

AIRBORNE PUBLIC SAFETY ASSOCIATION



The

Safety

Wire

March 2019

AUTOMATION FAILS. Over the last few weeks, the world has spent a considerable amount of time in the wake of the latest Boeing 737 accident talking about something that every aviator already knows...every computer will eventually fail. Computers can only do what they have been programmed to do. Programming is based on known variables and expected tasks. We operate in an unscripted environment where unforeseen things happen on a regular basis. There is no algorithm to predict Mother Nature.

To reap the benefits of the human factor, we have to exercise our intuitive decision making skills. These decision-making abilities are made strong through scenario based learning that goes beyond basic skills. Some of you have powerful autopilot



systems, such as those aboard the 737's currently in the news. If you have not already trained for those systems to fail, it is likely recent events have ignited that conversation at your organization. For the rest of us, we have plenty of computer failures and malfunctions that we should consider incorporating into our training.

UAS operators should always be ready for a failure of the stability augmentation system, GPS signal loss or other automated flight assistance feature to go off-line. Losing any of these systems means hand flying the aircraft or engaging a secondary system to recover the aircraft. This should be part of your initial and ongoing training. Manned aircraft operators often include the loss of an autopilot in training, but what about a failure where the autopilot, SAS or electric trim engages, uncommanded, by the pilot? Does the aircrew know how to recover and shut off the system?

Recently, I made the rookie mistake of taking a cross-country instrument training flight with only the iPad for my IFR charts and approach plates. Guess what happened when we arrived at the midpoint destination? Most of you are mumbling the answer...dead battery. A perfectly good set of paper plates and charts lay on my desk back in the office. A fully charged battery pack for recharging the iPad was in my backpack, which was next to that desk.



It's not just pilot stuff we need to train for. What about failures in the camera, mapping and other mission related systems we've come to rely on? An aircrew should train for any of those systems to fail in the middle of a high-priority call. The scenario should be designed to help the crew work through the problem and continue providing services

as best as possible. Throwing our hands up and announcing that we are going home because the mapping system, camera, searchlight or monitor failed should not be the first answer.

When designing a training scenario, we need to remember to refrain from focusing on just the system failure in question. We've all attended training where the scenario seems focused on just showing us how something can jump out and hurt us, coupled with a stern warning to, 'be careful.' The training should be designed to expose the crew to a realistic manifestation of the failure in the real world and then give them the skills needed to address it and reach a desired result. Don't train just to point out a failure, train to success. If you have anything computer based in your aircraft, train for the day it fails.

There is no such thing as a natural-born pilot.

~General Charles "Chuck" Yeager

ONLINE MEETINGS

APSA conducts regularly scheduled online meetings for safety officers, maintenance technicians, and UAS operators via a conference call you can join using your computer, device or phone. Online meetings are open to any APSA member. Contract maintenance providers to APSA members are welcome to participate in the maintenance meeting as well.

Beginning in March, we are changing the frequency of our online meetings. We believe this will boost participation and productivity. Safety Officer Meetings and UAS Meetings will be conducted in odd-numbered months (March, May, July, September, November); Maintenance Meetings will be conducted in even-numbered months (April, June, August, October, December). SAR Meetings, new for 2019, will be conducted quarterly beginning in April, followed by August and November.

The schedule for upcoming APSA online meetings is as follows.
If you would like to join, send an email to: safety@publicsafetyaviation.org



Maintenance:

Wednesday, April 17, 2019
1:00 PM - 2:00 PM EDT (1700 UTC)

SAR:

Thursday, April 18, 2019
1:00 PM - 2:00 PM EDT (1700 UTC)

Safety Officers:

Friday, May 10, 2019
1:00 PM - 2:00 PM EDT (1700 UTC)

UAS:

Wednesday, May 29, 2019
1:00 PM - 2:00 PM EDT (1700 UTC)

RESOURCES

Transport Canada Aviation Safety Letter:

<http://www.tc.gc.ca/eng/civilaviation/publications/tp185-menu-5395.htm>

FAA Safety Briefing:

https://www.faa.gov/news/safety_briefing/

USHST February 2019 Safety Report:

<http://ushst.org/Portals/0/USHST%20Safety%20Report%2020190318.pdf>

FAA UAS Webinar – What Public Safety Officials Need to Know:

<https://www.youtube.com/watch?v=zezbqGiSP5c>

Anybody who doesn't have fear is an idiot.
It's just that you must make the fear work for you.

