Transport Canada Transports Canada

Aviation Safety Letter

Learn from the mistakes of others and avoid making them yourself . . . **Issue 4/2000**

Do You Brief VFR Approaches?

On February 19, 1999, a Beech King Air C90 was returning to Slave Lake, Alberta, from a night visual flight rules (NVFR) MEDEVAC flight to Red Earth, Alberta. During the first approach to Runway 10 at Slave Lake, flown by the co-pilot, the aircraft was not aligned with the runway and an overshoot was initiated. The captain decided to fly the second approach and, shortly after the overshoot was commenced, the aircraft entered cloud and the pilots lost visual reference with the ground. The aircraft struck the surface of a frozen lake while in a left, descending turn. This synopsis is based on the Transportation Safety Board of Canada (TSB) Final Report A99W0031.

At 23:45 local time, the captain was tasked with the flight to Red Earth, Alberta, to pick up one patient. The captain advised the co-pilot, checked the weather with the Edmonton Flight Service Station (FSS), and proceeded to the airport. The flight was to be conducted at night in visual meteorological conditions (VMC) and under VFR. The aircraft departed Slave Lake at 00:34. The 20-min flight to Red Earth was uneventful.

On the return flight to Slave Lake, the crew obtained a weather update from the Edmonton FSS. The automated weather observation system (AWOS) at Slave Lake was reporting an overcast ceiling of 500 ft above ground level (AGL) and a visibility of 2.5 mi. As they were approaching Slave Lake, the pilots could see the airport and town lights to their left. They entered a layer of haze and mist at 1000 ft AGL and lost sight of the lights. The aircraft entered clear air again at an estimated 500 ft AGL. The captain then provided verbal vectors to the co-pilot so that he could align the aircraft with Runway 10. During the manoeuvring, the aircraft crossed the centreline of Runway 10, and the co-pilot, assessing that he could not carry out a safe landing, passed control of the aircraft to the captain. The captain took control and commenced an overshoot. He turned the aircraft left toward the lake, and while in the climbing turn, entered the haze and mist over the lake and lost visual contact with the ground.

The flight crew had not briefed an overshoot procedure, and once the overshoot was initiated, neither pilot briefed or questioned the actions of the other, and neither provided verbal communications as to their functions or tasks. The co-pilot reported that, after re-entering the mist, he was trying to maintain visual reference with the ground lights and maintain a check of the cockpit instruments as a backup for the captain.

While the aircraft was in the left turn, the radio altimeter, which was set to 415 ft, activated. Both pilots heard the altitude alert and saw the altitude light activate; however, neither pilot reacted. The aircraft struck the snow-covered lake while in a descent. The aircraft was substantially damaged during the impact with the snow and ice.

Both pilots had a valid pilot proficiency check on the aircraft and held a current Group I instrument rating. The captain attended a TC pilot decision making (PDM) course in 1997. His schedule required him to work on air ambulance flights and on

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company charter flights. While flying charter, he operated in a single-pilot cockpit environment. The majority of the captain's flight experience was in single-crew aircraft. The captain had received training specific to a two-pilot cockpit environment during his training sessions on the King Air C90.

The co-pilot completed his initial check on the King Air C90 in January 1999. It was his first twin-engine aircraft since obtaining his multi-engine rating. He attended a crew resource management (CRM) course during his initial pilot training. After his initial check on the King Air, he was paired with the occurrence captain and did not fly the King Air operationally with any other pilot. He worked the same schedule as the captain.

Before being assigned to the King Air, the co-pilot had not been assigned to a two-pilot cockpit flight operation except during his training. Except for his initial 3.8 hr. of flight training, he did not receive training in pilot/co-pilot responsibilities in a two-pilot cockpit environment. The co-pilot flew a total of 4.1 hr. with the captain two days before the accident flight. Both pilots were well rested prior to the flight.

When he was just about to depart from Slave Lake, the captain called Edmonton FSS at 00:15 to file a flight plan and check the weather forecast. The forecast for Slave Lake called for visibility of 1 SM in mist and ceiling 700 ft broken. In addition to the above, the Slave Lake AWOS was reporting a visibility of 3.5 SM and a few clouds at 200 ft.

The pilots reported that they could see the mist and stars clearly above the airport prior to their departure from Slave Lake. At 01:22, on the return flight to Slave Lake, the pilots received a special weather report from an AWOS (SPECI AUTO) for Slave Lake at 0814Z, which indicated 2.5 mi.visibility and an overcast ceiling of 500 ft.

There is one published non-precision instrument approach procedure for the airport: an NDB/DME approach aligned with Runway 28. The airport is equipped with a type K aircraft radio control of aerodrome lighting (ARCAL) system. The captain activated the lights during the initial approach, and both pilots reported having observed the runway lights. Runway 10/28 has a functioning visual approach slope indicator system (VASIS) installed, but the pilots did not recall visually sighting it.

The aircraft touched down on the ice of the lake three miles from the threshold of Runway 10. Marks left in the snow indicate that the aircraft touched down in a slightly left-wing-low, nose-level attitude. As the aircraft settled, both propellers came in contact with the snow. The aircraft came to rest about 640 ft after initial ground contact.

The aircraft was used exclusively in the air ambulance role and was equipped for flight in instrument meteorological conditions (IMC). The flight crews were selected based on their performance on other company aircraft. Company training is based on the principle of self-study, and it is a pilot's responsibility to prepare for annual check rides and written exams. The company does provide annual flight training prior to a check ride, and company staff will help individuals who require study assistance.

Flight training and check rides are conducted by the chief pilot acting as a flight crew member. Paired crews are not checked in flight; crew co-ordination is assessed based on the crews' interrelationship with the check pilot. Crew co-ordination and CRM are not the subjects of structured training, but they are discussed at the company in informal settings.

The *Company Operations Manual* contains detailed information on cockpit checks and briefings for instrument flight rules (IFR) flight, including approach and overshoot briefings. Challenge and response calls are to be used for certain altitudes during en-route and approach operations. The sections of the manual addressing VFR operations did not contain information related to detailed in-flight briefings, as required under subpart 703 of the *Canadian Aviation Regulations* (CARs) and section 723.107 of the *Commercial Air Service Standards* (CASS). It was the crew's belief that during VFR operations approach briefings were informal in nature and briefings for missed approaches were not needed. The *Company Operations Manual* has been changed to incorporate VFR briefing requirements.

