# [EN-031] Human factors in General Aviation: FAA and ASF efforts to mitigate accidents and fatalities

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**Abstract:** A review of the annual U.S. aviation accidents and incidents data shows that General Aviation (GA) is responsible for the greater majority of these accidents and incidents. Fatality is equally large when compared on the basis of carrying capacity, with Commercial Aviation. The National Transportation Safety Board's (NTSB) accidents/incident database contains a detailed account of each accident or incident and usually ends with a statement about probable cause. The growing concerns about too many accidents and fatalities involving General Aviation have led to a vigorous campaign by the FAA to set up the "FAASafety" WINGS Pilot Proficiency Program run by qualified FAA certified instructors to provide continuing education and flight proficiency training for GA pilots to improve their aviation expertise and professionalism. The *WINGS* program is considered a better alternative to the regular biannual flight review. GA pilots participating in the program are exempted from biannual flight reviews. The Aircraft Owners and Pilots Association (AOPA) through its Air Safety Foundation also provide online education and regular seminars for the benefit of GA pilots. Data over a six year period analyzed in this study indicate that the efforts of these bodies are having positive effect in reducing GA accidents and fatalities.

**Keywords:** Accident; incident; fatality; General Aviation; NTSB; FAA; ASF; FAASafety; WINGS; proficiency

## 1. Introduction

A review of the annual U.S. aviation accidents and incidents data shows that General Aviation (GA) is responsible for the greater majority of these accidents and incidents. The number of fatality is equally staggering. On the basis of carrying capacity the annual fatality in GA accidents is greater in comparison to Commercial Aviation. Each entry in the National Transportation Safety Board (NTSB) accidents/incident database [1] contains a detailed account of the accident or incident and usually concludes with a statement about probable cause. One probable cause that is generally left unstated is that the vast majority of GA pilots do not have the rigor of training as their airline transport pilots, (ATP). This paper examines the U.S. GA accident and incident records from the NTSB database from January 2004 to December 2009 to see if FAA and AOPA efforts are achieving the desired outcome.

## 2. Case studies

In the preceding sections one randomly selected NTSB accident report [*ibid*], from each year of the study period is reproduced (in full or in part), to provide an overall picture of the various challenges facing the GA pilot as he or she enjoys the freedom of the air in pursuit of pleasure. All the events cited here resulted in fatalities and or serious injuries.

### *2.1 Case 1*: January 01, 2004 in Glasgow, MT

The pilot and three passengers were completing the final leg of a round robin cross-country flight that originated earlier in the day. Approximately 2 hours 30 minutes into the final leg of the cross-country flight, the pilot received an in-flight weather update for the route of flight. The weather specialist reported low ceilings and low visibilities along the intended route. Additionally, the specialist reported that VFR flights were not recommended due to an AIRMET for IFR conditions, icing conditions and areas of mountain obscuration. Subsequent to receiving the updated weather information, the pilot reported that he was diverting to and alternate airport northwest of his location. After failing to arrive at the planned destination, an ALNOT, (Alert Notice) was issued for the missing airplane. The airplane wreckage was later located southeast of the intended alternate. Infrared weather satellite imagery showed areas of enhanced widespread cloud cover and cloud tops northwest of the accident location on the night of the accident. Dark night conditions prevailed at the time of the accident.

### *2.2 Case 2:* March 27, 2005 in West Union, IA

The airplane collided with the terrain following a loss of control during takeoff on a 4,248 foot long, concrete runway. Inspection of the airplane and engine failed to reveal any pre-impact failures/malfunctions which would have resulted in the loss of control. The flaps were found set to 25 degrees, which is the flap setting normally used for short and soft field takeoffs. The normal takeoff flap configuration is zero degrees. The pilot had received his private pilot certificate one and a half months prior to the accident. The pilot's logbook indicated he had a total flight time of 73.3 hours of which 49.5 hours in the accident airplane. Two 14-pound weights were located in the rear fuselage area of the wreckage. The airplane owner stated they usually kept the weights in the airplane to help balance the airplane's center of gravity when there were just two adults in the front seat. The aircraft occupants during the accident flight consisted of two adults in the front seats and two children in the rear seats.

