Pilot Fixation as a Human Factor in Aviation Accidents

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Pilot fixation has led to the destruction of many perfectly flyable aircraft and the needless loss of life. This paper will explore fixation and its role as a human factor contributing cause in aviation accidents. The paper will define what fixation is in an aviation context, focus on three of the root causes of fixation, explore what causes fixation as well as look at what is being done from a training stand point to mitigate fixations role in accidents. To better illustrate the insidious nature of fixation three actual aviation accidents will also be examined as well as the author's own personal experience with a fixation incident from which valuable insight was gleaned.

Webster's dictionary defines fixate as "to focus or concentrate one's attention intently or obsessively" (Mish, 1993, p. 441). To define fixate in a more aviation/human factors context it could be said that fixation occurs when a pilot or crew concentrate so intently on a task or issue that they fail to maintain safe control of the aircraft. Fixation is often initiated by a distraction but this is not necessarily always the case. Fixation can also occur due to a pilot task. When a pilot fixates it keeps the pilot from performing his/her primary task of flying the aircraft. Pilot's have a golden rule "aviate, navigate, communicate." This rule states the three primary responsibilities of the pilot and the order that those responsibilities should be carried out. When a pilot fails to follow the golden rule and does not first and foremost concentrates on flying the aircraft in a safe manner, bad things usually happen.

Cognitive psychologists tell us that humans can successfully do up to two task simultaneously (Rosen, 2008). Doing more than two tasks leads to quick degradation of all tasks (Rosen, 2008). Fixation causes all cognitive capacity to be focused on one task exclusively. If this task is not flying the aircraft then the potential for an accident rises exponentially. Fixation

is not just a single pilot issue but can also befall entire crews as will be illustrated in the case study of Eastern Air Lines flight 401. Fixation can be linked as a contributing cause to many aviation accidents. Unfortunately one will be hard pressed to find specific statistics tracking fixation as an accident cause in major accident studies such as the annual Joe Nall Report published by the AOPA Air Safety Foundation (Kenny, Wright, & Vasconcelos, 2008). The reason for this is simple; fixation is only a contributing factor to many of the major accident categories. These include controlled flight into terrain (CFIT), loss of control which often times results in a stall/spin accident, and mid-air collisions. These are the accident categories that are tracked by the National Transportation Safety Board (NTSB) and other national equivalent organizations. Unfortunately many of these accidents types are predicated on pilot or crew fixation.

There are three primary causes of fixation. These causes include equipment problems, abnormal situations, and target fixation. Equipment problems are commonly distractions where the pilot becomes preoccupied with aircraft equipment that is not functioning normally (Australian Transport Safety Bureau, 2005). Examples of equipment problems include an instrument gauge malfunction such as a gear indicator light or a pitot/static problem which can manifest itself in erroneous readings on the air speed indicator, vertical speed indicator, and altimeter. The second primary cause is an abnormal situation. An abnormal situation is a situation that occurs out of the normally anticipated course of events (Australian Transport Safety Bureau, 2005). A pilot anticipates a flight to occur in several phases: takeoff, climb, enroute cruise, descent and landing. During these phases he/she anticipates certain events to occur requiring essentially scripted actions on the part of the pilot. When an abnormal situation occurs this orderly sequence of events is disrupted. The pilot must divert from the script and

often tends to focus all cognitive capacity on resolving the abnormal situation. An abnormal event does not necessarily have to be an emergency situation. It can be more benign than the loss of an engine or other major emergency. Examples of an abnormal situation include the opening of a door or window in flight or a sick passenger. The final primary cause of fixation is almost the exclusive domain of military pilots, target fixation (*USAF Accident Report*, n.d.). As stated earlier not all types of fixation are related to an issue or malfunction that the pilot must deal with. Fixation can also occur due to a task that the pilot must perform. In the case of target fixation the pilot is attempting to perform a task that is secondary to flying the aircraft. Often the pilot is attempting to destroy a ground or air target with ordnance. Concentrating exclusively on this task can lead to the pilot flying the aircraft into the ground (CFIT) in the case of a ground target or having a mid-air collision in the case of an air target.