~Brigadier General Robin Olds, USAF

EMERGENCY PROCEDURE OF THE MONTH

In each monthly emergency situation, discuss what you would do, as a crew, to respond to the following emergency. If the EP does not apply to your specific aircraft, discuss something similar.

NAV/COM System Loss – Combined GPS/Radio and Transponder Fails

Camera system reboots during vehicle surveillance/pursuit



Reality Check...

Note: The following reports are taken directly from the reporting source and edited for length. The grammatical format and writing style of the reporting source has been retained. My comments are added in *red* where appropriate. The goal of publishing these reports is to learn from these tragic events and not to pass judgment on the persons involved.

Aircraft: Pilatus PC 12
Injuries: 3 Fatal
NTSB#: CEN17FA168

<https://app.nts.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20170429X35104&AKey=1&RType=HTML&IType=FA>

The pilot and two medical crewmembers departed on an air ambulance flight in night instrument meteorological conditions to pick up a patient. After departure, the local air traffic controller observed the airplane's primary radar target with an incorrect transponder code in a right turn and climbing through 4,400 ft mean sea level (msl), which was 800 ft above ground level (agl). The controller instructed the pilot to reset the transponder to the correct code, and the airplane leveled off between 4,400 ft and 4,600 ft msl for about 30 seconds. The controller then confirmed that the airplane was being tracked on radar with the correct transponder code; the airplane resumed its climb at a rate of about 6,000 ft per minute (fpm) to 6,000 ft msl. The pilot changed frequencies as instructed, then contacted departure control and reported "with you at 6,000 [ft msl]" and the departure controller radar-identified the airplane. About 1 minute later, the departure controller advised the pilot that he was no longer receiving the airplane's transponder; the pilot did not respond, and there were no further recorded transmissions from the pilot. Radar data showed the airplane descending rapidly at a rate that reached 17,000 fpm. Surveillance video from a nearby truck stop recorded lights from the airplane descending at an angle of about 45° followed by an explosion.

The apparent pitch and roll angles, which represent the attitude a pilot would "feel" the airplane to be in based on his vestibular and kinesthetic perception of the components of the load factor vector in his own body coordinate system, were calculated. The apparent pitch angle ranged from 0° to 15° as the real pitch angle steadily decreased to -42°, and the apparent roll angle ranged from 0° to -4° as the real roll angle increased to -78°. This suggests that even when the airplane was in a steeply banked descent, conditions were present that could have produced a somatogravic illusion of level flight and resulted in spatial disorientation of the pilot.

Exemplar airplane testing revealed that the "autopilot disengage" caution indicator would only illuminate if the autopilot had been engaged and then disconnected. It would not illuminate if the autopilot was off without being previously engaged nor would it illuminate if the pilot attempted and failed to engage the autopilot by pressing the "autopilot" pushbutton on the mode controller. Since the "autopilot disengage" caution indicator would remain illuminated for 30 seconds after the autopilot was disengaged and was likely illuminated at impact, it is likely that the autopilot had been engaged at some point during the flight and disengaged within 30 seconds of the impact; the pilot was reporting to ATC at 6,000 ft about 30 seconds before impact and then the rapid descent began.

