it is often necessary to leave a crew aboard a flying boat at moorings. Aircraft left at docks should not be without a guard and regular pilot inspection of securing ropes and bridles is essential to a good seaplane and boat operation.

Conclusions

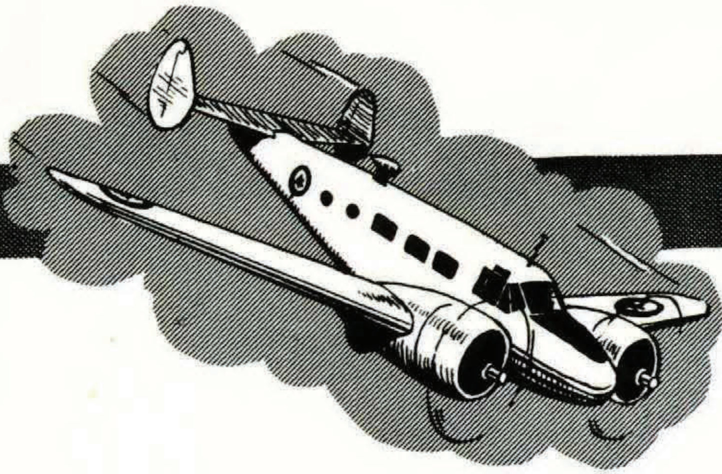
In the past few years the emphasis in the RCAF has been primarily on jet flying. We still have, however, a requirement for a relatively small number of skilled water-borne pilots. Although somewhat less spectacular, the occupation has many advantages associated as it is with advanced base operations. There is a greater freedom of action which in turn permits a pilot to exercise more initiative. His responsibilities are increased and must be accepted if unnecessary accidents are to be avoided. Additional and continuous training in seamanship is required. Some sail-boat time, which makes one conscious of submerged and floating obstacles and the peculiarities of wind and current, is time well spent in the training of a seaplane pilot. In conclusion, let us keep our summer free of water craft accidents. Watch out for that glassy water surface. When in doubt assume the condition exists. Remember all water is suspect until your inspection proves otherwise. Check for submerged rocks and sand-bars. Watch for floating logs and dead-heads. Carefully pre-plan your docking, beaching, or mooring, before through failing to do so, you find yourself up the well known creek. Maintain a well trained crew and keep them briefed on your plan.



NORSEMAN

NO. 38 ----- "TRACK" ----- !!!!!

After completion of the landing run the pilot made a 270 degree turn to port into the parking area. The Norseman was on skiis and the surface of the tarmac area was icy. The aircraft turned past the desired heading and slid toward some buildings on the edge of the parking area. The pilot was not able to control the direction of the Norseman because of the icy surface conditions, so he cut the switches. Due to a down slope and tailwind the aircraft failed to stop and struck two buildings. The accident has been assessed "Pilot Error" because the captain taxied the Norseman into such a position on known surface conditions that he was unable to control the speed and direction of the aircraft.



EXPEDITOR

No. 39 -- IN THE SOUP

The pilot experienced intermittent reception on returning to base. He heard the tower state the runway in use but he did not receive the wind information. He lowered 20 degrees flap and touched down at the button. As the aircraft slowed it swung to the right. The pilot applied left rudder, then harsh brake which stopped the swing but the left wheel ran off the runway and sank to the oleo in mud. The aircraft nosed up in the mud bending both propeller tips. The cause of this accident has been assessed as "Pilot Error". The pilot lost directional control in strong crosswind conditions (70 degree crosswind with gusts to 26 mph) because he lowered his flaps and when the inevitable swing developed he attempted to correct with the use of rudder only.