Why does fixation occur? What causes pilots and entire crews to become so engrossed in an issue or task that they destroy a perfectly flyable aircraft and kill themselves? In some ways it appears to be related to the type of people who are attracted to becoming pilots. Pilots are usually Type A personalities (Joseph, 2005). They tend to be very goal oriented and like being successful at everything they attempt to do (Joseph, 2005). If presented with a problem they want to fix it. If presented with a mission objective such as to destroy a target in the case of a military pilot, they want to achieve that objective. For this reason issues that may present themselves in flight or task that must be accomplished can easily become the entire focus of the pilot. Unfortunately if this occurs it is at the expense of flying the aircraft in a safe manner.

So what is being done to address the problem of fixation? Unfortunately very little on the civilian side of pilot training. For the most part training for distractions and fixation is absent in the FAA's private pilot training syllabus (DOT/FAA, 2002). There is no structured training or

procedures for teaching student pilots the dangers of fixation. Flight instructors are left to their own on devising ways to train pilots on the dangers of fixation. The FAAs private pilot test standards do urge the check ride examiner "cause realistic distractions during the flight portion of the practical test to evaluate the applicant's ability to divide attention while maintain safe flight" (DOT/FAA, 2002, p. 9). This single check however is not adequate to address the dangers of fixation. The military takes target fixation very seriously as it claims the lives of military pilots and destroys multi-million dollar aircraft every year. The military has very structured and regimented training programs to address the dangers of target fixation and other forms of fixation.

Examining real world examples of pilot fixation can help to better understand just how insidious the problem can be. A real world accident example of equipment malfunction fixation occurred with a Eastern Air Lines Flight 401, a Lockheed L-1011 on December 29, 1972 ("Eastern Flight 401," n.d.). This particular example of fixation is unique in that not just the pilot flying but the entire crew became fixated by an equipment malfunction. The scheduled flight had departed John F. Kennedy Airport in New York bound for Miami International Airport. The flight was uneventful until the crew prepared for landing at Miami. During the course of landing preparations the Captain called for the extension of the landing gear. Normally three lights on the flight panel would illuminate green indicating that the gear was down and locked. On this occasion the nose wheel gear indicator light did not illuminate. The Captain aborted the landing and informed Miami tower of the problem. ATC then vectored the aircraft over the Everglades 18 miles west of the airport to troubleshoot the problem ("Eastern Flight 401," n.d.). The Captain directed that the aircraft be placed on autopilot while the crew troubleshot the equipment malfunction. At some point during the troubleshooting process the

autopilot disengaged. The L-1011 began a very gradual descent. The crew was so fixated on correcting the malfunction that no one noticed the autopilot disengagement and gradual descent. Seconds before impact the crew realized something was not right. The aircraft impacted the Everglades at 227 MPH. Approximately 101 people were killed in the accident and the aircraft was destroyed. The NTSB investigation would later uncover that the nose gear indicator light had burned out ("Eastern Flight 401," n.d.). This accident example demonstrates that single pilot operations are not the only area where fixation can occur. Entire crews can lose situational awareness by focusing intently on an issue or problem.

Another real world accident that illustrates fixation in an abnormal situation occurred more recently in Norfolk, Virginia on July 11, 2006 ("NTSB Accident DFW06FA180," 2007). In this case the accident aircraft was a popular general aviation aircraft, the Beechcraft Sierra. The pilot held a private pilot certificate and had a passenger and two dogs on board the aircraft. The aircraft took off from Norfolk International Airport and moments later contacted the control tower to report that a door had opened on the aircraft and that the pilot needed to return for landing. The tower gave the pilot instructions to fly a downwind leg. During the downwind leg the aircraft was at low altitude and slowing. It is likely that the pilot became fixated with the open door and the dogs being in close proximity. This situation and his attempts to either secure the door or ensure the dogs did not fall or jump out of the open door so fixated the pilot that he failed to attend to his primary responsibility, flying the aircraft. He did not monitor his airspeed or altitude as the aircraft slowed and descended to dangerous levels. The tower instructed the pilot to turn on to the base leg for landing on runway 32. At this point the aircraft entered into a stall and spin impacting the ground killing the pilot, passenger, both dogs and destroying the aircraft ("NTSB Accident DFW06FA180," 2007). The situation the pilot was confronted with

was outside of the normal events he anticipated would occur during the flight. The abnormal situation absorbed all of his cognitive ability. The aircraft manufacturer had conducted tests of the aircraft with an open door in flight and found that flight characteristics are unchanged ("NTSB Accident DFW06FA180," 2007). Had the pilot essentially concentrated on flying the aircraft he could have returned to the airport and landed without incident.

