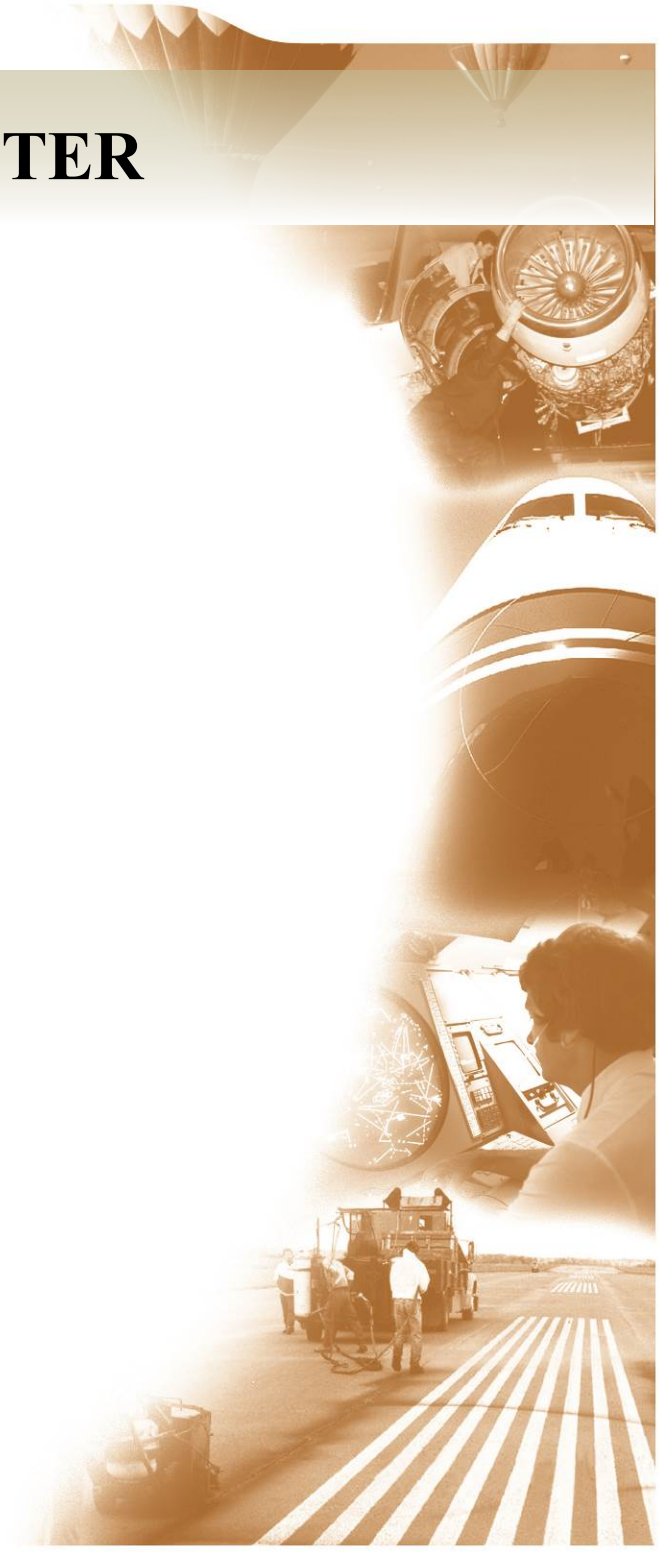
Transport Canada Transports Canada

TP 185E
Issue 1/2019

AVIATION SAFETY LETTER

In this issue...



Learn from the mistakes of others;
You'll not live long enough to make them all yourself…

Canada

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Table of Contents

Integration of Electronic Flight Bags in the General Aviation Cockpit

by Kathleen Van Benthem, Ph. D., ACE Lab, Visualisation and Simulation Centre, Carleton University, Ottawa, Canada; and Elena Psyllou, Imperial College London, UK.

The last three issues of the *Aviation Safety Letter* (ASL) contained updates from the studies on general aviation, cognition, and aging conducted at the Advanced Cognitive Engineering (ACE) Lab. In this issue, we would like to share the findings of two studies that investigate the effects of the use of an electronic navigational aid* during visual flight rules (VFR) flight. In 2017, we embarked on a collaborative effort with Dr. Arnab Majumdar from Imperial College London, UK to determine how the use of an iPad with the ForeFlight app might affect flight path maintenance across the phases of a short cross-country flight. In this article we review findings from interviews with pilots across Europe and preliminary findings from the ACE Lab study. Based on our findings, we make some recommendations regarding electronic navigational aid use for VFR flight.[1]

The progressive integration of satellites into aviation operations has not gone unnoticed by the general aviation (GA) community around the world. An increasing number of GA pilots currently navigate using information from satellites as well. According to the Canadian Owners and Pilots Association (COPA) 2017 survey, 3 in 10 pilots use a tablet and 4 in 10 pilots use a Global Positioning System (GPS). Figure 1 illustrates the frequency of electronic navigational aid use in our recent study at the ACE Lab and shows that over 80% of the study participants use electronic aids to navigate, either exclusively or in combination with traditional paper maps.