Analysis—If during the flight to and from Red Earth, the pilots discussed options for alternate airports should the weather at Slave Lake deteriorate prior to their return. On the return flight, the crew received a report from the Edmonton FSS based on the AWOS at Slave Lake. Although a low ceiling and low visibility were being reported, the crew did not alter their plans for a VFR approach. As well, they did not brief for the eventuality of a missed approach; they believed that the AWOS report was faulty because they could see the lights of Slave Lake through the overcast, and they thought that missed approach briefings were required only for IFR flight. By not briefing for a missed approach, the crew did not have a plan should a missed approach be necessary.

When the aircraft entered the undercast mist and haze at about 1000 ft AGL, the crew continued the descent even though they had lost sight of all outside visual references and

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were now operating in IMC. During this time, the co-pilot was flying and attempting to gain visual contact by looking cross-cockpit, and the captain was attempting to provide verbal guidance for the approach. Once the co-pilot realized that a landing could not be made, the captain took control and turned left over the lake and away from the lights of the town. Thus, he placed himself into an area that would have few ground lights or references, even in clear air. Additionally, the captain initiated a climb back into IMC and would, therefore, be flying with reference only to instruments. By entering cloud and not changing to instrument flight, the crew lost situational awareness.

In the absence of a stated plan and intra-cockpit communications, flying the aircraft effectively became a one-pilot operation. This may be due, in part, to the mix of single- and two-crew cockpit operational environments that the pilots regularly work in and their limited training in crew co-ordination; i.e., the crews are placed into a two-crew cockpit without the benefit of training specific to their duties as captain or co-pilot. Without the benefit of such training, the crew is less apt to work effectively as a team. Although the ground and flight training met the intent of CAR 703, the training did not ensure that adequate defences were in place to ensure that the flight crew worked as a team during flight operations.

The TSB determined that, during the overshoot, the aircraft entered cloud and the flight crew lost situational awareness, resulting in the pilot unintentionally flying the aircraft into the ice surface of the lake. Contributing to the loss of situational awareness were the lack of planning and briefing for the approach, the breakdown in crew co-ordination during the overshoot, and inadequate attention being paid to the flight instruments.

Since this accident, the operator has placed an emphasis on standard operating procedures (SOP) for VFR and IFR operations with ad hoc in-flight checks by the chief pilot to provide a mechanism for the company to monitor the flight crew. The company has amended the SOPs to include VFR approach briefing requirements. In addition, the company is instituting recurrent ground training. △

Call For Nominations for the 2001 TC Aviation Safety Award

Do you know someone who deserves to be recognized?

The Transport Canada Aviation Safety Award is presented annually to stimulate awareness of aviation safety in Canada by recognizing persons, groups, companies, organizations, agencies, or departments that have contributed in an exceptional manner to this objective.

You can obtain an information brochure explaining award details from your Regional System Safety Office or by visiting the following Web site: *<http://www.tc.gc.ca/aviation/syssafe/brochure/english/tp8816e.htm>*.

The closing date for nominations for the 2001 award is December 31, 2000. The award will be presented during the thirteenth annual Canadian Aviation Safety Seminar, which will be held in Ottawa, Ontario, May 14 to 16, 2001. △

Flight 2005—One Final Look

This review of the two remaining evolving directions established in Transport Canada's *Flight 2005,* a safety framework for Civil Aviation, completes our four-part series on *Flight 2005*.

Evolving direction No. 5: **Human and Organizational Factors**—Taking account of human and organizational factors in safety management practices. While individual human factors contribute to the majority of aviation accidents and incidents and have received considerable attention, there is a growing realization that organizational factors can also create unsafe conditions. Civil Aviation needs to focus its attention on developing valid and practical means of evaluating strategic and operational decisions, work processes, organizational culture, communications and system design. Only by acquiring a broad understanding of these factors, their interrelationships and the ways in which they influence human performance can Transport Canada promote their consideration in safety management practices.

Evolving direction No. 6: **Communications**—Proactively communicating with targeted audiences on aviation safety. Transport Canada communicates with a wide variety of audiences, including the general and travelling public, each sector of the aviation community, parliamentarians, senior departmental and government officials, and the media. Given the increased public attention to aviation issues, it is important that Transport Canada expand on current initiatives and improve its capacity for proactive communication. Over the next five years, Civil Aviation will work with its partners to recognize distinct audiences, listen to concerns and implement communications strategies that meet information needs.

For a complete look at *Flight 2005*, visit <*http://www.tc.gc.ca/aviation/2005/toc.htm*>. △

Customs—Your Partner in General Aviation

Over the last number of years, the Canada Customs and Revenue Agency (CCRA) has been improving its service to general aviation under the CANPASS program. Currently, customs services are available at 208 airports in Canada, the majority of which are dedicated to small general aviation.

It is imperative that pilots understand their legal obligations under the *Customs Act*. Under section 11(1) ". . . *every person arriving in Canada shall . . . forthwith present himself at the nearest customs office designated for that purpose* . . .", and under section 11(3) ". . . *every person in charge of a conveyance arriving in Canada shall . . . ensure that the passengers and crew are forthwith on arrival in Canada transported to a customs office* . . . ."

For small general aviation, those airports now designated as AOE-X in the *Canada Flight Supplement* (CFS) are available so that pilots and their passengers can meet their obligations. Future changes to the designation will have general aviation–only airports designated as AOE/15; the *15* indicates the maximum number of passengers and crew that can be processed at these airports. These airports are limited to general aviation, but general aviation operators can use all airports where customs services are offered.

Before leaving for Canada, pilots should refer to the CFS to determine whether the airport of their destination is an AOE and verifies the hours of service. At least 1 hr., but no more than 72 hr., before flying into Canada, the pilot must telephone, toll-free from anywhere in the United States, 1-888-226-7277 (1-888-CANPASS) to make personal customs arrangements (see the "General Section" of the CFS). If the pilot is not a registered user of CANPASS, a second telephone call must be made upon landing. A number of fixed-base operators (FBO) and airports have facilities available to communicate with customs.

In instances where weather or an emergency forces an aircraft to land at a site that is not designated for customs reporting, the pilot must contact customs officials by calling 1-888-226-7277 or the nearest office of the Royal Canadian Mounted Police as soon as possible.

The CCRA, along with its partners NAV CANADA and Transport Canada, has updated the CFS and the "FAL Section" of the *A.I.P. Canada* to inform the flying public of customs procedures and the services that customs offers.