The third and final example study involves a military pilot and illustrates target fixation. The incident occurred northwest of Baghdad on November 27, 2006 and involved a USAF F-16 Fighting Falcon single engine jet aircraft (*USAF Accident Report*, n.d.). The F-16 was called to provide close air support (CAS) to coalition forces that had come under intense small arms fire from insurgents. The pilot made a strafing run using his 20mm cannon against multiple insurgent targets; he then repositioned the aircraft for a second attack. On the second strafing run the pilot became so fixated on destroying the targets that he failed to pull the aircraft out of the attack run (*USAF Accident Report*, n.d.). The aircraft impacted the target area killing the single pilot and destroying the multi-million dollar aircraft. In this particular case there was no mechanical issue with the aircraft and no abnormal situation to deal with. The pilot became fixated not on an issue within the aircraft but instead on a task, in this case destroy insurgents, outside of the aircraft.

In addition to the real world examples the author has personally experienced a fixation incident while flying an aircraft. Personal experience can often provide valuable insight into how or why a certain phenomenon occurs. It was from this experience that the author realized textbook training on fixation will do little to prevent fixation from occurring. A pilot will not totally comprehend the danger until they have experienced a fixation event whether that event is simulated or real.

The personal example occurred on July 7, 2010 in Payson, Arizona while flying a Piper Cherokee PA-28-151. The aircraft received a pre-flight inspection prior to the incident and nothing out of the ordinary was found. The takeoff roll and initial climb out appeared normal. At 200ft AGL it was noticed that the airspeed indicator was indicating a lower than normal airspeed and not increasing. The aircraft climb angle was reduced and the throttle was confirmed to be fully forward yet the airspeed did not increase. At that point the author observed that the vertical speed indicator was indicating a zero climb rate. The author realized that a pitot/static malfunction had occurred. The feeling of being drawn into analyzing and solving the problem was extremely strong at that moment. The aircraft at the time of the incident was in a very vulnerable stage of flight having climbed only a few hundred feet above the ground and slow. The author had only recently been checked out in this particular make and model of aircraft and was not familiar with the location of the alternate static source. The alternate static source provides the pilot with a backup within the cockpit in the event that the external static source becomes blocked by ice, insects, or other debris. It is usually installed under the pilot's side of the control panel. The author began rooting around for the valve which required diverting attention away from the outside of the aircraft and reference to the aircraft's attitude. Without instrument indicators the only way to safely fly the aircraft was by pitch and power. The aircraft did not need the instruments in order to fly. The author lost complete situational awareness of flying the aircraft before suddenly coming to the stark realization of what was occurring. It took a very concentrated mental effort to disregard the equipment malfunction and fly the airplane. This concentrated mental effort and the strong draw of the problem provided a deeper understanding into how so many pilots can become fixated and lose control of an aircraft. For a pilot to have such an "ah-ha" experience will almost guarantee the future ability to quickly

realize when such a situation is occurring and to know what steps must be taken to break the fixation accident chain. In the end the plane was landed safely using conservative pitch and power settings and the problem was troubleshot and resolved safely on the ground.

In conclusion, fixation is a human factor issue that transcends pilot training sources. It is a problem that impacts all sectors of aviation to include general aviation, air carriers, and the military. Fixation is not a problem for just single pilot operations but can affect entire air crews as illustrated by the Eastern Air Lines Flight 401 accident. The adoption of crew resource management has gone a long way to mitigate fixation in the multi-pilot aircrew. The military has also taken huge strides in addressing fixation in their training programs. On the general aviation front more needs to be done training new pilots in single pilot operations. While the FAA evaluates a pilot's ability to handle distractions during the practical test a more regimented training plan needs to be devised for Part 61 and 141 flight schools. Awareness of falling into the fixation trap is the number one key to breaking the accident chain. Above all else all pilots must never forget the golden rule of aviation, first and foremost fly the aircraft. Until fixation can be "bred out" of the pilot population perfectly fine aircraft will continue to be destroyed and lives lost.

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