NO. 40 -- SNOW BANKS MEAN TROUBLE

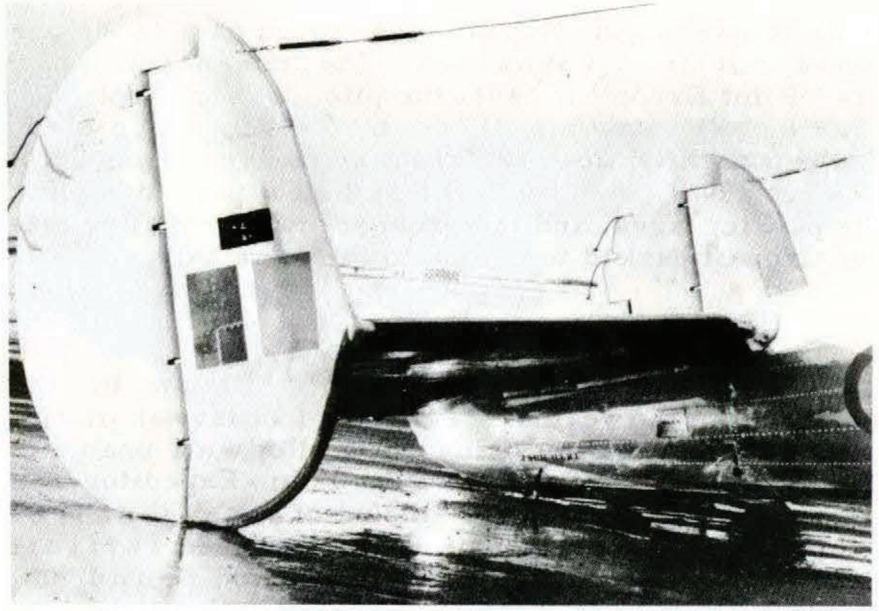
While parking the Expeditor the lower part of the port fin was damaged when it struck a snow bank. The primary cause of this accident was "Pilot Error" because the pilot, who is fully responsible for the safety of his aircraft, did not take sufficient precautions when parking the aircraft. However, there were two errors committed by ground personnel. The snow had not been plowed back far enough from the parking area, and the groundcrew marshaller attempted to have the aircraft parked too close to the snow bank.

NO. 41 -- CLEAR ICE

The pilot was dispatched in advance of the main night navigation detail to check the weather. The met forecast was merging layers of cloud and moderate rime icing. The pilot was unable to find any clear layers and returned to base as his Expeditor was icing up rapidly. He underestimated the amount of ice on the aircraft and consequently did not increase his approach speed sufficiently to execute a safe landing. The aircraft stalled on round out and then ground-looped to port. "B" category damage resulted. Investigation revealed one-half inch of clear ice covering the leading surfaces. The primary cause of this accident - "Pilot Error"; the secondary "Briefing", because had the met forecast been correct the aircraft would not have been dispatched into clear ice.

THERE IS NO SUBSTITUTE FOR SAFETY

NO. 42 -- BEWARE OF FREEZING SLUSH

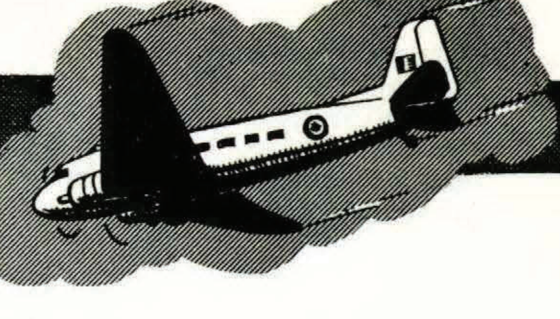


Two pilots were authorized to undergo mutual training. Both pilots noticed on take-off that the runway was wet with patches of slush. They also knew the surface temperature was +35°F and the forecast freezing level was at the surface. Despite these facts the pilot failed to take the precaution of operating the undercarriage and flaps several times after take-off to prevent freezing in the "UP" position. Furthermore, the pilots had been briefed on this subject. On completion of the landing run the pilot unlocked the tailwheel and noticed considerable vibration. The Expeditor was stopped and the second pilot discovered the tailwheel was in the "UP" position. Technical examination revealed the tailwheel was frozen in the "UP" position.

NO. 43 -- NOSE IN THE MUD

On return from a transport flight with four passengers aboard, the pilot decided to use crosswind landing technique despite the fact the runway in use was nearly into wind at 18 mph. He did not lower flaps and touched down on a short runway at the excessive speed of 100 knots. The Expeditor became airborne on encountering a rise in the runway but instead of immediately overshooting, the pilot tried to force it onto the runway. The pilot braked hard in an endeavour to stop before running off the end of the runway but to no avail. He selected wheels up but there was too much weight on the oleos for the undercarriage to retract. The aircraft overshot the runway into soft mud where it nosed up. "B" category damage was sustained.

DAKOTA



NO. 44 -- UTILIZE THE CREWMAN

This captain did not take adequate precautions when parking his aircraft. On swinging the Dakota into position the starboard elevator struck an upright iron post damaging the elevator beyond repair. The primary cause of this accident was "Pilot Error" because the captain of the aircraft should have given instructions to his crewman or co-pilot to get out and direct him into the parking area. The secondary cause is assessed against "Flying Control" because the SFCO was negligent in permitting an unmarked obstruction to remain in the parking area. Furthermore, the DFCO failed to inform the pilot of the existence of the obstruction.

NO. 45 -- ICE - BEWARE !!!