Pilots are reminded that advising customs does not fulfill their flight planning requirements and that a flight plan must be filed for all transborder flights.

The CCRA is an integral part of planning a transborder and international flight and wants to ensure the safety and security of travellers. With safety and security being paramount, meeting your obligations under the law can only compound the pleasure and freedom that flying brings. △

Over-the-counter Medication

by Dr. Paul Cervenko, Aviation Medical Officer, Pacific Region

You wake up one morning, on a day you're going flying, and you don't feel so great. Should you pop a pill, cancel your flight plan, make a fast trip to a clinic, or just tough it out?

If you've been a pilot for long enough, you've already faced such a decision. Your decision had safety implications for you, your passengers, the public, and your aircraft.

When making such a decision, ask yourself the following questions:

What's wrong?

Do I really need to take something so I can fly today?

If the answer to the second question is yes, be very careful! You should probably get a medical opinion, and remind your doctor that you are a pilot.

If you can honestly answer no to the second question, go back to the first question. If it's some weird, new, or severe symptom, you're better off getting professional advice (just like you would if your engine makes strange sounds during start-up).

If it's something familiar to you, such as a cold or allergies, you might be able to confidently judge the severity based on experience, e.g., the degree of sinus congestion and how easily your ears clear while on the ground.

Let's say that you don't feel very sick and have some mild symptom. You'd like to take something to make yourself more comfortable. For any medication, whether prescription or not, the effects on target organs must be considered. The *big three* for pilots are the **brain**, **heart**, and **eyes**.

The **brain** is both self-centered and important, and the rest of the body is constantly reminded of this since the brain consumes a large proportion of the body's blood circulation and oxygen. But this selfishness backfires when medications are on board and the much higher drug concentrations lead to brain side effects, such as dizziness and drowsiness. The eyes get the blame for any double vision, though the eye muscles are actually under the brain's control. The heart, a tough reliable workhorse, is sometimes affected by medications but, if you are in good shape, this is rare since most medication with serious effects are available only by prescription. Nevertheless, some medications can affect heart function in some people.

To determine the possibility of side effects, start by reading the package label. It tells you the uses and major or common side effects of the medication.

Take things further: ask your local pharmacist to provide some more information, especially when it comes to possible interactions with other medications you might be taking. Sometimes a medical exam by your doctor is needed to sort through the implications of your illness, so if in doubt, don't hesitate to go this route. If further information is needed, especially regarding the physiologic effects of the flying environment, your regional aviation medical examiner is a good starting point. Also, don't forget that the aviation medical officer at Transport Canada Civil Aviation Medicine is available to help with unclear or complex problems. Even if the evidence would indicate that a medication should be all right for you, the safest rule of thumb when using a medication for the first time is to take it when you don't plan on flying. This way you can see if you are susceptible to any unusual individual side effects.

So the bottom line when it comes to over-the-counter medication is to **think about the following:**

a) the underlying medical condition;
b) how much the medication is going to help, versus any side effects;
c) how (a) and (b) might affect your performance, especially with regard to the brain, heart, and eyes; and
d) how you can get the information you need to make a decision.

Gesundheit! △

New Aviation Safety Videos

Safety Services is pleased to announce the release of two new aviation safety videos. The first video, *Flying Without Flight Attendants: the Ground (and Air) Rules*, is 15 minutes long and is targeted to all crews and passengers of commercial aircraft that are not required to have a flight attendant. This generally means all commercial aircraft with less than 20 passengers. It discusses important safety aspects in and around the aircraft.

The other video, *A Simple Mistake*, is a dramatic simulation of a fatal accident caused by two simple and, unfortunately, common mistakes: one, a procedural error, and the other, an error of omission. Two small aircraft collide at an uncontrolled aerodrome in Northern Saskatchewan and five lives are lost. The video covers procedures that must be followed in order to ensure an acceptable level of safety in aircraft operations at an uncontrolled aerodrome. The lessons to be found in this video, although initially targeting general aviation, apply equally to **all** operations.

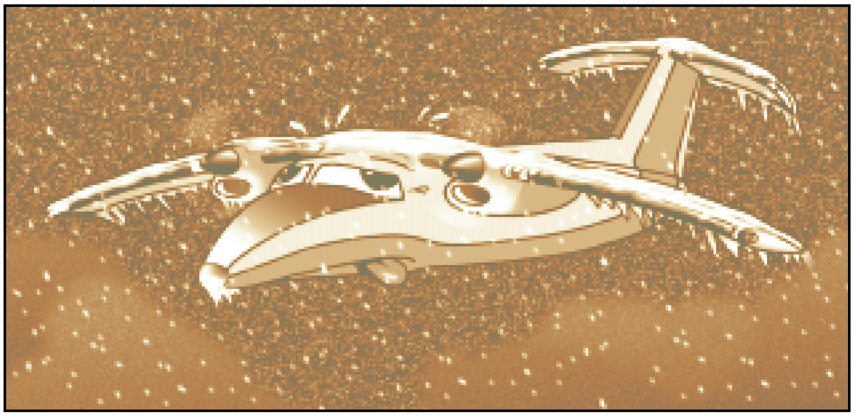
Both videos are available for loan from your regional System Safety office or for purchase through the TC Civil Aviation Communications Centre, which you can reach at 1-800-305-2059. △

Think Winter Flying

Avoiding Ice Fright—Planning Ahead Minimizes the Risk of Icing

by Thomas A. Horne, AOPA Editor at Large; this article was originally published in the October 1999 Issue of AOPA Pilot*; it has been edited for space and reprinted with permission.*

An inadvertent encounter with icing conditions ranks right near the top of a pilot's worst fears. Even small ice accretions can decrease an airfoil's lift, increase drag, and cause dangerous drops in airspeed. That is why the cardinal rule of thumb is to take evasive action fast at the very first sign of airframe icing. Having ice-protection systems, or flying an airplane certified for flight in known icing conditions, can buy you some time to make your escape, but know this: Many airplanes with full complements of ice protection equipment and known-icing certification have crashed after lingering too long in icing conditions.



How it happens—A pilot receives a weather briefing mentioning the chance of icing conditions, or even reported icing conditions, and launches anyway. Or a VFR-only, or even instrument-rated, pilot continues flying into deteriorating weather, eventually runs into instrument meteorological conditions, flies into clouds, and ices up.

Icing-related accidents closely resemble one of the biggest killers in general aviation—continued VFR flight into instrument weather. The antidote to these accidents? Maintain better-than-VFR separation minima.