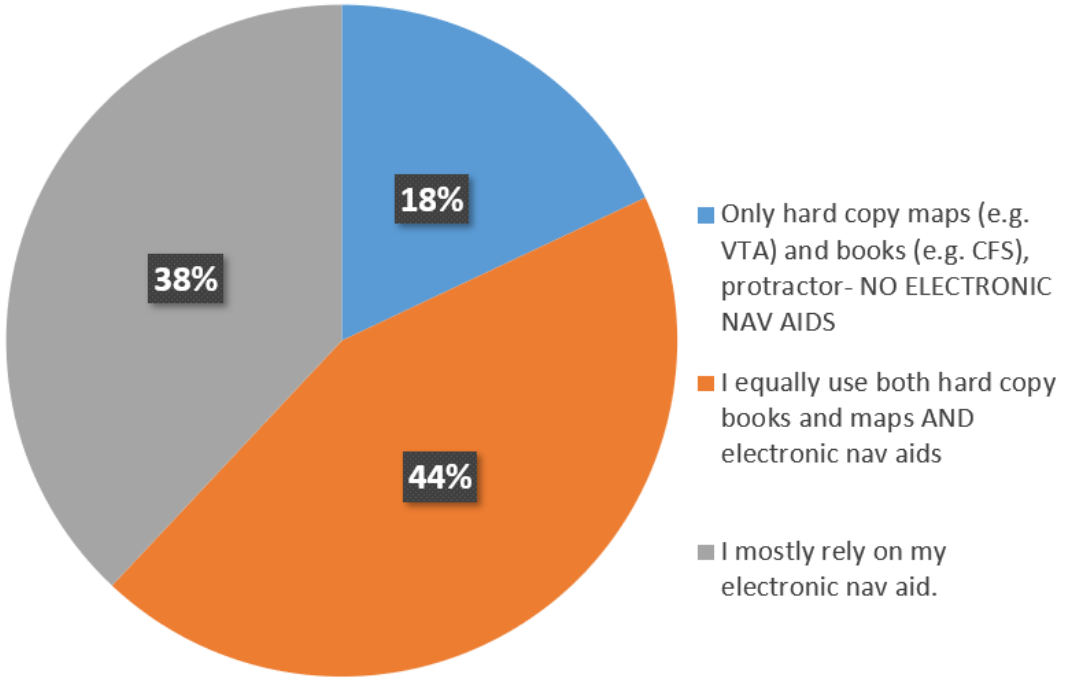


Figure 1. Frequency of electronic navigational aid use (unpublished data, 2019). Most pilots who use electronic navigational aids reported that they use the ForeFlight app, while others used Garmin products or FltPlan Go.

*Space-based navigation can be achieved either by certified avionics device with an antenna installed, e.g. Garmin 1000, or by a receiver installed in a tablet or mobile phone that is not specifically designed for aviation, commonly known as an electronic flight bags.

1. Psyllou, E., Majumdar, A. and Ochieng, W. (2018) "A Review of Navigation Involving General Aviation Pilots Flying under Visual Flight Rules," Journal of Navigation. Cambridge University Press, pp. 1–13.doi: 10.1017/S0373463318000279.

Your Turn: Have you thought about how the use of your electronic navigational aid changes your activities while flying?

In a study conducted in Europe in 2016, 75% of GA pilots who flew a fixed-wing power aircraft, such as a Cessna 170, stated that they used a dashboard mounted GPS receiver with either a tablet or a paper map, with the main motivators being the ability to graphically see the aircraft track over the digital map and the time they save in calculating the position of their aircraft in-flight. Furthermore, the pilots stated that the space-based navigation has improved their navigation especially when they fly over sea, where no visual landmark is present. This finding can also be applied to the rural areas of Canada that are covered by forests and have little street lighting.

Despite the expanding prevalence of electronic aids and space-based navigation in GA, their use is not explicitly included in the teaching syllabus for the GA pilot's licence, leaving GA pilots to teach themselves how to integrate a rather modern device in their standard non-glass cockpits. In the European study, pilots also indicated that there may be potential drawbacks of handheld-style electronic navigational devices in the cockpit. For example, pilots may unconsciously rely solely on these technologies and, as a result, they might fail to notice that their aircraft is travelling faster than anticipated, leading to a loss of situational awareness. Furthermore, pilots might stare at the tablet or GPS display and only monitor the aircraft's symbol, forgoing frequent checks of the flight instrument or out the window for navigation.

Preliminary results from the recent study of navigational aids at the ACE Lab suggest that there may be a trade-off involving task performance when hand-held electronic navigational aids are used by pilots with low flight time. For example, while low-experience pilots may see some improvement in altitude and heading maintenance when using the navigational aid, their performance in the communication task suffers when compared to that of low-experience pilots not using the navigational aid.

Your turn: How will using a navigational aid reduce your risks while flying? Are there any risks that might increase?

Reports from pilots at the ACE Lab study suggest that pilots are most interested in the benefits of electronic navigational aid use that pertain to situation awareness. When participants were asked about their perceived benefits of using an electronic navigational aid, the following comments were made:

- I fly safer.
- I am better at route planning.
- I stick closer to my planned route.
- I feel less tired.
- I'm more likely to divert.