### 2.3 *Case 3:* June 08, 2006 in Provo, UT

After reporting the airport in sight and canceling an IFR flight plan, the pilot was executing a visual approach to an airport located on the shore of a lake during dark night visual meteorological conditions. The final approach path was over the lake. About 50 seconds before the accident occurred, the airplane was aligned for landing on runway 13 and was approximately 1.5 miles from the threshold, about 750 feet agl, at an indicated airspeed of 210 knots, and a descent rate of 1,900 feet per minute (fpm). Twelve seconds later, the airplane began a right turn. The airplane continued to turn right until it impacted the water on a heading of about 332 degrees, at an indicated airspeed of 123 knots, and a descent rate of 1,300 fpm. Examination of the wreckage confirmed that the airplane impacted the water in a right wing low attitude. No evidence of any mechanical discrepancies was found. Scattered very heavy and intense thunderstorms were located north through east of the accident location. No convective showers or thunderstorms were in the vicinity of the airplane when it crashed. Several cloud layers were present over the destination airport around the accident time. The amount and layers of low cloudiness make it unlikely that the pilot was able to maintain visual contact with the airport during his approach to the field. At the time the airplane turned right off the final approach course, it was at approximately the altitude of the lowest cloud layer. The pilot had completed a familiarization course in the airplane the day before the accident. The course consisted of about 30 hours of ground instruction and 18 hours of flight instruction. The course flight time was the pilot's total flight experience in this make and model of airplane. The instructor who provided the training reported that during the course he twice discussed with the pilot a list of pilot limitations to be adhered to following course completion. These limitations included no flights in IMC until the pilot had a minimum of 100 hours in make and model and no night flights until the pilot had a minimum of 50 hours in make and model.

### *2.4 Case 4:* November 08, 2007 in Las Vegas, NV

The airplane collided with rising mountainous terrain during climb to cruise about 21 nm southwest of the departure airport. The accident occurred during dark night, visual meteorological conditions, about 13 minutes into the night cross-country flight. No lighted roads or round structures were present in the area to provide ground reference to terrain. 1% of the moons disk was illuminated. Over the last 6 minutes of the flight, recorded radar data indicated the airplane's average groundspeed was 100 knots and its average rate of climb was 406 fpm; an average rate of climb of 600 fpm was required to clear terrain along the flight path. An examination of the accident site indicated that the airplane impacted rapidly rising terrain in a near level flight attitude before descending and coming to rest in a rock outcropping. The resultant high-energy impact forces, coupled with the extensive thermal damage, destroyed the airplane. A post accident examination of the airframe's structure and engine failed to reveal any preimpact failures or malfunctions. The airplane was equipped with a Garmin

G1000 Integrated Cockpit System, which incorporates a multifunction color display that is capable of displaying terrain elevation information when selected to the Terrain Proximity page. Due to the extensive impact and thermal damage that the component had sustained, it was not possible to determine if the pilot was using the display to receive topographic data during the airplane's ascent. Records indicate that the pilot had received G1000 training. The Pilot's Guide for the G1000 states: "CAUTION: Use of Terrain Proximity information for primary terrain avoidance is prohibited. The Terrain Proximity Map is intended only to enhance situational awareness. It is the pilot's responsibility to provide terrain avoidance at all times." The flight was departing on a VFR flight plan and was receiving VFR flight following services from the Las Vegas Terminal Radar Approach Control facility. Air traffic control radar data revealed that the airplane was continuously visible to the controller on his radar display from the departure airport until impact with mountainous terrain. The airplane's course remained constant as he approached and impacted the mountain during the dark nighttime flight. The air traffic controller did not issue a terrain-related safety alert, as required by a Federal Aviation Administration order, because he did not observe a conflict with terrain.

### *2.5 Case 5:* June 20, 2008 in Lake Placid, FL

The pilot and a wildlife-research passenger departed in the pilot's airplane on a brief aerial observation flight with the purpose of locating a bear tracking collar. The airplane was observed by multiple witnesses in multiple locations to be flying at "very low" altitudes. Most of these observations occurred when the airplane flew over several lakes in the local area. The airplane returned to the origination airport for landing about 1/2 hour after its departure. Instead of flying a normal airport traffic pattern, the pilot flew along the runway in the direction opposite of his intended landing direction, at an altitude of approximately 100 feet above the ground. He then initiated a rapid pull-up and small radius turn to complete the landing. The airplane impacted airport property in a near-vertical attitude, approximately 900 feet from the approach threshold. Both occupants were fatally injured. With one exception, no evidence of any preimpact airframe mechanical failure or malfunction was found. The flap cable was found disconnected from the flap handle, but it could not be determined when or how this occurred. If the flaps were inoperative, the condition would not have resulted in any airplane control problems during normal flight operations, and a normal landing could have been accomplished. No evidence of any preimpact mechanical failure or malfunction was found that would have prevented the engine from developing power. Toxicological testing revealed that the pilot was taking a prescription antidepressant medication, but the medication would not have likely resulted in impairment. Several individuals stated that the non-standard landing maneuver was not unusual for the pilot. Digital images recovered from the passenger's camera revealed that during the accident flight the airplane was operated at low altitude above the surfaces of several lakes, and that on at least one occasion the airplane's tires were in contact with the surface of a lake.