Types of icing—There are two basic types of icing—clear and rime. Clear ice occurs most often in the 0 to -10°C temperature range. As the name implies, clear ice is a near coating over the airplane's leading edges. It's often found in cumulus clouds and unstable conditions. Rime ice usually lurks in stratiform clouds with temperatures between -10 and -20°C. It has a milky pebbly appearance and first shows up as a thin white line on wing leading edges or other airframe protuberances, such as outside air temperature probes and antennas.

The icing process occurs when an airplane flies into clouds or precipitation composed of supercooled water droplets. Supercooled droplets are liquid but at freezing temperatures. They remain liquid until an airplane flies into them. Then they quickly freeze on impact with the leading edges. Rime ice is usually slower to build than clear ice.

The worst of the worst—High on the danger scale is freezing rain (abbreviator: FZRA). It is a fast-forming type of clear ice that occurs primarily in advance of winter warm fronts. It's caused by rain, snow, or ice crystals falling through a warmer layer of air at lower altitudes. Very large droplets associated with this phenomenon run far back on airfoil surfaces and can quickly disrupt lift.

But as bad as freezing rain is, freezing drizzle (FZDZ) is worse. It is characterized not just by large supercooled droplets, but also by its extremely high liquid water content. When freezing drizzle strikes an airplane, ice formations can become large and strangely shaped. Ridges of ice may form along the entire wingspan, causing aerodynamic havoc.

Freezing drizzle was studied heavily after the Oct. 31, 1994, crash of an ATR-42 in Roselawn, Indiana. The National Transportation Safety Board (NTSB) in its final report on the occurrence (NTSB Report DCA95MA001) concluded that the aircraft experienced an uncommanded roll excursion and crashed during a rapid descent. The NTSB attributed the loss of control to a sudden and unexpected aileron hinge moment reversal that occurred after a ridge of ice accreted beyond the de-ice boots. Researchers determined that supercooled "drizzle drops" likely caused the ridges of ice to form aft of the de-ice boots.

Freezing drizzle seems to occur most often in the Great Lakes and maritime regions, where the air in frontal systems can be loaded with huge amounts of liquid water. Results are pending from additional research, but the prevailing opinion these days is that freezing drizzle is predominantly a low-altitude phenomenon. The ATR's freezing drizzle encounters occurred between 10,000 and 8000 ft MSL, when it descended in a holding pattern.

Escape strategies—Viable strategies for escaping icing conditions depend on the conditions at hand. A descent to altitudes with warmer temperatures may solve the problem. A climb to on-top conditions can also do the trick if your airplane has the power to climb high enough and if you're certain of the nearby cloud-top altitudes. Climbing through clouds in icing conditions carries a risk: If you spend too much time at climb angles of attack, you could cause ice to form on the undersides of the wings and aft of any boot or bleed- or bleed-air-protected leading edge wing panels. This is a sure-fire way to kill lift quickly, which is the reason why some manufacturers publish minimum airspeeds for use when climbing in icing conditions.

Often, a 180° turn is the best idea. Presumably, you began your flight in ice-free conditions. A return to the areas behind you, then, ought to take you away from danger. What if icing conditions have closed in all around you? A landing at the nearest airport—or a precautionary off-airport landing—is the best move.

The important thing is to have a preconceived idea in your mind as to what you'd do if you inadvertently encountered icing. If you can't come up with a satisfactory plan that has an extremely good chance of success, then the best strategy is not to fly at all.

If you got'em, pop'em—Pilots who fly airplanes equipped with inflatable de-ice boots should inflate those boots as soon as ice forms on wing leading edges. The time-worn advice was to allow a certain amount of ice to form before inflating the boots. That theory was motivated by the belief that cycling the boots too often would cause ice to make a shell-like formation beyond boot-inflation limits. *Ice bridging*, it was called.

The latest research indicates that ice bridging is a myth. It's true that more ice will shed if more ice is allowed to build on booted surface. But experts now say there's no reason to believe that ice can continue to form and bridge over leading edges and leave boots to helplessly pulsate behind an ever-growing sheath of ice.

A decision tree—Avoiding ice starts at the pre-flight planning stage.

Pilots: If you're not instrument-rated, fly only in VFR, ice-free conditions. Should the weather turn ugly, you must be proficient in the skills and procedures necessary to deal with ATC and perform climbing or descending turns solely by reference to instruments. Those with instruments ratings should be current and proficient in the basics of instrument flying should the need to shoot a tough instrument approach arise.

The weather: Flying in winter fronts is not a good idea in airplanes without certification for flight in known icing. Even with known-ice certification, airplane performance can be crippled by a bout with severe icing.

During the pre-flight weather briefing, you're looking for above-freezing temperatures at or above any minimum en route altitudes (MEA). This way, should a descent be necessary you'll lose any ice accretions on the way down. As for cloud tops, they should be low enough that your airplane can top them if a climb out of icing conditions is in order. Ideally, you should have scattered to broken cloud layers along your route of flight and plenty of holes to allow ice-free climbs and descents to your flight-planned altitudes—and to you destination airport. Extra caution is called for at night: Icing and other clouds obviously can't be seen as well.

The airplane: For piston-powered airplanes, turbocharging comes in handy in the climbing-to-on-top department. Turbine-powered airplanes seldom have trouble climbing to on-top conditions—as long as the climb is initiated quickly enough. In the clear air above, any ice accumulations that you picked up down below will take some time to sublimate away (it could take hours), but at least you're not collecting any additional ice.

If you're in a piston-powered airplane with a comparatively low horsepower rating, your ability to climb out of ice is seriously compromised. So is your ability to overcome the drag caused by any ice you might pick up. These airplanes, though they may have heated pitot tubes and alternated engine air doors (tools that should be used on any airplane whenever flying in cloud or precipitation within the icing temperatures range), just aren't cut out for ice flying.

Terrain: Here the concern is flight over mountains and other high terrain. Icing is worse in the air currents over high terrain, and your ability to descend out of icing conditions is severely hampered by high MEAs.

If any of the variables listed above raises any concern, your pre-flight decision tree has a shaky limb or two. You don't need to ground yourself every time clouds pop in a winter forecast, but you do need to look extra hard to determine if the trip is really critical or if any of the deciding factors raises any level of concern. △

Dangers of Flying Home-made GPS Approaches

By Pierre Duchaine, SatNav Program Office, NAV CANADA

Isn't the global position system (GPS) neat? The latest avionics, the GPS receiver, has brought very accurate area navigation (RNAV) guidance within reach of all aviators. Just enter the runway threshold and GPS accuracy will line you up safely for an approach to any runway, **or does it**?

