Flight Advisor Corner by Hobie Tomlinson

April 2012 Annual Safety Issue Controlled Flight Into Terrain (Pt. I)

This month I thought we would use the break between article series to do a two part **Annual Safety Issue.** For this year's Annual Safety Issue topic, we will look at a subject that causes a lot of General Aviation accidents, but doesn't receive much instructional coverage. That is the issue of **Controlled Flight Into Terrain,** better known as **CFIT.**

Controlled Flight Into Terrain (CFIT) is a term that was created by Boeing engineers in the late 1970s to describe an accident caused by *an airworthy aircraft still under the pilot's control being unintentionally flown into the ground, a mountain, water, or some other obstacle.*

CFIT was one of the leading causes of fatal airline accidents, until avionics systems started becoming capable of providing a technological (i.e. engineering) solution. Early Ground Proximity Warning Systems (GPWS) used a radar altimeter and simple software to detect ground closure rates and conditions, which are considered abnormal and thus trigger a cockpit warning to the crew. The big disadvantage of the early GPWS is that they had no "Look Forward" capability, only a "Look Down" capability; thus, they were of limited usefulness when approaching steeply rising terrain. This shortcoming was resolved when terrain data bases developed for cruise missiles became available. Incorporating a terrain data base and more sophisticated software gave these units "Look Forward" capability, and they were renamed Enhanced Ground Proximity Warning Systems (EGPWS). With rapid advances in GPS tracking capability and modern high tech software, these systems evolved into the current Terrain Awareness and Warning Systems (TAWS).

While TAWS has practically eliminated CFIT as a cause of airline accidents, in the General Aviation light airplane world, they still happen with chilling regularity. There are several reasons for this. First the majority of light aircraft are still not equipped with these systems. Second they fly at the lower altitudes. Third they are involved in flight operations which are incredibly varied and much less structured than the airline world. Fourth and last, sometimes General Aviation pilots put their aircraft into situations which don't have solutions and a TWAS system would not affect the outcome.

In Researching CFIT, I was surprised by the lack of instructional material available to light aircraft pilots in FAA publications. That being the case, I elected to proceed by looking at some typical types of CFIT accidents and what we can do to avoid being made a statistic by one of these CFIT events.

Typical CFIT Accident Types are as follows:

1) **Unwarranted Low Flying**
2) **Mountain Flying**
3) **Confined Space Flying**
4) **Wind Shear**
5) **Scud Running**

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6) **VFR into IMC**
7) **Icing**
8) **Night VFR Departures**
9) **Night X-C**
10) **Night Underneath "B" Airspace**
11) **Night Visual Approaches**
12) **Night Airport Operations**
13) **Loss of Situational Awareness on Approach**
14) **Busting Approach Minimums**

Unwarranted Low Flying (Buzzing) is one of the major causes of CFIT type accidents. In the modern world, the altitudes below 1000 feet agl are known as the 'Strike Zone" and are full of towers, high tension wires, and other man-made obstructions. While flying in this altitude zone can be done safely, it requires planning and extra vigilance. Pilots of helicopters, agricultural aircraft, sea planes, bush planes and gliders all have to be taught what to look for, where to look for it, and the requirement to maintain extreme vigilance when operating in this altitude zone. Trouble begins when a pilot impulsively proceeds to operate at low altitudes without a well thought out plan.

A Typical Accident involved a Cessna 180F aircraft in Townsend, MT. Observed by witnesses to be flying 20 to 30 feet above the ground at a high rate of speed, the airplane pitched up and to the left, making a 180-degree turn steep enough to see the tops of both wings. The wreckage was located two days later after being the subject of a missing airplane alert notice. Accident site documentation was indicative of a high-speed controlled flight collision with trees and subsequently the ground. The airframe and engine revealed no evidence of any preimpact mechanical anomalies. (1 Fatality)

Hazardous Attitudes Exhibited: Impulsiveness, Macho & Anti-authority.

Operational Pitfalls: Flying Outside the Envelope, Extreme Maneuvering at Low Altitude, and Inadequate Obstruction Planning.

Mitigation Strategies: Safety and Legality are separate issues which are generally in concert, but not always. There are times when it is safe to fly low, but not legal, and vice versa. Before low altitude flight is attempted, the legal, environmental, political, and safety ramifications must all be considered. Low altitude flight must never be attempted until the area is carefully surveyed for any obstructions, the approach and departure paths carefully planned, and the required maneuvering area evaluated. This is something that is taught in any good seaplane course as part of landing and departing from random water surfaces, and it is of critical importance to helicopter pilots. In our current culture, the noise and environmental impact of aircraft are generally not well received. This fact should be kept in the forefront of your mind when considering low altitude operations. Obviously, "buzzing" is a juvenile behavior which does not belong in the cockpit.