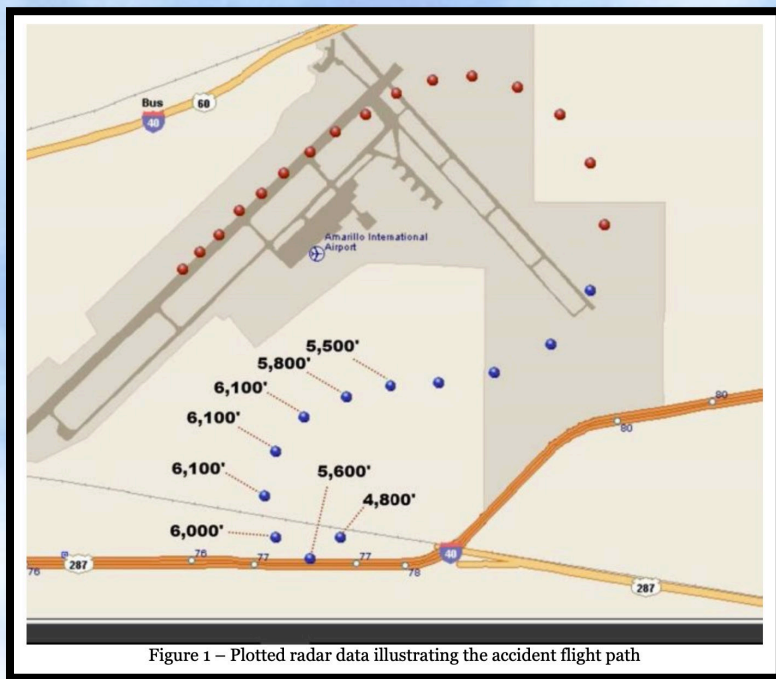


Figure 1 - Plotted radar data illustrating the accident flight path

- The pilot likely engaged the autopilot after the airplane climbed through 1,000 ft agl about 46 seconds after takeoff, because this was the recommended minimum autopilot engagement altitude that he was taught.
- According to the airplane performance study, the airplane's acceleration exceeded the autopilot's limit load factor of +1.6g about 9 seconds before impact. If it was engaged at this time, the autopilot would have automatically disengaged.
- The roll angle data from the performance study were consistent with engagement of the autopilot between two points: 1) about 31 seconds before impact, during climb, when the bank angle, which had stabilized for a few seconds, started to increase again and 2) about 9 seconds before impact, during descent, at which time the autopilot would have automatically disengaged. Since the autopilot would have reduced the bank angle as soon as it was engaged and there is no evidence of the bank angle reducing significantly between these two points, it is likely that the autopilot was engaged closer to the latter point than the former. Engagement of the autopilot shortly before the latter point would have left little time for the autopilot to reduce the bank angle before it would have disengaged automatically due to exceedance of the normal load factor limit.

The operator reported that the airplane had experienced repeated, unexpected, inflight autopilot disconnects, and, two days before the accident, the chief pilot recorded a video of the autopilot disconnecting during a flight. Exemplar airplane testing and maintenance information revealed that, during the flight in which the video was recorded, the autopilot's pitch trim adapter likely experienced a momentary loss of power for undetermined reasons, which resulted in the sequence of events observed in the video. It is possible that the autopilot disconnected during the accident flight due to the pitch trim adapter experiencing a loss of power, which would have to have occurred between 30 and 9 seconds before impact.

Probable Cause and Findings

The pilot's loss of airplane control due to spatial disorientation during the initial climb after takeoff in night instrument meteorological conditions and moderate turbulence.

Aircraft: Bell 429
Injuries: 2 Fatal
NTSB#: CEN17FA103

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While performing a dark night, cross-country flight, the helicopter cruised towards its destination. The helicopter impacted a marshy area of a lake. Impact signatures were consistent with the helicopter colliding with trees and terrain in a nose low attitude. Weather information for the time of the accident showed that the helicopter was operating in an area favorable for instrument flight rules (IFR) conditions due to precipitation and mist, cloud ceilings between 1,000 to 1,600 ft above ground level, and possible moderate turbulence. Due to cloud cover, it is likely that the Moon was not visible. There is no evidence that the pilot obtained a weather briefing prior to takeoff. The pilot's log books were not recovered during the investigation and the pilot's total time, and night experience is not known. While the pilot held a rating for instrument airplane, it is not known how much training the pilot obtained, if any, for an instrument helicopter rating. It is likely that the pilot had no more than 30 hours in make and model.