Based on the research findings, we have a few suggestions for addressing risk and electronic navigational aids, particularly for VFR flight:

- Be aware of the changes that the tablet and GPS can have on your performance. For example, think about the routine you already have for checking gauges while you fly. How can you add your electronic navigational device to this routine, without compromising important tasks?
- Talk to your instructor or pilot examiner about your plans to use an electronic flight bag. They may have very handy tips and advice for you.
- Remember that external devices and their apps can fail, freeze up in the cold, lose battery power, or stop working for a variety of reasons. Are you ready to fly without them?
- Develop the best method of displaying and mounting external navigational devices. Ask other pilots what works best for them.
- Read the manual that accompanies your electronic flight bag so that you are aware of its limitations and operating procedures.

Try this exercise the next time you fly: while you are preparing for departure, make a guess as to the extent to which you will rely on the tablet or GPS. After you land and during your de-briefing, ask yourself, "What do I remember more: the tablet's screen or the terrain?" If you would like, you can share your responses with us. We would appreciate hearing your thoughts on electronic navigational aids and risk for GA pilots. Please send your comments to kathy.vanbenthem@carleton.ca. △

How is Your Situational Awareness?

by Pierre Ruel, Chief, Flight Standards, Standards, Civil Aviation, Transport Canada

As a saying in the fighter-pilot world goes, it is much easier to analyze a situation at one G and zero knots (kt) than it is to analyze it while one is in fact busy flying a high-performance aircraft. An analogy in football is called the "armchair quarterback". And so, this article is written with the caveat that there is a distinct advantage in evaluating a scenario while on the ground instead of dealing with it while moving forward, burning fuel, and realizing that time is somewhat of the essence… If you are a professional aviator, you likely take time to read major accident investigation reports from the Transportation Safety Board (TSB) and the National Transportation Safety Board (NTSB). If you only fly for recreational purposes, you should still make an effort to review pertinent accident reports, as they contain a lot of valuable information, conclusions, and recommendations. When I read TSB and NTSB reports, I always try situating myself in the cockpit minutes before the mishap and, in the majority of cases, my own personal questioning revolves around one item: What was the situational awareness (SA) in the cockpit a few minutes prior to the accident?

I am sure you will agree that prior to an accident—unless it was a pure mechanical failure for which nothing could be done, a very rare occurrence—the SA in the cockpit is low: pilots are "low SA". But what is SA? The *Risk Management Handbook* (FAA-H-8083-2) produced by the Federal Aviation Administration (FAA) explains that SA is "…the accurate perception and understanding of all the factors and conditions within the four fundamental risk elements (pilot, aircraft, environment, and type of operation) that affect safety before, during, and after the flight". Dr. Mica R Endsley, an engineer and former Chief Scientist of the United States Air Force, defines SA as "… the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future". Most fighter pilots define SA as knowing what is going on around them and being ahead of the game, plain and simple.

So, SA is pretty much the Holy Grail of aviation. If you have high SA ("hi SA"), you are very unlikely to experience a controlled flight into terrain (CFIT) accident, a loss of control in-flight (LOC-I), or a MAC (mid-air collision). If there is high SA in the cockpit, the pilot(s) will avoid undesirable situations, recognize when things start to go wrong, and do something about it before it gets worse. Unlike machines, humans vary in performance, and the ability to maintain high SA on a particular day depends on factors such as fatigue, stress, physical environment, and so on. In other words, as hard as one may work on improving SA, it can be limited by factors beyond one's control. A simple analogy is to compare SA to a bucket: its size is finite and can vary from day to day.

Whatever the size or limit of one's bucket on any given day, the best approach for preventing mishaps is to prioritize what has to go into the bucket and stay there, and what may not be essential during a certain segment of the flight. In other words, given the fact that perfect SA may not always be achievable, the best way to prevent an accident is to think about the most serious threats for specific portions of a flight and to ensure that the proper counter-measures for those threats are the first to go into the bucket. If a pilot can break down the flight into different segments, he or she can review the most likely threat(s) for those portions of the flight and reset when going from one segment to another. For example, the major threats for the take-off and climb portions of a flight should be reviewed prior to that segment. Once the aircraft is at altitude and enters the cruise segment, the potential threats for that portion of the flight should be reviewed and re-prioritized. The same goes for the descent, approach, and landing: the flight is broken down into segments and the most significant threats are reviewed for each. This helps the pilot(s) maintain a certain level of SA, no matter how big or small the "bucket" is on a given day.

All pilots are taught to use a checklist for various phases of flight. Checklists are necessary so that a pilot can ensure that the machine he or she is about to fly (whether it is a CF-18, a Super Decathlon, an ultralight, or a B777) is properly configured and that all systems will do what they are supposed to do. However, checklists deal mostly with equipment, not with SA. Every takeoff is different (location, terrain, time of day, wind, outside air temperature, etc.). What is it that the pilot should really consider as potential threats for a particular takeoff and climb? What about the next segment, cruise flight? Checklists and standard operating procedures (SOPs) are critical tools for pilots, but focusing one's SA prior to each segment of the flight is also good practice. The next time you go flying, go ahead and challenge yourself before you're airborne and, subsequently, during the various phases of the flight by asking yourself: How is my situational awareness? △

Annex 19 & Canada's State Safety Program

by Gordon R. Swanson, Executive Advisor, State Safety Program, Technical Programs, Evaluation and Coordination Division, Transport Canada

Our international air transportation system and its interrelated activities are increasing in complexity. Furthermore, air traffic is projected to double in the next fifteen years. For these reasons, having a single set of global norms and practices surrounding safety management is now considered critical to civil aviation safety.