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Mountain Flying (Ridgelines) can cause serious problems for plots that are not aware of the local wind flows which are always present in mountainous areas. Serious downdrafts, which often exceeds the climb capability of light aircraft, especially at high density altitudes, are often present on the lee side of mountain ridges. If you are approaching the lee side (downwind) of a mountain ridge and are not at least 2000 feet above the ridgeline, it should be approached at a 45-degree angle. This is so that if a downdraft is encountered, it will be possible to turn toward lower terrain with only a 90-degree turn, rather than a 180-degree turn during which the first 90-degrees is still toward higher terrain.

A Typical Accident involved a Cirrus SR22 aircraft in Belgrade, MT. An aircraft with 4 people on-board was performing "flybys" of a motor glider which was providing a ride to the airplane pilot's friend. After the airplane passed the glider at approximately 8.900 feet MSL, it entered a mountain bowl formed by mountains with peak elevations above the airplanes altitude, while the glider turned away from the mountain bowl after encountering a sinking air mass. The surviving airplane passenger reported the stall warning first sounding, and then stopping as the pilot lowered the airplane's nose. The pilot then initiated a descending left turn and remarked "hang on; we might get a couple of trees on this one." Distribution of the wreckage indicated the airplane impacted trees on the ridgeline at an elevation of 8553 feet and traveled about 360 feet before coming to rest. (3 Fatalities)

Hazardous Attitudes Exhibited: Invulnerability.

Operational Pitfalls: Flying Outside the Envelope, Environmental Factors, and Inadequate Escape Route Planning.

Mitigation Strategies: When operating at high density altitudes in mountainous terrain, it is extremely important to be aware of the excess performance margin available in your airplane. This includes minimizing aircraft weight, operating during the cooler part of the day, being aware of wind direction and velocity aloft, anticipating areas of potential sink, and avoiding areas without obvious escape routes.

Confined Space Flying (Box Canyons) are usually associated with navigational errors or serious judgment errors when flying in the Rocky Mountains. However, they can occur whenever an airplane is operated in a confined area at an altitude lower than the surrounding obstructions. While this is trained in Sea Plane and Helicopter operations, it is not emphasized in land plane operations.

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A Typical Accident involved a Cessna 180H aircraft in Yellow Pine, ID. GPS tracking info indicated the aircraft entered and followed a valley ending in a box canyon with rising terrain. The last tracking point indicated the airplane made a steep left turn with decreasing altitude and increasing airspeed. On site documentation indicated the aircraft collided with several tall trees before coming to rest inverted. Post-accident inspection of the airframe and engine did not indicate any evidence of mechanical failure or malfunction. (1 fatal) **Note:** A very similar accident happened in a Cirrus SR-20 aircraft in Manhattan NYC, NY. The airplane crashed into an apartment building while attempting a course reversal turn in the narrow Class B exclusion zone, which then existed over the East River, during marginal visual flight rules (MVFR) conditions. (2 Fatalities)

Hazardous Attitudes Exhibited: Macho and Invulnerability.

Operational Pitfalls: Flying Outside the Envelope, Environmental Factors, and Inadequate Escape Route Planning.

Mitigation Strategies: While mountainous areas provide outstanding scenery to the general aviation pilot, it is important that canyon and mountain valleys be flown in the direction of descending terrain. It is also important to be acutely aware of your actual position in relation to the upcoming terrain, as well as your available excess performance margins, whenever you are flying below the ridgelines. One of the purposes of ground reference maneuvers is to teach the ability to accurately control your aircraft's path over the ground as well as to give an awareness of the amount of ground space it takes to maneuver the aircraft. When was the last time you considered any of this in your current airplane? Also remember that the higher true airspeeds occurring at high density altitudes will increase the turning space required. Never put yourself into any confined space that does not allow an adequate escape route should unanticipated conditions be encountered.

Wind Shear accidents typically occur at tree lined airports when the departing pilot is not able to adequately control his flight path once the aircraft encounters the stronger wind velocity above the tree tops.

A Typical Accident involved a Cessna 172P aircraft in Post Mills, VT. The pilot elected to depart the 2600 ft. turf runway at the valley airport in a downwind direction. Upon becoming airborne, the stronger tailwind aloft caused the aircraft's performance to deteriorate and created drift away from the extended runway centerline toward trees. It subsequently collided with the trees and crashed. (2 Fatalities & 2 Serious Injuries)

Hazardous Attitudes Exhibited: Invulnerability.

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Operational Pitfalls: Peer Pressure**,** Flying Outside the Envelope, Get-there-its, and Inadequate Preflight Performance Calculations.

Mitigation Strategies: A little known fact among general aviation pilots is that an airplane's inertia is related to its groundspeed, not its airspeed. Combine that with the fact that wind velocity always increases after takeoff due to a reduction in the retarding effect of the earth's surface friction. This means that even seemingly insignificant tailwinds can have a devastating impact on the aircraft's departure performance, as well as its ground track. In any situation where there are limited departure performance margins, zero tailwinds are to be tolerated. It is also important to maintain the extended runway centerline ground track, as the tree cuts at the departure end of small airport runways are usually quite narrow.