This article aims to destroy this myth and explain why pilots must use instrument flight rules (IFR)–certified receivers, follow a published approach, and use a current database to safely line up with the runway while in cloud. Doing it any other way is like playing Russian roulette with the lives of all on board.

TSO C129 GPS receivers—To fly GPS under IFR in Canada, pilots must use a GPS receiver that meets Technical Standard Order (TSO) C129 (commercial pilots must also receive approved training and certification). The C129 standard ensures that the receiver will have, among other things, proper course deviation indicator (CDI) sensitivity and receiver autonomous integrity monitoring (RAIM). The RAIM function ensures that the position displayed to the pilot is trustworthy for the receiver's *perceived* phase of flight. The CDI sensitivity helps the pilot stay right on track—essential on short final. The table below shows the modes for each phase of flight used by the receiver.

Strict regulations oblige the pilot to retrieve the approach (waypoints and sequences) from a current database. This is how the receiver *knows* to change the RAIM alert threshold to 0.3 NM. The pilot must also verify the position (usually bearing and distance) of the waypoints against the approach chart.

RAIM—RAIM works by comparing the position solutions from different groups of four satellites in view. If there aren't enough satellites in good positions to make a comparison, the GPS integrity light will come on. If there are enough satellites in view for RAIM to work and a satellite is transmitting faulty signals, the position solutions using that satellite might exceed the alert threshold for that phase of flight, triggering the GPS integrity light. Upon seeing the light, the pilot must revert to using traditional aids.

The catch is that, by default, most receivers *think* the aircraft is *en route* unless an approach has been loaded from the database. In other words, the receiver might show that you are right on track (without an alarm), but you could be almost 2 NM off. This is OK if you are actually en route, but not if you are executing an approach. The only way to get the RAIM in approach mode is by flying an approach procedure loaded from the database.

Instrument approach procedure design process—Flying an approach with the wrong CDI sensitivity is also asking for trouble. To understand this, one must grasp the rigorous process for developing a published instrument approach procedure (IAP). Presently in Canada, public approaches are designed, verified and published by NAV CANADA in accordance with standards prescribed by Transport Canada.

Approach designers have received certified training and undergone on-going on-job assessment on this very technical task. In most cases, they are current airline-rated pilots with varied flying experience.

Phase of flight perceived by the GPS receiver	*RAIM alert threshold*	*CDI sensitivity (full deflection)*
En route	2.0 NM	5.0 NM
Terminal	1.0 NM	1.0 NM
Approach	0.3 NM	0.3 NM

All GPS approaches are based on very accurately surveyed runway reference points. These are used as anchor points for the whole transition and comprise about six waypoints. The paths between two consecutive waypoints are called *segments*, for which particular requirements, such as minimum altitudes, are prescribed based on depicted obstacles on the topographical map and a current national obstacle database. Segments are narrower near the runway threshold as this is where there is less manoeuvring expected by the pilot. The prescribed dimension of each segment is the result of adding the inherent maximum GPS signal and receiver error (called a *navigation system error*) to the potential pilot tracking error (called a *flight technical error*). The latter has been determined through extensive test flights by pilots flying using terminal and approach CDI sensitivities.

Once an approach has been designed, it is reviewed locally and test-flown to verify the accuracy of the waypoints, the flyability, the local signal interference and, most important, the actual location of the obstacles used to determined minima for each segment. Quality assurance designers carry out a further review on a national level to check for compliance with standards. These steps follow a traceable documented ISO 9000 process.

After approval, the approach is distributed to Natural Resources Canada for inclusion in the *Canada Air Pilot* (CAP) and to database suppliers, such as Jeppesen, for the inclusion in the global database from which subscribers receive their regional databases every 28 days.

Why do I need a database? Besides the risk of misentering the co-ordinates, manually entering waypoints, especially for an instrument approach, means danger. We saw earlier that in the case of a manually entered approach, the receiver does not know that the pilot is intending an approach; it thinks that the aircraft is still in the en-route mode. Therefore, the pilot operates with an integrity alert (RAIM alert threshold) of two nautical miles and a full-CDI deflection, which represents five nautical miles off course.

At five nautical miles full deflection, the width of the needle can represent a large error in navigation, which is outside the flight technical error assumed during the design of the approach. Although some receivers can be forced into increased CDI sensitivity, the only safe way to ensure proper CDI sensitivity is again to load an approach from a current database. Manually entering co-ordinates of a published approach will not do.

Conclusion—Without a proper approved receiver and an IAP retrieved from a current database, flying a GPS approach is simply taking risks, serious risks.

For more information—*Aeronautical Information Circular* 1/00 contains all the terms and conditions for the use of GPS under IFR in Canada.

The SatNav Program Office (SNPO) is the focal point for the introduction of SatNav in Canada. This group of pilots and engineers teams with experts in Transport Canada and in a wide range of international and national organizations to sort out the operational and technical issues involved in bringing the benefits of SatNav technology to Canadian aircraft operators safely and expeditiously. SatNav information can be found on their Web page on NAV CANADA's Web site *<http://www.navcanada.ca>*. The SNPO e-mail address is SatNav@navcanada.ca; their fax number is (613) 563-5602.

Upcoming Regional Events

The following schedule for upcoming courses and/or workshops is tentative. Please contact your regional office for exact location and cost.

Atlantic Region

PDM November 4 Waterville, N.S. November 9 Goose Bay, Nfld.
HPIAM November 2–3 St. John's, Nfld. November 6–7 St. John's, Nfld
CRM November 7–8 Goose Bay, Nfld.
CASO October 24–25 Halifax, N.S.
Courses and workshops are available on demand. For further information, please contact Rosemary Landry at (506) 851-7110.

Quebec Region

Skills Review Seminars. Topic: *Piloter : facteurs de risque et prise de décision* **(all in French except where noted)**
November 15 Montreal (Association des Pilotes de Brousse du Québec) November 18 Sherbrooke
January 16, 2001 Chibougamau January 17 Rouyn January 26 Rimouski
CASO October 25–26 Montreal
HPIAM November 22–23 Quebec City December 12–13 Sept-Îles
CRM and PDM courses are available on demand. For more information or to register, please call (514) 633-3249.