Accordingly, Transport Canada and the International Civil Aviation Organization (ICAO) support the continuous evolution of proactive strategies to improve safety performances. The foundation of this proactive strategy is based on the implementation of a State Safety Program (SSP), which systematically addresses safety risks. It creates a framework to facilitate data-informed, evidence- based decision making. It will be a collaborative effort between the government and industry to establish a safety culture to continuously improve aviation safety and share best practices.

What is the SSP?

The State Safety Program (SSP) is an integrated set of regulations and activities aimed at improving aviation safety. SSP applies to both the State (Canada) and industry safety programs to achieve an acceptable level of safety performance in aviation.

To assist States with implementing an SSP, ICAO has developed Standards and Recommended Practices (SARPS), *Annex 19—Safety Management,* and the *Safety Management Manual (SMM) (Doc 9859),* which outline the requirements States are to meet for an effective SSP. In addition to the SSP, these SARPS establish the international standards for the consistent application of a safety management system (SMS) with the sharing, exchange, collection, analysis, and protection of safety data and safety information.

Annex 19 came into force in 2013, consolidating material from existing annexes regarding the SSP, SMS, safety data use, and State Safety Oversight (SSO) activities. This strategy to create a single annex for safety management was seen as crucial, given the rapid growth and increased complexity of our global aviation system.

Annex 19 requires that the SSP for each State shall include the following components:

- State safety policy, objectives and resources;
- State safety risk management;
- State safety assurance; and
- State safety promotion.

Why does it matter to Canada?

As the United Nations' specialized agency governing aviation, ICAO establishes SARPS for its member nations. As a member State, Canada must comply with ICAO annexes to demonstrate conform to global civil aviation norms.

Indeed, there are also many benefits to having a SSP. It highlights the importance of safety management at the State level, enhances safety by consolidating safety management provisions applicable to multiple aviation domains, facilitates the evolution of safety management provisions, and more.

Why does it matter to me?

Ultimately, the goal of Annex 19 is to foster a positive and proactive safety culture. By taking the time to inform yourself of the SSP and its components, you are playing an integral role in cultivating a positive and proactive safety culture in both your organization and the civil aviation system overall. We all have a responsibility to stay informed.

To whom does it apply?

The SSP does not directly apply to specific individuals in the aviation community. The SSP requirements under Annex 19 specifically target two groups: States and industry.

States, like Canada, are required to establish mechanisms to monitor and measure safety performance using SSP requirements and guidance.

Canada's SSP applies to all government entities who have an influence on Canadian aviation safety. Government entities may include the Transportation Safety Board, National Research Canada, and the Department of National Defence, to name a few.

Industry also plays a critical role in advancing the objectives of Annex 19. They are required to address safety proactively by implementing robust SMS.

Transport Canada envisions a collaborative approach to safety management. Therefore, government and industry must work in tandem to breathe life into the aspirations of Annex 19 in Canada.

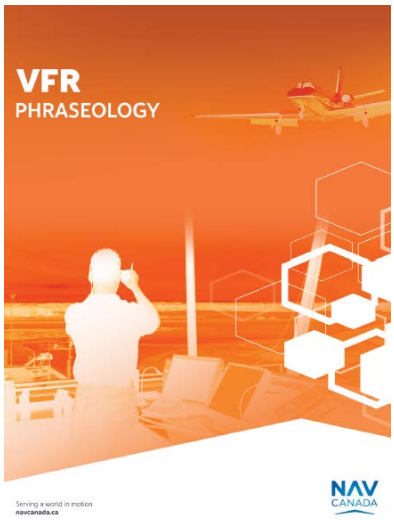
What's next?

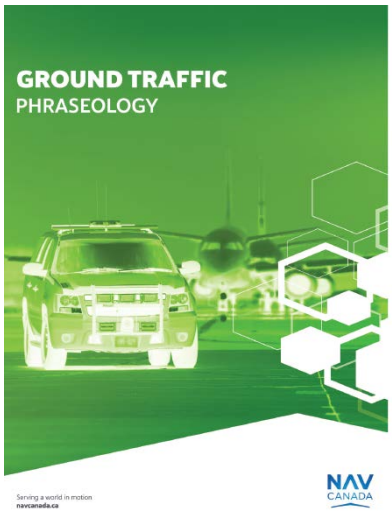
ICAO member States are committed to the implementation of Annex 19 by November 2019. Canada is on track to meeting Annex 19 standards. △

Phraseology Guides

by Gary Robertson, NAV CANADA

In collaboration with its aviation partners, NAV CANADA has released two aviation phraseology guides: the *VFR Phraseology Guide* in 2015 and the *Ground Traffic Phraseology Guide* in 2018. A third publication, the *IFR Phraseology Guide*, is scheduled to be released in 2019.