Scud Running, which is trying to maintain visual contact with the terrain by flying at very low altitudes while instrument conditions exist, is a persistent cause of CFIT accidents.

A Typical Accident involved a de Havilland Canada DHC3T Turbine Otter aircraft in Aleknagik, AK. The flight was enroute between two fishing lodges in very poor weather conditions, with previous aircraft in the area reporting visibilities of less than 1 mile. No flight plan had been filed and the aircraft impacted mountainous, tree-covered terrain. Ironically, while this aircraft was equipped with a Terrain Awareness and Warning System (TAWS), the pilot had elected to fly with the system turned off to preclude false warnings in Alaska's highly variable terrain. (5 Fatalities and 4 Serious Injuries)

Hazardous Attitudes Exhibited: Macho and Invulnerability.

Operational Pitfalls: External Pressure, Loss of Positional Awareness, Get-there-Itis, Deactivating a Safety System, and Physiological Stress.

Mitigation Strategies: The importance of predefined operational limits (personal minimums) and the ability to say "NO" regardless of the inconvenience and the consequences are two of the most valuable safety assets any pilot can have. It is worth remembering that whatever importance was attached to arriving at the destination, they still did not get there!

VFR into IMC, Continuing visual flight rules (VFR) into instrument meteorological conditions (IMC) can result in a collision with the ground or obstacles. When this is attempted by a VFR only pilot, it is almost always accompanied by spatial disorientation and loss of control prior to ground impact.

A Typical Accident involved a Cessna 172M aircraft in Brownville Jct., ME. The Instrument rated pilot was VFR enroute when instrument meteorological

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conditions (IMC) were encountered. The airplane subsequently impacted trees on rising terrain while flying straight and level. There was no evidence of any pre-impact mechanical malfunctions (1 Fatality)

Hazardous Attitudes Exhibited: Invulnerability and possibly Resignation

Operational Pitfalls: External Pressure, Loss of Positional Awareness, Get-there-its, Mind Set, Operation Below Minimum Enroute Altitude, and Physiological Stress.

Mitigation Strategies are the same as for Scud Running. The importance of predefined operational limits (personal minimums) and the ability to say "NO" regardless of the inconvenience and the consequences are two of the most valuable safety assets any pilot can have. It is worth remembering that whatever importance was attached to arriving at the destination, they still did not get there!

Icing conditions can make it impossible for a light aircraft to maintain the instrument minimum enroute altitude, resulting with a collision with terrain or obstacles.

A Typical Accident involved a Diamond DA40 aircraft in Allagash, ME. The flight was proceeding westbound on an instrument flight plan at 6,000 feet during a flight between Halifax, Nova Scotia, Canada and Quebec, Canada when it entered an area with a current AIRMET for light to moderate icing. At the pilot's request, the aircraft was being issued vectors around mountainous terrain when Montreal Center lost contact with the airplane. Search and rescue operations were initiated within thirty minutes and the wreckage was located approximately one hour after the accident. The aircraft had descended until it impacted trees in the heavily wooded area. The closest official surface observing station in Frenchville, ME was reporting moderate freezing precipitation. (1 Fatality and 1 Serious injury)

Hazards Attitudes Exhibited: Macho and Invulnerability.

Operation Pitfalls: Mind Set (Continuation bias), Get-There-Itis, Flying Outside the Envelope, Inadequate Preflight Planning, and Lack of an Alternate Course of Action.

Mitigation Strategies: When flying light aircraft in winter conditions, it is important to recognize that any accumulation of ice will dramatically lower your sustainable enroute altitude. This is true of aircraft certified for flight in known icing conditions; uncertified aircraft must never be flown into known icing conditions. It is also important to look at the single engine altitude capability of multiengine aircraft when operating over high terrain. An adequate escape plan (Plan B) must always be available in the case that worsening conditions preclude continuing the flight as originally planned. Flights which do not allow for an

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adequate alternate course of action for unplanned events should be cancelled. Again, the discipline of predefined operational limits (personal minimums) and the ability to say "NO" regardless of the inconvenience and the consequences are two of the most valuable safety assets any pilot can have.

This is a good place to break for this month. We have covered some daytime causes of CFIT accidents and in next month's Part II issue we will look at some of the night and IMC CFIT accident types.

The thought for this month is ***"By three methods we may learn wisdom: First, by reflection, which is noblest; Second, by imitation, which is easiest; and Third by experience, which is the bitterest." ~ Confucius***

So, until next month, be sure to **Think Right to FliRite!**

DHC3T Turbine Otter near Aleknagik, AK

NTSB Image

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