Ontario Region

HPIAM October 4–5 Thunder Bay November 2–3 Dryden December 4–5 Toronto
January 10–11, 2001 North Bay February 6–7 Ottawa March 6–7 Toronto
PDM October 28 Toronto
Safety Seminar November 18 Thunder Bay November 23 London
For information or to register for the above courses, or for information on the Toronto area Monthly Aviation Safety Seminars schedule, please contact Nicole Nel at (416) 952-0175.

Prairie & Northern Region (PNR)

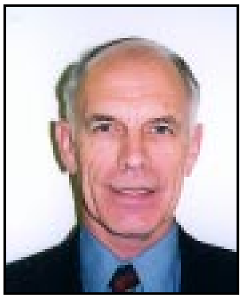
CRM October 25–26 Saskatoon, Sask. November 15–16 Winnipeg, Man. December 6–7 Edmonton, Alta.
CASO October 24–25 Winnipeg, Man. November 22–23 Calgary, Alta. December 12–13 Edmonton, Alta.
PDM*: This course is available on request with a minimum of 12 participants.*
HPIAM November 8–9 Winnipeg, Man. December 19–20 Calgary, Alta. January 18–19, 2001 Edmonton, Alta.
For information on courses and workshops in PNR, please contact Carol Beauchamp at (780) 495-2258; fax (780) 495-7355 or e-mail: beaucca@tc.gc.ca.

Pacific Region

CRM December 5–6 Richmond
CASO January 30–31, 2001 Richmond
PDM Richmond—every third Thursday of every month. (Except October and December)
Abbotsford—every three months (Next date: October 26)
HPIAM November 1–2 Richmond
In order to help distribute information, we are compiling an e-mail distribution list of those in the Pacific Region who want to receive information on upcoming workshops and presentations electronically. Send an e-mail to Lisa Pike at pikel@tc.gc.ca to request that your e-mail address be added to the workshop distribution list. You will be automatically notified of any workshops or presentations that become available. For more information, please call Lisa at (604) 666-9517.

Know Your RASOs—Fred Johnson and Rae Simpson, Ontario Region


Fred Johnson


Rae Simpson

Fred Johnson started his aviation career as a private pilot in 1962. By 1964 he was flying commercially, but it took until 1969 for him to discover the uniqueness of helicopter flight. Fred currently holds both an airline transport pilot licence (ATPL) (Helicopter) and a commercial (Aeroplane) licence. Fred is registered as a Professional Engineer in both Alberta and the Northwest Territories. He holds a Master of Engineering degree in Engineering Management and a Bachelor of Science degree in Civil Engineering from the University of Alberta. Fred has served in management, first for Canadian Helicopters (Western Division) in Edmonton, then later for Nunasi Helicopters in Yellowknife, as an Operations/ Special Projects Manager for most of the past 12 years.

Rae Simpson began his aviation career in 1961 when he earned his private pilot licence in Toronto. He joined the military the following year and earned his wings in 1967. For the next 28 years, he held a variety of positions as a fighter pilot and as a test pilot in the Canadian Forces. He later joined Bombardier Aerospace as Chief Flight Test Engineer for the de Havilland Dash 8 series 400 certification program. Rae has experience as an instructor pilot in light aircraft and gliders. He holds a BASc and a MASc degree in aerospace engineering from the University of Toronto. He is a graduate of the United States Naval Test Pilot School and of the Canadian Forces Flight Safety Officers Course. He holds an ATPL (Aeroplane) for land and sea.

You are encouraged to voice your safety concerns or comments to Fred or Rae in Toronto at (416) 952 0175. △

Answers for Self-paced Study Program

1. *19:00 local time*
2. *Never exceed speed*
3. *Yes*
4. *In the CFS*
5. *Wind, altimeter setting, air temperature, and dew point*
6. *4; 12; 12*
7. *3; 3*
8. *3,000; 5*
9. *When weather changes of significance to aviation are observed*
10. *600 ft AGL*
11. *light rain showers and mist.*
12. *blowing snow in the vicinity*
13. *Helicopters: 1 SM, clear of cloud; all other aircraft: 2 SM, clear of cloud*
14. *90% increase in take-off distance; 50% decrease in climb performance*
15. *sky condition: scattered or clear; ground visibility: 5 mi. or more*
16. *a readback of the hold-short point*
17. *10*
18. *200*
19. *downwind; circuit*
20. *500*
21. *From the upwind side.*
22. *(A) joining the downwind leg; (B) established on final approach, stating intentions; (C) clear of the active runway after final landing*
23. *transponder*
24. *20; 40*
25. *The nearest ATS unit or the nearest Rescue Co-ordination Centre (RCC)*
26. *Only during the first five minutes of any UTC hour*
27. *The "Emergency Procedures" section (Section F)*
28. *1530; December 15, 2000*
29. *A replacing or cancelling NOTAM must be issued*
30. *60; 24; 24 months*
31. *5; 6*
32. *TP 10737, Use of Automobile Gasoline (MOGAS) in Aviation*
33. *MOGAS is more susceptible to carburetor ice: ice may form at outside air temperatures (OAT) up to 20º higher than with AVGAS*
34. *.25; .3*
35. *Cross at a tower, at 45º to the line*
36. *seriously*
37. *hyperventilation*

Night VFR Part 1—Do You See The Hazard? *cont. from p. 12*

along air routes or routes specifically established by the air operator and designed in accordance with section 723.34 of the *Commercial Air Service Standard* (CASS). As ground features may be very difficult to see, identify any NAVAIDs that you can use along the way to assist in navigation. Always carry a serviceable flashlight or, better yet, carry two. Pre-fold your maps and bookmark pages in any flight publication that you may be using to help you find the information you are looking for.

Aircraft

Last but not least, is your aircraft. Check all interior and exterior lights, and make sure you are totally familiar with the operation of all instrument panel, overhead and cabin lights. Test the dimmers, which will allow you to adjust your cockpit lighting as required. Also, it is a little known fact that CAR 605.16 requires the pilot-in-command to have a number of spare fuses that is equal to at least 50% of the total number of installed fuses of that rating accessible to him/her during flight. (Bet you didn't know that.)

Start, Taxi and Run-up

With the dim lighting, it will be more difficult to find your charts, pencil, flashlight, *Canada Flight Supplement* (CFS), etc., so organize your cockpit to have all items easily and quickly accessible. Passengers can reduce your workload by holding a map or the CFS for you.