The introduction of the *VFR Phraseology Guide* is a comprehensive and easy-to-use reference guide offering examples of best practices for pilot-controller communications and recommended phraseology to enhance pilot safety.

The *Ground Traffic Phraseology Guide* targets airport operators and maintenance engineers and provides guidance primarily for vehicles operating on aerodromes.

The VFR and ground traffic phraseology guides are available in both official languages on the NAV CANADA website and can be accessed here.

The *IFR Phraseology Guide* will concentrate on communications involving IFR flight and is intended for flight schools and airline operators so that they may acquire greater insight and understanding of air traffic control communications. It will also offer best practices and relevant examples.

The purpose of these publications is to provide flight schools, airport operators, and aviation stakeholders with a training tool that will enhance communications and improve aviation safety. It is the product of a collaborative initiative between NAV CANADA and its aviation partners, including Transport Canada, airlines, flying clubs, and other aviation-related organizations, and also utilizes extensive input from NAV CANADA Air Traffic Controllers and Flight Service Specialists.

Over the years, miscommunication has been recognized as a cause or contributing factor in operating irregularities and continues to be a challenge. It is our goal to provide a robust communication environment for everyone. Hopefully, these phraseology guides will assist in making aviation in Canada even safer. △

Updating Publications

Pilots have a responsibility to keep updated publications and global positioning system (GPS) databases and to read NOTAMs prior to flying. Flight planning is important.

Between January 1, 2016 and November 10, 2018, there were 2550 reported occurrences across Canada related to "communication error". Of these "radio communication error" occurrences, 156 were reported "wrong frequency" events.

Good pre-flight planning is important for obtaining crucial information about the airport or aerodrome.

Many incidents involving pilots using the wrong communication frequency while flying in a mandatory frequency (MF) or aerodrome traffic frequency (ATF) zone continue to occur. Updates to publications such as the *Canada Flight Supplement* (CFS), the *Canada Air Pilot* (CAP), navigation maps, GPS databases, and NOTAMs are constantly being made; however, pilots continue to fly without current CFS information and without updating their GPS databases. The risk of collision with another aircraft increases greatly when pilots do not use the appropriate frequency for the airspace in question.

Additionally, incidents and accidents continue to occur every year when airport/aerodrome movement areas are under construction. Pilots do not keep up to date with published NOTAMs and AIP Supplements, which relay important information on the closed or reduced length or width of runways, taxiways, and aprons. The lack of important airport/aerodrome information puts not only pilots' lives at risk, but also the lives of their passengers and those of construction workers on the ground. △

Are you an air operator?

To learn more about preventative measures and de-/anti-icing procedures, refer to chapter 10 of Guidelines for Aircraft Ground–Icing Operations *(TP 14052):*

https://www.tc.gc.ca/eng/civilaviation/publications/tp14052-menu-314.htm#toc-10

Night Flying Tips

Reprinted and adapted with permission from Justin Willcocks, Civil Aviation Authority (CAA), General aviation (GA) Unit

It's dark out there—so let's look at the hazards related to night flying

Weather

On nights suitable for flight there might be high pressure leading to clear skies, or a high cloud base with good visibility and light winds.

But as welcome as this weather is for flying, it can lead to a rapid drop in air temperature when the sun goes down, so it's important to be aware of the freezing level, since any amount of moisture on the airframe might freeze.

Never fly in known icing conditions. If you do need to descend from an icing level to try to melt ice from the airframe, be wary of high ground you simply can't see—refer to the maximum elevation figure (MEF), which indicates the highest feature in each quadrangle.

We all know when it's mist and fog season, but the forecast should warn of it: where conditions are forecast to improve, the forecast BECMG condition shall be considered to be applicable as of the end of the BECMG time period.

Where conditions are forecast to deteriorate, the forecast BECMG condition shall be considered to be applicable as of the start of the BECMG time period.

Preparation

At night, pre-flight inspection takes on a new meaning: Do the navigation lights and the landing/taxiing and anti-collision beacon(s) all work? Is there any airframe ice that needs to be removed? (In doing so, be careful to not push it into the control surface hinges or the pitot-static system.) As there can be a greater risk of water condensing in fuel tanks, ensure that fluid is removed from the tanks.

For comfort you'll want to ensure that the cabin heater/demist is working, but think about the last time you used it. A fault might allow carbon monoxide into the cabin (the first signs are often a headache).

For engines with a carburetor, the alternative air or carburetor heat control should be used as per the flight manual or pilot's operating handbook, but it's worth using full carburetor heat periodically anyway—and keeping it on long enough for it to be effective.

With the increase in the number of pilots complaining of laser lights being pointed at aircraft, be extra vigilant if you hear such reports.