Data downloaded from onboard avionics found that the flight was uneventful until 4 minutes before the accident when the helicopter made a right turn and began flying to the southwest. As the helicopter tracked southwest, the altitude dropped to about 600 ft msl (500 ft above ground level [agl]). A minute later, the helicopter turned left turn and descended in the turn to about 420 ft agl before it pitched up to 40° nose high, resulting in a 2,500 ft per minute (fpm) climb. The helicopter momentarily stabilized on a 55° heading. At this time, the pilot armed the airspeed hold mode but did not turned on the force trim, so the autopilot would not engage. It is likely that the pilot expected the autopilot to engage, and when the helicopter began a left bank, he turned on the force trim but did not re-

engage the autopilot. Shortly thereafter, the helicopter exceeded a 45° left bank and the pitch exceeded 40° nose low. The helicopter rapidly descended and impacted terrain. An examination of the avionics data, airframe, and engine did not identify any preimpact anomalies. While several substances were found in the pilot's toxicology, their use did not appear to contribute to the accident. The circumstances of the accident are consistent with the pilot's inadvertent encounter with instrument meteorological conditions, which resulted in spatial disorientation, loss of control, and subsequent impact with terrain.

Data captured revealed that the pilot flew a majority of the accident with the Force Trim off. He also did not select any flight director modes. At 0022:46 (27 seconds prior to impact), the pilot armed the airspeed hold mode. The pilot's action would have presented him flight director commands, but due to the Force Trim being off, the autopilot could not engage to hold this mode. At 0022:56 (18 seconds prior to impact), the pilot turned on the Force Trim. However, the pilot did not reselect an attitude mode for the autopilot to engage to a mode. The manufacturer recommends turning on Force Trim shortly after takeoff.

Aircraft: Airbus AS 350B2
Injuries: 2 Fatal, 1 Serious
NTSB#: WPR16FA040

<https://app.nts.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20151216X13718&AKey=1&RTtype=HTML&IType=FA>

The commercial pilot was repositioning the helicopter (with a flight nurse and flight paramedic on board) to its base following an air ambulance flight. The paramedic, who survived the accident, reported that after refueling, they departed and headed east towards mountainous terrain; peak elevations were 5,700 to 6,000 ft. About 10 minutes after takeoff, the helicopter entered the mountainous terrain, and the height of the helicopter above the terrain began to vary as the terrain elevation rose and fell. During the final few minutes of the flight, the helicopter's altitude above the ground varied between 30 ft and 770 ft.

About 30 seconds before impact, the helicopter flew east over a north-south canyon and continued through a saddle on the canyon's east wall, clearing the terrain by about 30 ft. As the helicopter passed over the eastern ridgeline, it banked to the right and reached a ground speed of about 120 knots. After the helicopter cleared the ridge, it started to descend and accelerate. The ground speed reached a maximum of 148 knots, and about 10 seconds later, there was an abrupt increase in the helicopter's pitch and right roll rates, consistent with right and aft cyclic inputs. According to the paramedic, around this time, the pilot said an expletive in a panicked voice. The paramedic looked up and saw a ridgeline immediately in their flight path and terrain filling up the view. The paramedic described the subsequent motions of the helicopter as a violent hard right bank, and he stated that the pilot did not say anything else but was making jerky, fast hand movements. The flight characteristics seconds before impact, as described by the paramedic and shown in flight data, were consistent with a rapid onset of servo transparency. The helicopter impacted terrain on the northwest facing slope of a ridgeline, near a saddle, at an elevation of about 5,035 ft.