### *2.6 Case 6:* February 05, 2009 in Avalon, CA

On February 5, 2009, about 1642 Pacific standard time, a Beech A36, N66819, collided with terrain near Avalon, California. Skyblue USA LLC was operating the airplane under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The private pilot and two passengers were killed. The airplane sustained substantial damage to the wings, fuselage, and empennage from impact forces and a post crash fire. The cross-country flight departed Avalon's Airport in the Sky about 1639, with a planned destination of Santa Ana, California. Instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan had been filed, but not activated.

A preliminary review of recorded radar data noted a secondary 1200 (VFR) beacon code at a mode C reported altitude of 1,600 feet mean sea level (msl) at the departure end of runway 22 at 1639. The airport's elevation is listed as 1,604 feet msl. The target made left and right turns; the maximum mode C altitude attained was 2,400 feet. The target decreased 600 feet in altitude over the last two returns, which covered 9 seconds. The coordinates for the last radar return were 33 degrees 23.0 minutes north latitude by 118 degrees 25.25 minutes west longitude. The coordinates for the accident site were 33 degrees 22.73 minutes north latitude by 118 degrees 25.27 minutes west longitude. Investigators completed a preliminary examination of the wreckage at the accident scene. The accident site was in mountainous terrain. The debris path was along a magnetic heading of 058 degrees, which was toward rising terrain. The first identified point of contact (FIPC) was the principal impact crater (PIC) which had symmetrical ground scars on its left and right sides. Green lens fragments were a few feet past the outer edge of the right ground scar. On propeller blade and pieces of the nose landing gear assembly were in the PIC. The airplane came to rest inverted with the engine underneath it. Fire consumed most of the cabin area and center wing sections. Investigators identified all flight controls at the scene.

## 3. six-year accident data

In the majority of the accident report, a pattern emerges which suggests that many of the GA pilots often ignore potentially hazardous situations that ultimately lead to dire consequences. Many GA aircraft nowadays have advanced cockpit instrumentation. The potential for too much reliance on automation cannot be overlooked. A number of check pilots have reported that during flight reviews many GA pilots have been observed to keep their eyes continuously on the instrument panel most of the time and paying no attention to what is outside of the window. Marianne Rudisill [2], report on a survey of pilots from thirteen commercial transport aircraft who voiced several concerns with regard to the use of automation. Pilots admitted that automation made things too easy and could place them in a "trap" that leads to accidents and incidents. For instance in a glass cockpit, it is easier to be "drawn in" and lose sight of the aircraft, causing a loss of awareness of ongoing operation. Pilots also reported a decrease in confidence in the handling abilities, a loss of scan, and a decrease in navigation and position awareness. It is can be inferred that the general aviation pilot place in similar circumstances faces considerable challenges

The accidents described in case 4 shows just shat can happen when too much reliance is placed on the glass cockpit. That accident presented many fellow pilots with bewilderment because of the caliber of the two occupants. A more detailed account has been given by Bruce Landsberg [3]. In his story the author notes that the two occupants were highly experienced Civil Air Patrol pilots with more than 50,000 hours of flight time between them. Both held airline transport pilot certificates with numerous ratings, yet fell victim to improper flight planning that led to dire consequence. The night time VFR flight from North Las Vegas to Rosamond, CA resulted in the aircraft hitting Mount Potosi in Nevada killing both occupants. The second pilot apparently knew about the terrain but (presumably) out of respect for his friend failed to mention this to his pal. They were flying a turbocharged Cessna 18T, equipped with Garmin G1000 avionics. Records also indicated that the pilot was in contact with ATC for most part during the initial climb out phase of the flight but received no safety alert.

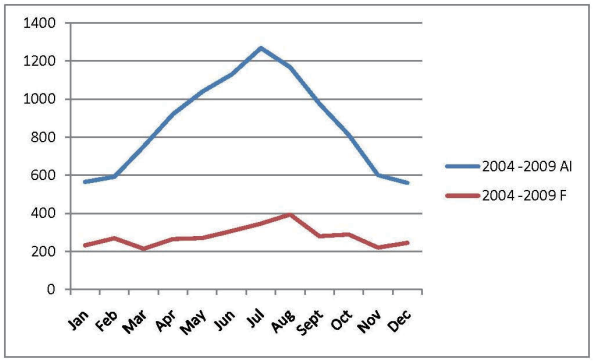
Sadly in situations such as this, where a controller may have neglected to provide a crucial warning alert, FAR 91 [4], is clear. *"The pilot-in-command of an aircraft is directly responsible for, and is the final authority as to the safe operation of that aircraft. In an emergency requiring immediate action, the pilot-in-command may deviate from any rule in the General Subpart A and Flight Rules Subpart B in accordance with 14 CFR Section 91.3"*

The complete accident/incident data for the period from January 2004 to December 2009 are shown in Table 1 below. The cumulative six-year monthly totals are depicted in figure 1. As can be seen the month of July had the greatest number of accidents in all but 2008 during the six year period. Fatality numbers were correspondingly high during the same periods. Also in all cases the increases begin from April or May, peak in July then decline starting from September. This is consistent with increased activity as a result of good weather conditions especially during night time hours in these months.