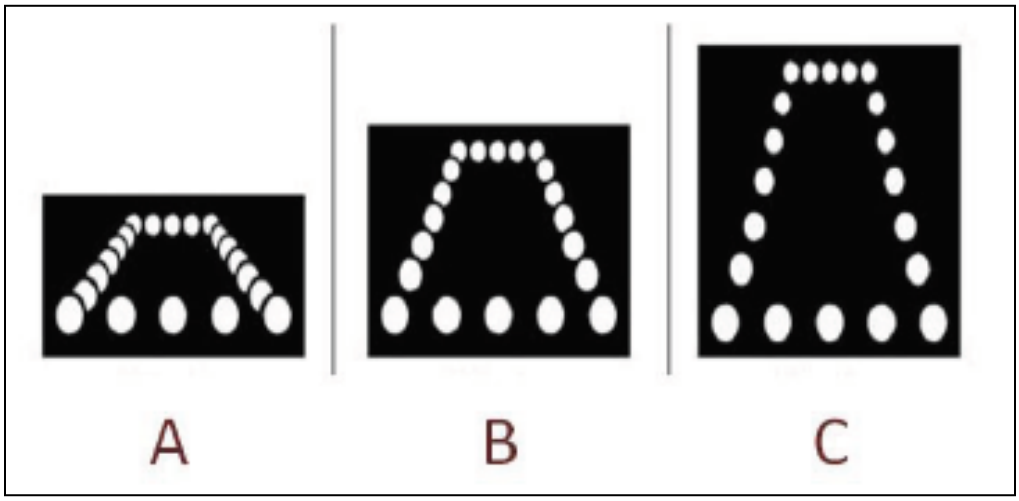
Visual Illusions

While the views on night flights can be stunning, there are also illusions to be aware of, especially on approach.

In any unlit areas, the "black hole" scenario can arise. This effect, sometimes called the "featureless terrain illusion", fools pilots into thinking they are higher than they actually are, leading to dangerously low approaches. Perception scientists disagree as to the exact cause, and it's likely that no single theory fully explains the phenomenon. The most extensive study was conducted by Boeing researchers after a series of "black hole" airline accidents in the 1960s. Using a flight simulator, Boeing instructor pilots (with more than 10 000 hours each) conducted entirely visual approaches to runways in black-hole conditions. Without the aid of an altimeter or glide slope information, most pilots flew excessively low approaches and crashed into terrain short of the runway.

While man-made obstacles near an airport such as buildings or towers are normally lit up in the dark, natural ones such as hills or trees obviously aren't, so unless there is exceptional illumination such as a full moon on fresh snow, they'll be largely invisible. This factor greatly increases the potential of flying into the ground. Numerous such accidents have occurred, so follow the abbreviated precision approach path indicator (APAPI) or precision approach path indicator (PAPI) indications (if available) or keep your focus on the runway edge lights to provide an aspect on the runway.

Another significant night visual approach risk stems from the way we interpret visual cues. Consider the runway light illustrations: Which one indicates that the aircraft is on the correct flight path for the approach?*



Training

If you haven't flown at night for some time, seek some refresher training. It's also an opportunity to identify which regulations have changed since you last flew at night.

Finally, remember to enjoy night flying: it can be a stunning experience.

*Yes, it's B.△

Transport Canada Aviation Safety Seminars

We offer free safety seminars to the general aviation community. These seminars provide pilots with tools, tips, and best practices to help you make well-informed decisions.

About the seminars

The seminars are 2-to-3-hour sessions that address aviation safety topics. You're invited to share your experiences as a pilot, and the seminars are an opportunity to meet other aviation enthusiasts.

In addition to keeping your skills current, attending a seminar allows you to meet the 2-year recurrent training requirement in the *Canadian Aviation Regulations*, Standard 421.05(2).

Upcoming seminars

We will be visiting all regions (Pacific, Prairie and Northern, Ontario, Quebec, and Atlantic). For more information, please visit: https://www.tc.gc.ca/en/services/aviation/licensing-pilots-personnel/staying-current-proficient-pilot/aviation-safety-seminars.html

David Charles Abramson Memorial—Flight Instructor Safety Award

The 16th recipient of the annual DCAM Flight Instructor Safety Award for the year 2018 was Wayne L. Cave of Chinook Helicopters, Abbostford, B.C..

Mr. Cave has been an aviator since the age of 17. Flight instruction quickly became his passion; his dedication and superior teaching skills clearly shine through.

His tenure of 14 years with Coastal Pacific, B.C. enabled him to develop and update a variety of post-secondary curricula for the Bachelor of Business Administration Aviation Degree (BBAA) program. He has personally influenced the safety training of a large portion of pilots who have trained at Abbotsford, and he is now working at Chinook Helicopters, Abbotsford, B.C. where he started up their fixed-wing division. His work ethic and commitment to safety are second to none.

Photo credit: Mike Doiron

Presentation of the 2018 DCAM Flight Instructor Safety Award to Wayne Cave by Adam Wright, Captain, Air Transat (in the absence of founder Jane Abramson)

A quote from this year's recipient:

"The importance and benefit of this award is to recognize those who are passionate about flight instructing and who work together to impart their cumulative knowledge onto students across the country. To have an award that acknowledges the individuals who are training the next generation of pilots is a benefit to the entire aviation community."

This year's deadline for submission is September 14, 2019: http://dcamaward.com/contact-information/ △

TSB Final Report Summaries

The following summary was extracted from the final report issued by the Transportation Safety Board of Canada (TSB). It has been de-identified and includes the TSB's synopsis and selected findings. Unless otherwise specified, all photos and illustrations were provided by the TSB. For the benefit of our readers, the occurrence title is hyperlinked to the full TSB report on the TSB Web site. —Ed.