Servo Transparency begins when the aerodynamic forces acting to change the pitch of the rotor blades exceed the hydraulic servo actuators' capability to resist those forces and maintain the commanded blade pitch angles. The force deficit is then transmitted back to the pilot's cyclic and collective controls. On clockwise turning main rotor systems such as the AS350B3, the right servo receives the highest load when maneuvering (retreating blade), resulting in an uncommanded right and aft cyclic motion accompanied by down collective movement. The NTSB's Servo Transparency Study for accident No. LAX03MA292 notes that the pilot's control force required to counter this aerodynamically-induced phenomena "tends to be progressive" and is "proportional to the severity of the maneuver," and "may give a pilot who is not aware of this phenomenon an impression that the controls are jammed." If the pilot does not reduce the maneuver, the aircraft will roll right and pitch-up, but the phenomenon normally lasts less than 2 seconds.

The general load on the main rotor increases under the following conditions: high speed, high torque (increase in collective pitch), high g-load, and increase in density altitude.

Although the helicopter will self-correct and recover from the servo transparency, the potential exists for a significant flight path deviation. The onset of servo transparency is rapid and could conceivably lead to a helicopter in a right turn exceeding 90° of bank before the pilot was able to recognize what was happening and react accordingly.

The associated transition from light and responsive controls to heavy controls that require considerable force to counter the uncommanded maneuver, could cause an unsuspecting pilot to believe that he was experiencing a malfunction, rather than a known characteristic of the helicopter when maneuvered at the published performance limits.

The Operation Control Center mistakenly lost tracking of the helicopter about 2 hours and 10 minutes after the accident occurred. Another company helicopter was then sent to search for the accident helicopter and located the wreckage about 50 minutes later. Due to the mountainous terrain and limited access to the accident site, another helicopter responded to the area about 4 hours after the accident and was capable of hoisting medics to the accident site.

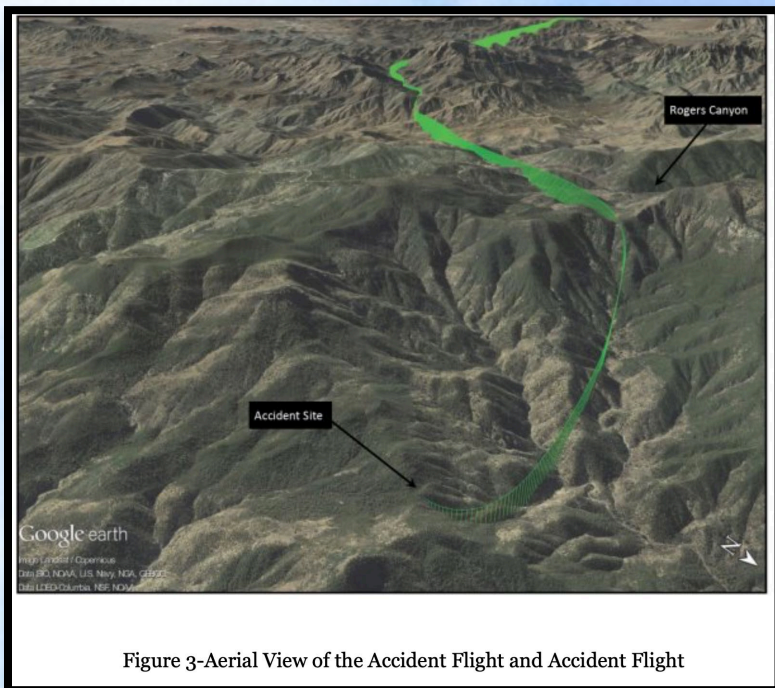


Figure 3--Aerial View of the Accident Flight and Accident Flight

The emergency locator transmitter (ELT) did not activate during the accident sequence, resulting in the delayed response of the search and rescue teams. Examination of the ELT revealed that the G-switches in the unit failed to activate due to a powdery residue from internal wear.

Probable Cause and Findings

The pilot's loss of helicopter control in mountainous terrain as the result of operating the helicopter outside the performance envelope of its hydraulic system and encountering the servo transparency phenomenon. Contributing to the accident was the pilot's decision to perform low-level, high-speed maneuvers through mountainous terrain.

There are no new ways to crash an aircraft...

...but there are new ways to keep them from crashing.

Safe hunting,

Bryan 'MaGu' Smith

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