While on an IFR flight at night the pilot encountered heavy rime ice. At met briefing he had been assured there was no ice along his path. After breaking cloud at his destination the pilot endeavoured to shed the ice with all the facilities at his command. The Dakota was lightly loaded so the pilot approached at a slightly higher speed than normal. When he rounded out the aircraft stalled and the starboard wing tip struck the ground. On inspection of the aircraft, after shut down, it was noted that the Dakota was heavily covered with hoar frost and rime ice. The primary cause of the accident has been assessed as "Pilot Error", because the pilot neglected to allow sufficient airspeed on his approach and landing to compensate for the amount of ice the aircraft was carrying. The secondary cause has been assessed as "Briefing", and charged against the MET section for their incorrect forecast.

LANCASTER

NO. 46 -- HAPHAZARD D.I.

On an operational flight the number one engine began to belch smoke and flames. The engine was feathered and a successful forced landing was made at the nearest airfield. The cause of this accident was careless maintenance. The drain plug in the coolant pump became loose resulting in coolant loss, which caused damage to the head and valves in number one engine. Maintenance personnel failed to ensure the plug was locked when filling the coolant system and had failed to check the coolant system for leaks and security on the D.I.

NO. 47 -- TIGHTEN THOSE NUTS

About forty minutes after take-off on a routine squadron training exercise, the captain of the Lancaster noticed the RPM on number one engine increasing steadily. Movement of the pitch and throttle controls had no effect on the RPM. When the RPM reached 2600, the pilot feathered the engine and made a successful forced landing at base. The cause of this accident has been assessed against the squadron's maintenance personnel because the bolt holding the serrated actuating arm to the CSU had become loose through the nut not being securely locked.

NO. 48 -- DANGEROUS OBSTRUCTION

While taxiing out for a night take-off, the starboard rudder and the propeller of number four engine were damaged when they came in contact with a five foot iron pipe which was located approximately six feet from the edge of the taxi strip. The iron pipe was to be used for mounting a GCA reflector. Flying Control personnel failed to ensure the pipe had been placed at a safe distance from the taxi strip. As this accident occurred at night, the pilot was unable to see and avoid striking this unlighted obstruction. The cause of this accident has been charged against the station SFCO.

NO. 49 -- SECURE THE FILLER CAPS

While returning to base from a search operation, number one engine was feathered because of greyish smoke emitting from the exhaust stacks. Because of intermittent black smoke and fluctuating instruments from number four engine the captain of the Lancaster landed at the nearest airfield. Technical examination revealed the glycol header tank cap was not properly secured thereby causing a glycol leak.

NO. 50 -- FAULTY MAINTENANCE

On a practise bombing run the throttles were retarded for the let down. On completion of the bombing run, number four engine would not respond to the throttle advance. The propeller was feathered and the pilot made a successful three engine landing at base. Technical inspection revealed that the control arm from the lay shaft to the carburettor butterfly valve became disconnected. It is believed the locking cotter pin had been left out by the manufacturer and was not noticed on the engine installation. Maintenance has been charged with causing this accident.

"If a little knowledge is dangerous, where is the man who has so much as to be out of danger" Thomas H. Huxley

COMMENDATORY ENDORSEMENT

36913 F/O J.H. Barger

On 5 Mar 53, F/O Barger was leading a section of two Sabres in high level formation practice. After completing the exercise a standard radio compass let down and GCA was requested. GCA advised the section leader that a heavy belt of snow was over the station and a complete GCA was not possible. The weather was a ceiling of 400 feet obscured, visibility 1/8 mile in snow and blowing snow. F/O Barger made a radio compass let down, and after four runway procedures, landed safely.

F/O Barger displayed excellent airmanship and skill under extreme adverse weather conditions. He has received a pilots' commendatory endorsement.

WELL DONE

Our congratulations are extended to

30286 F/L C.J. Day

who safely landed his Sabre aircraft despite restricted elevator control due to a jammed bellcrank.

On the afternoon of 9 Jan 53 F/L Day was making a routine engine air-test on a Sabre aircraft. He noted that while inverted he could not move the control column forward enough to hold the nose up. In easing out of a gentle dive his elevator controls locked. The emergency trim also failed to operate. He rocked the control column laterally until he obtained backward movement of the control column. Forward travel of the elevator control was still restricted to just ahead of neutral. F/L Day joined the circuit and selected dive brakes out. The nose came up and again the elevator controls locked solid. He recovered by throttling back and selecting dive brakes in. He overshot by aileroning to port. F/L Day gained partial control again by rocking the control column. He safely completed his second landing attempt. On the ground the control column would still not move forward of neutral. It was revealed on examination that a one inch screw was jammed between the control column bellcrank and the cockpit floor, thereby restricting movement of the elevator controls.

F/L Day displayed good airmanship in overcoming a potentially dangerous situation.

DFS