TSB Final Report A18W0052—Loss of Nose Wheel on Touchdown

History of the flight

On 9 April 2018, the Air Georgian Ltd. Beechcraft 1900D aircraft on a flight from Cranbrook/Canadian Rockies International Airport (CYXC), B.C. to Calgary International Airport (CYYC), Alta. departed at 19:10 with 2 flight crew members and 8 passengers on board. The captain, seated in the left seat, was the pilot flying; the first officer, seated in the right seat, was the pilot monitoring. While the aircraft was taxiing, an unusual noise was heard coming from the airframe. The captain thought there was a possibility that ice had accumulated in the main landing gear brake assemblies, so he turned on the brake de-ice system. Once he noticed that the outside air temperature was 10 °C, the system was turned off. By this time, the aircraft had back-taxied on Runway 16 and, while the aircraft was turning around, the noise stopped. Because the noise stopped, both the captain and the first officer thought that the issue had been resolved and carried out a normal takeoff from Runway 16.

As the aircraft was climbing toward 15 000 feet (ft) above sea level (ASL), the captain noticed that the landing gear in-transit light was on. Arrangements were made with air traffic control to level off at 17 000 ft ASL, and speed was reduced to allow for the operation of the landing gear. The landing gear was selected to the down position and 3 green down-and-locked light indications were obtained. The captain then selected the landing gear up.

While the landing gear was retracting, an unusual sound was heard. All the landing gear lights went out, indicating that the landing gear was up and locked.The flight proceeded to CYYC, using the VESGA FOUR ARR arrival route for

Figure 1. The occurrence aircraft on Runway 17R.

Runway 17R. The crew discussed the possibility of a landing gear issue and planned to land as smoothly as possible. The aircraft touched down approximately 3000 ft down the runway, just before the intersection with Runway 11/29. The touchdown on the main wheels was smooth, but, as the nose wheel touched the runway, there was an immediate shimmy followed by a drop in the pitch attitude when the nose wheel became separated from the nose wheel assembly. A grinding noise was heard and the tower controller informed the crew that sparks were coming from the front of the aircraft.

The crew declared an emergency. Once the aircraft came to a stop on the runway, the passengers were evacuated via the main cabin door and taken to the terminal by an airport shuttle bus. There were no injuries, and there was no fire. The emergency locater transmitter did not activate.

TSB Final Report A18W0111—Collision with Obstacle on Takeoff

History of the flight

At approximately 13:00 on 29 July 2018, the Piper PA-28-161 Warrior II aircraft departed from Claresholm Industrial Airport (CEJ4), Alta. on a visual flight rules flight with 2 people on board, both of whom were licensed pilots. The aircraft was bound for a mixed-hay field approximately 2 nautical miles (NM) east of Black Diamond, Alta. At approximately 13:30, the aircraft landed along the southern edge of the hay field, which was normally used as the landing area. The aircraft occupants proceeded to work in the field for the rest of the afternoon. At 19:00, they prepared to depart for the return trip to Claresholm. At approximately 19:15, the take-off run was conducted heading east, beginning from the southwest corner of the field (Figure 1).

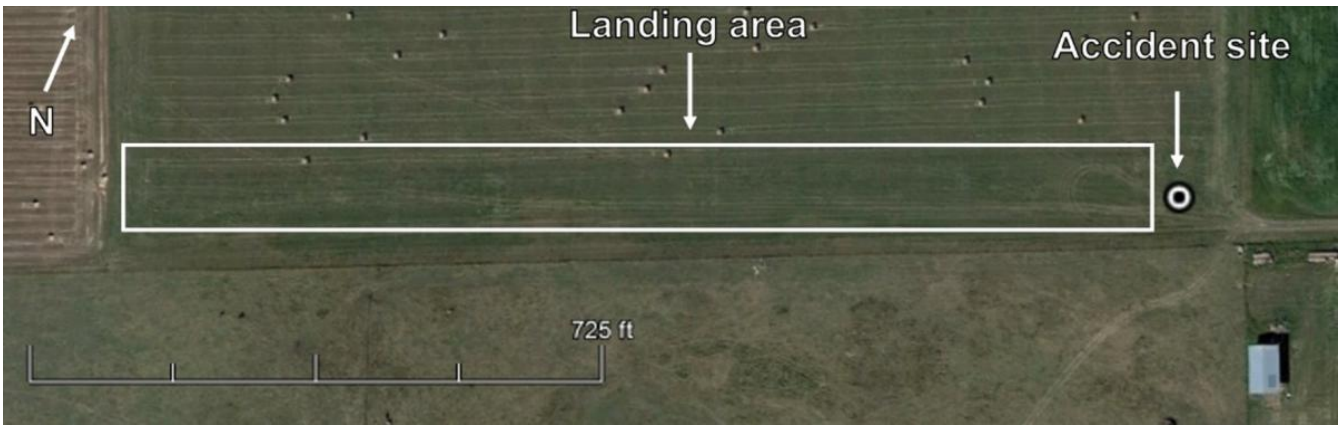


Figure 1. View of hay field and landing area (Source: Google Earth, with TSB annotations)

The aircraft failed to climb sufficiently to clear some hay bales that had been stacked in the southeast corner of the field, and struck them. The left-wing fuel tank ruptured on impact, and the resulting post-impact fire destroyed the aircraft (Figure 2).