Because of the restricted visibility, taxi at a reduced speed, particularly in the vicinity of other aircraft and obstacles. Taxi speed is deceptive at night, and there is a tendency to taxi too fast. One reason for this is the lack of customary visible ground objects that make speed apparent during the day. At night, stationary lights are nearer than they appear to be, which makes judging distance difficult. Also, our depth perception is reduced in dark conditions, so give yourself a little extra room while manoeuvring.

Some aircraft do not have a taxi light, so the landing light could be used. Keep in mind that at the slower speeds, the landing light may overheat and fail. Also keep in mind that other pilots may be trying to adapt to night vision and would not appreciate your landing or taxi light illuminating their immediate surroundings. It is also more difficult to detect movement at night; therefore, when parked with the engine running or doing your run-up, make sure you have the brakes firmly applied and be on the look-out for any movement that may occur.

Takeoff and Climb

One of the high accident rate areas at night occur during the takeoff and climb phase. According to information from the Federal Aviation Administration (FAA), you are more than five times as likely to have an accident during this phase of flight at night. Prior to takeoff, adjust your cockpit lighting so that the brightness does not interfere with your night-adapted eyes or reflect off windows to the point of distraction, but keep it bright enough to clearly read the instruments.

It may take some time to find the correct level of lighting for the given situation and will change as your eyes adapt to the darkness, which will take about 30 min. After time spent in bright sunlight, the eye is slow to adapt to darkness, and this may reduce night vision. To improve dark adaptation, pilots should use sunglasses during the day to avoid eye fatigue. For the most part, the take-off procedures are the same at night as they are during the day except that once you leave the ground, you will have fewer visual clues and will become more susceptible to illusions.

Keep an eye out for Part 2 in an upcoming issue of *Aviation Safety Letter*, and contact your regional System Safety office for the latest on our NVFR safety promotional campaign. △

ASL Safety Caption Contest Answers

In ASL 2/2000, we asked you to send photo captions of what you thought the crews may have said to each other after this landing.

Here are some of the best responses.

"I've heard of fly-fishing, but this is ridiculous." Laurent Desnoyers, Saskatoon, Sask.

"I guess this will wash me out for this route check, eh?" Douglas Sowden, Nanaimo, B.C.

"I think I need to raise my seat a bit . . . " Gord Howe, Burnaby, B.C.

"I told you it would float." Dave McIntosh, Val des Monts, Que.

"Sir, a passenger in 34C has a complaint about the halibut . . . " R. Stickel, Red Deer, Alta.

"I just can't seem to get it onto the step." Herb Williams, Winnipeg, Man.

The ASL thanks all of you who sent an entry, including several making reference to pumping the floats! △

Night VFR Part 1—Do You See The Hazard?

by John Heiler, Regional Aviation Safety Officer, Pacific Region

Night visual flight rules (NVFR) flight has always been and continues to be more hazardous than day VFR flight, mostly because of the lack of visual cues and our vulnerability as humans to be affected by illusions. Historical accident data indicates not only that the risk of specific types of accidents increases at night (in the form of dark night takeoffs, inadvertent instrument meteorological conditions (IMC), controlled flight into terrain (CFIT), and black-hole illusion) but also that these accidents are usually fatal.

Even though the hazards associated with flying at night have been known within the industry for many years, these types of accidents continue to occur, which suggests a relatively low level of awareness within the pilot community. This article will address some of these hazards, which usually affect our human physiological limitations.

Whether we are a low-time recreational pilot or a highly experienced airline veteran, we are all affected by the increased risk of night flying. In January 1999, a DC-3 was en route from Vancouver to Victoria, B.C., on an NVFR flight when it collided with trees on Mayne Island, at about 900 ft ASL. The aircraft then fell into a valley, where a post-crash fire occurred. The two occupants of the aircraft sustained fatal injuries, and the aircraft was destroyed. This CFIT accident occurred even though there were almost 30,000 hours of flight experience between the two pilots!

Pilots can have difficulty seeing terrain at night, even in clear visual meteorological conditions (VMC). In addition to the above example, one of the most publicized CFIT accidents claimed the lives of eight members of country music singer Reba McEntire's band and two flight crew members. While flying below controlled airspace in San Diego, California, and awaiting an instrument flight rules (IFR) clearance, the flight crew of the Hawker Siddeley DH-125 flew under controlled flight into mountainous terrain. The night was clear and moonless with 10 mi. visibility.

Pilot Self-check

It is primordial that you are physically and physiologically at your best before flying at night. While you may be tempted to squeeze in a few circuits during the day with a head cold and get away with it, the same trick at night may cause you more than a few sniffles. Never fly at night if you are sick, tired, or taking medication. This may sound overly paternalistic and just plain motherhood, but it needs to be said. Also, it is generally believed that smoking prior to a night flight may reduce your visual acuity—a good time to butt out!

Pre-flight Planning

With any flight, pre-flight planning is extremely important; this is especially true at night. As it is difficult to see weather at night, you need to review the weather conditions that you may encounter. Pay particular attention to the temperature-dew point spread. Be very cautious when the spread is less than 5°C. Section 602.115 of the *Canadian Aviation Regulations* (CARs) requires a visibility of three miles for NVFR flight but, remember, this is a minimum.

Dark Night Conditions

Dark night conditions normally occur when there is no or there is very little celestial lighting or when this lighting is obscured by an overcast layer of cloud. Most night accidents happen in these conditions because of the lack of visual cues available to the pilot even in VMC.

In a recent accident, a Piper PA-31 with nine occupants on board departed Rainbow Lake, Alta., westbound at night and collided with trees and terrain approximately 3000 ft west of the departure end of the runway. The sky was clear with unrestricted visibility and light winds. The ambient lighting conditions were described as dark, with no moon, little illumination from the night sky and no lights to the west of the airport, basically, dark night conditions. The Transportation Safety Board of Canada (TSB) determined that the aircraft was inadvertently flown into trees and the ground in controlled flight because a positive rate of climb was not maintained after takeoff.

The pilot's night departure technique was considered to be the active failure in this accident. Night departures in dark conditions require full use of the aircraft flight instruments, and it is essential that the pilot achieve and maintain a positive rate of climb. In the absence of outside visual cues, the pilot must rely on aircraft instruments to maintain airspeed and attitude to overcome any false sensations of a climb. In this case, the pilot was either relying on outside visual cues during the initial climb and/or using only a partial instrument panel scan while being influenced by a somatogravic illusion. (See "Controlled Flight into Terrain (CFIT) at Night" in ASL 4/99 or TSB Final Report A98W0009 for a complete review of this accident.)