Table 1 General Aviation monthly accident/incident (AI) and fatality (F) numbers from 2004 to 2009

| | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 2009 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AI | F | AI | F | AI | F | AI | F | AI | F | AI | F |
| Jan | 98 | 38 | 104 | 51 | 102 | 36 | 92 | 24 | 83 | 36 | 86 | 47 |
| Feb | 118 | 31 | 98 | 47 | 87 | 50 | 94 | 34 | 106 | 37 | 89 | 70 |
| Mar | 118 | 41 | 134 | 34 | 117 | 37 | 141 | 32 | 124 | 31 | 118 | 39 |
| Apr | 147 | 36 | 151 | 37 | 157 | 40 | 165 | 63 | 158 | 35 | 143 | 54 |
| May | 175 | 48 | 186 | 44 | 178 | 30 | 163 | 53 | 178 | 59 | 159 | 36 |
| Jun | 170 | 55 | 216 | 52 | 178 | 53 | 191 | 40 | 195 | 71 | 179 | 36 |
| Jul | 218 | 57 | 213 | 64 | 196 | 70 | 229 | 61 | 199 | 55 | 213 | 39 |
| Aug | 194 | 83 | 208 | 71 | 162 | 43 | 190 | 55 | 221 | 76 | 192 | 66 |
| Sept | 179 | 61 | 172 | 50 | 125 | 36 | 192 | 53 | 155 | 39 | 153 | 41 |
| Oct | 159 | 87 | 147 | 40 | 129 | 43 | 155 | 47 | 116 | 30 | 106 | 42 |
| Nov | 109 | 45 | 107 | 37 | 113 | 43 | 116 | 45 | 103 | 17 | 53 | 33 |
| Dec | 108 | 53 | 114 | 61 | 116 | 76 | 105 | 39 | 95 | 3 | 22 | 13 |

Fig. 1 The six-year total accident/incident (AI) and fatality (F) show increasing numbers in the months from May through August. December of 2008 and 2009 both show fewer accidents and fatalities.




## 4. Pilot Proficiency Program

As already mentioned both the FAA and The AOPA are very concerned about the large number of accidents and fatality involving General Aviation and have taken positive steps to reverse the trend. To increase proficiency among GA pilots the FAA introduced a pilot proficiency WINGS program run by its "FAASTeam" members. The mission of the program is [5]:

"***To improve the Nation's aviation safety record by conveying safety principles and practices through training, outreach and education. At the same time, FAASTeam Managers and Program Managers will establish meaningful aviation industry alliances and encourage continual growth of a positive safety culture within the aviation community.***"

The program is designed to be regional and community oriented. The FAASTeam uses accident data from all sources to decide what should be done to reduce accidents. These data include:

Accident/incident reports involving airmen from the area. Hazards identified by Inspectors at local Flight Standards District Offices, and Information from the local aviation community. Once the data are collected and analyzed the FAASTeam Program Managers develop tasks that they plan to accomplish with the help of all their FAASTeam members, in an effort to mitigate future accidents. Beginning in July, 2006 depending on the type of training required, credit was given for training performed in the airplane, flight training device, or simulator, [6]. When combined with a minimum of three attendances of FAA safety seminars, the GA pilot earned an exemption from the biannual flight review (BFR).

The program ensures that GA pilots undergo continuous proficiency flight training with Certified Flight Instructors, (CFI) over the entire two or three year period between flight reviews. The FAA considers that this approach ensures proficiency and makes the GA pilot develop a positive safety culture. The AOPA Air Safety Foundation, ASF [7], also promotes safety and pilot proficiency in general aviation through quality training, education, research, analysis, and the dissemination of information. On December 31, 2007 the original "Wings" ended and was replaced by a new somewhat more rigorous program. The new program attempts to provide better standards for pilots getting flight reviews and training, adding the most common causes of accidents into the curriculum and providing set standards for maneuvers, instead of giving a minimum flight time to complete.

## 5. Summary

While no one is showing complacency, it must be said that the reduction in the number of accidents and associated reduction in fatalities indicates that the efforts by the FAA and the ASF are beginning to achieve the desired results. In an ideal world, it would be nice to have zero accidents. In the real world, however, what we hope for is fewer accidents and equally fewer fatalities. While the last two years in the study period show promising drop in the number of accidents and fatality, it will require at least five or more years of such trend for the efforts to be declared complete success.

## 6. ACKNOWLEDGEMENTS

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