The investigation determined that neither occupant was wearing the available shoulder harness; however, both occupants were wearing their lap belts. Both occupants received head injuries. One managed to escape the aircraft, but the other did not and was fatally injured.

Figure 2. Accident site, looking west

Personnel information

The investigation was unable to determine who was acting as pilot-in-command on the occurrence flight; however, both occupants were licensed pilots and had acted as pilot-in-command on previous flights.

Weather information
There is no aviation weather information specific to the accident location. The closest airport is the Calgary International Airport (CYYC), Alta., which is approximately 27 NM northeast. The aerodrome routine meteorological report (METAR) at the time of the occurrence for CYYC was as follows:

- winds: 140° true (T), varying from 020°T to 170°T, at 3 knots (kt)
- visibility: 10 statute miles (SM)
- clouds: few at 21 000 ft
- temperature: 27 °C
- dew point: 4 °C

Aircraft performance
The aircraft's journey logbook was in the aircraft at the time of the occurrence and was destroyed in the post-impact fire; therefore, a precise empty weight for the aircraft was not available to the investigation. However, an approximate take-off weight for the aircraft was calculated to be 2059 pounds (lbs) and, based on the performance charts published in the *Warrior II PA-28-161 Pilot's Operating Handbook* (POH), ground roll distance calculations were completed (Table 1). The calculations were made using a take-off weight of 2050 lbs, an outside air temperature of 23 °C, and a headwind component of 3 kt, on a paved, level, dry runway. The POH states in part, "Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance [...]"

Table 1. Ground roll distance calculations for the occurrence aircraft

Flaps	Ground roll (ft)	Lift-off speed (knots indicated airspeed [KIAS])
0°	1350	47
25°	1200	47

In section 4 of the aircraft's POH, the soft field, obstacle clearance take-off procedure states the following:

> *Flaps……25° (second notch)*
>
> *Accelerate and lift off nose gear as soon as possible. Lift off at lowest possible airspeed. Accelerate just above ground to 52 KIAS to climb past obstacle height. Continue climbing while accelerating to best rate of climb speed, 79 KIAS.*
>
> *Flaps……retract slowly*

The occurrence pilots typically selected the flaps in the first notch (10°) on takeoff, because they felt it helped the aircraft get out of the grass more easily. The target airspeed for rotation was 55 KIAS. There is no procedure or performance chart in the aircraft's POH for flaps placed in the first notch. No performance calculations had been completed before takeoff.

Accident location
The accident occurred in the southeast corner of a mixed-hay field located approximately 2 NM east of the town of Black Diamond.

The portion of the field being used as the landing area was not a prepared surface; however, at the time of the occurrence, the field had been cut and the remaining hay was approximately 3 to 4 inches (in.) high. A field-boundary fence (wood posts and wire) ran the width of the southern edge of the field, and a windsock had been installed at the approximate mid-field position. The available length for takeoff or landing was approximately 1320 ft in an east–west direction.

The aircraft had been flown into and out of this particular field for approximately 2 years.

As there had been strong winds in the area, 4 hay bales had been stacked, 2 wide by 2 high, in the southeast corner of the field to protect the aircraft from being damaged by the winds while it was parked. The bales had been in position for approximately 7 to 10 days and the pilots had flown into and out of the field with the hay bales in position approximately 5 times.

Aircraft examination
The aircraft was examined at the accident site. The left-wing fuel tank was found ruptured. The right-wing fuel tank was found intact and still containing approximately 10 U.S. gallons of avgas. The flap handle was found in and the flaps-retracted position. Because the aircraft had been almost completely destroyed by the crash and post-impact fire, it could not be determined whether any pre-impact failure or system malfunction contributed to this accident. The aircraft systems were examined to the degree possible, and no indication of a malfunction was found.

The engine was transported to the TSB regional facility in Edmonton, Alta., for examination. No anomalies were found that would have inhibited the engine from being able to produce full power. As a result of the post-impact fire, some components were destroyed and could not be tested or verified. A review of the aircraft's historical maintenance records was completed. No discrepancies were noted that could have contributed to the accident.

Safety messages
Operating recommendations issued by the aircraft manufacturer ensure that optimum aircraft performance is achieved and that the aircraft is operated within acceptable safety margins.

Aircraft performance calculations should be completed before flight to ensure that the actual or anticipated aircraft performance is at the level expected by the flight crew.

Shoulder harnesses are an important part of the safety equipment installed in the aircraft that, when worn, can reduce the risk of injury or death in an accident. △

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New Regulation on Alcohol Consumption

The regulations have changed! Be sure to check out the change in **section 602.03(a)** regarding alcohol consumption.

602.03 No person shall act as a member of an aircraft

- (a) within *12 hours* after consuming an alcoholic beverage;
- (b) while under the influence of alcohol; or
- (c) while using any drug that impairs the person's faculties to the extent that the safety of the aircraft or of the person on board the aircraft is endangered in any way.

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