Route Study

A thorough route study is required to identify any hazards or obstructions along the way. For commercial operators, CAR 703.27(*a*) prohibits en route NVFR at less than 1000 ft above the highest obstacle. In addition, NVFR must be conducted

cont. on p. 11

Transport Canada
Flight Crew Recency Requirements, Self-Paced Study Program
Refer to *Canadian Aviation Regulations* (CARs) 421.05(2)(*d*)

This self-paced study questionnaire is for use from October 5, 2000 to October 4, 2001. When completed, it meets the 24-month recurrent training requirements of CAR 401.05(2)(*a*). It is to be retained by the pilot.

Note: The answers may be found in the *A.I.P. Canada* or in the *Canada Flight Supplement* (CFS); references are at the end of the questions. Amendments to these publications may result in changes to answers or references, or both.

1. Using the *A.I.P. Canada* GEN 1.6.2 charts, find the beginning of Evening Civil Twilight on March 30th at 50º North latitude and 90º West longitude. ____(GEN 1.6.2)
2. Define V_{ne}. ____(GEN 1.9.1)
3. After all normal communications failure procedures have been followed, is it permissible to contact an Air Traffic Service (ATS) unit by cellular phone?____(COM 5.14)
4. Where are the telephone numbers of ATS units published? ________________________________COM 5.14)
5. What meteorological information is available from a Limited Weather Information System (LWIS)? ____(MET 1.2.5)
6. Graphic Area Forecasts (GFA) are issued _______ times per day and cover a _______-hour period, with an outlook for a further _______ hours. (MET 3.3.2)
7. A GFA package includes _______ Clouds and Weather charts and _______ Icing, Turbulence and Freezing Level charts. (MET 3.3.2)
8. In the GFA "IFR OTLK" section, VFR means a ceiling of more than _______________ feet AGL and a visibility of more than _______ SM. (MET 3.3.9)
9. When is a SPECI report issued?_ ____(MET 3.15.1)
10. SPECI CYVR 061843Z 09008KT 4SM -SHRA BR BKN006 BKN015 OVC040 RMK SF5SC2SC1 TCU EMBDD=
    What is the height of the reported ceiling? ____(MET 3.15.3(k))
11. The weather code -SHRA BR is decoded as ____
    ____(MET 3.15.3(j), "Significant Present Weather Codes" table)
12. The weather code VCBLSN is decoded as ____(MET 3.15.3(j))
13. What are the day VFR weather minima in uncontrolled airspace below 1,000 feet AGL? ________________
    ____(RAC 2.7.3, figure 2.8)
14. Airport pressure altitude: 3,000 feet; temperature: 30ºC.

    Using the Koch Chart (CFS, section C), determine the percentage increase in take-off distance and percentage decrease in climb rate. ______________________ ___________________(CFS, section C, or text books)
15. For a VFR Over-the-Top flight, the forecast sky condition and visibility at the destination must be _______
    ____(RAC 2.7.4)
16. If a ground controller issues instructions to **HOLD SHORT**, the pilot shall acknowledge with ____(RAC 4.2.5)
17. Unless otherwise advised by ATC, pilots departing from an airport should not request release from tower frequency and, when practical, should monitor tower frequency until _______ NM from the control zone. (RAC 4.2.9)

18. When Simultaneous Intersecting Runway Operations (SIRO) are in use, landing pilots are obligated to remain _______ feet short of the closest edge of the runway being intersected. (RAC 4.4.9(b))

19. When a pilot is **"cleared to the circuit**," ATC expects the pilot to join the circuit on the ____________ leg at the _________________ height. (RAC 4.4.2)

20. When crossing an uncontrolled aerodrome prior to joining the circuit, it is recommended that the pilot accomplish the crossover at least _______ feet above circuit altitude. (RAC 4.5.2 (a))

21. Where should the pilot enter the circuit when the pilot is uncertain of the location of circuit traffic and mandatory frequency (MF) procedures are not in effect.
____(RAC 4.5.2 (a))

22. When conducting continuous circuits at an uncontrolled aerodrome, the pilot of a radio-equipped aircraft shall report (A) ______________________________, (B) ___________________________________, and (C) ____. (RAC 4.5.7)

23. To be detected by traffic alert and collision avoidance system (TCAS)/airborne collision avoidance system (ACAS) equipment, an aircraft must be equipped with an operating ____________________(RAC 12.15.1)

24. Raising an ELT from ground level to 2.44 m (8 ft) increases the range _________ to _________%. (SAR 3.6)

25. Who should you notify in the event of an accidental ELT transmission? _____________________________
____(SAR 3.7)

26. When may an ELT test be conducted? ____(SAR 3.8)

27. What section of the CFS contains procedures to follow when sighting a downed aircraft or a ship in distress or when receiving an ELT signal?
____(SAR 4.8.2)

28. 000211 NOTAMN CYSB SUDBURY RWY 04/22 CLOSED TIL APPROX 0012151530
Runway 04/22 is expected to be open at _______Z on (date) ____________________________(MAP 5.6.1)

29. What is the significance of the term "APPROX" in the above NOTAM? ____________________(MAP 5.6.1)

30. A Canadian Medical Certificate for a Private Pilot Licence is valid in Canada for _______ months if under age 40 and for _______ months if age 40 or older. What is the validity period for these certificates outside Canada? ____ (*Aeronautical Information Circular* 10/00)

31. In order to carry passengers, you must have completed _______ takeoffs and landings in the same category and class of aircraft in the previous _______ months. (LRA 3.9)

32. What Transport Canada publication provides detailed information on the use of MOGAS?
____ ____________________________________(AIR 1.3.1)

33. How does MOGAS affect the formation of carburetor ice? __________________________________(AIR 2.3)

34. In the absence of a Canadian Runway Friction Index (CRFI) report, you can expect a snow-covered runway to have a CRFI value of from _______ to______________________________ (AIR 1.6, Table 4)

35. If it is necessary to fly over a power line at low altitude, where should you cross the line in relation to the towers and at what angle? ____(AIR 2.4.1)

36. Simple drugs, such as antihistamines may (slightly/seriously) impair the judgment and co-ordination needed by a pilot. __________________________________ (AIR 3.12)

37. A pilot on a stressful flight below 8,000 feet notices feelings of slight dizziness, coldness, and pins and needles in the hands and feet. The pilot should suspect ________________ is the cause. (AIR 3.2)

Signature ____Date _________________