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BEHAVIORAL TRAPS IN CREW-RELATED AVIATION ACCIDENTS

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The majority of aviation accidents are still attributed to human error, with flight crew actions accounting for the majority of these mishaps. The Federal Aviation Administration (FAA) has identified 12 behavioral traps that can ensnare even experienced pilots. This study examined the FAA-defined behavioral traps and the regularity with which they occurred in flight crew related accidents. The top three traps were *Neglect of Flight Planning, Preflight Inspection, and Checklists*; *Loss of Positional or Situational Awareness;* and *Getting Behind the Aircraft,* which were found in 72%, 61%, and 48% of aviation accidents, respectively. The results showed the contributing factors of training inadequacies/lack of Crew Resource Management, night, and low ceiling and/or visibility compounded the effects of the unsafe attitudes. These conditions were found in 48%, 46%, and 42% of accidents, respectively.

Approximately three out of four aviation accidents result from human error (FAA, 2009). The FAA uses studies in human behavior in an effort to reduce human error in aviation accidents. Flying consists of decision making activities, some of which are routine, others more complex. Effective aeronautical decision making (ADM) is essential to flight safety. The first two steps of ADM are "(1) identifying personal attitudes hazardous to safe flight and (2) learning behavior modification techniques" (FAA, 2009, p. 5-3).

Unsafe pilot behaviors have been part of FAA literature since the foundations of ADM. The concept of *hazardous attitudes* refers to pilot personality factors that may affect decision making and judgment. These attitudes include macho, anti-authority, impulsivity, resignation, and invulnerability. *Behavioral traps* (refer to Table 1) are operational pitfalls to which aviators may fall prey as a result of bad decision making, often leading to negative consequences.

Literature Review

Helmreich and Foushee (1993) found that flight crew actions were the cause in more than 70% of accidents between 1959 and 1989. Wetmore and Lu (2006) studied fatal general aviation (GA) accidents and found that hazardous attitudes have a devastating effect on risk management, decision making, and the utilization of all resources, three of the most important skills in Crew Resource Management (CRM).

Table 1.
Overview of Behavioral Traps as defined by the FAA (2008, p. 9-12)

Behavioral Trap	Definition
Peer Pressure	Poor decision making may be based upon an emotional response to peers, rather than evaluating a situation objectively.
Mind Set	A pilot displays mind set through an inability to recognize and cope with changes in a given situation.
Get-There-Itis	This disposition impairs pilot judgment through a fixation on the original goal (destination), including a disregard for any alternative action.
Duck-Under Syndrome	A pilot may be tempted to make it into an airport by descending below minimums during an approach. A pilot may believe that there is a built-in margin of error in every approach procedure, or a pilot may not want to admit that the landing cannot be completed […].
Scud Running	This occurs when a pilot tries to maintain visual contact with the terrain at low altitudes while instrument conditions exist.
Continuing Visual Flight Rules (VFR) into Instrument Conditions	Spatial disorientation or collision with ground/obstacles may occur when a pilot continues VFR into instrument conditions. This can be even more dangerous if the pilot is not instrument rated or current.
Getting Behind the Aircraft	This pitfall can be caused by allowing events or the situation to control pilot actions. A constant state of surprise at what happens next may be exhibited when the pilot is getting behind the aircraft.
Loss of Positional or Situational Awareness	In extreme cases, getting behind the aircraft results in a loss of positional or situational awareness. The pilot may not know the aircraft's geographical location or may be unable to recognize deteriorating circumstances.
Operating without Adequate Fuel Reserves	Ignoring minimum fuel reserve requirements is usually the result of overconfidence, lack of flight planning, or disregard of regulations.
Descent Below the Minimum En Route Altitude	The duck-under syndrome, as mentioned above, can also occur during the en route portion of an Instrument Flight Rules (IFR) flight.
Flying Outside the Envelope	The assumed high-performance capability of a particular aircraft may cause a mistaken belief that it can meet the demands imposed by a pilot's overestimated flying skills.
Neglect of Flight Planning, Preflight Inspections, and Checklists	A pilot may rely on short- and long-term memory, regular flying skills, and familiar routes instead of established procedures and published checklists. This can be particularly true of experienced pilots.

The understanding of individual pilot attitudes and their role in CRM still requires further research (Salas, Shuffler, & Diaz, 2010). The study of unsafe pilot attitudes has extended over three decades (Casner, 2010; Hunter, 2005; Lester & Bombaci, 1984; Murray, 1999). However, much has been limited to GA and to the hazardous attitudes. This study examined pilot behavioral traps in the multi-crew environment and aimed to see with what regularity behavioral traps were extant in crew-related aviation accidents. The specific research questions were:

1. Which behavioral traps are present, and with what frequency do these occur, in flight crew related accidents?

2. What relationships exist between the pilot behavioral traps and the contributing factors to aviation accidents?

Methodology

The study used archival methods to explore the behavioral traps contributing to flight crew accidents. The primary data source was the Flight Safety Foundation's (FSF) accident report archives. Research focused on FSF's *Accident Prevention* periodical, which cataloged 218 accidents from 1988 to 2006. From a total of 218 reports, 110 were determined to have flight crew-related causes. Using the Krejcie and Morgan (1970) formula, an appropriate sample of reports to review consisted of 83 accidents attributed partly or wholly to flight crew error. A description of the dataset and the database itself can be obtained at the FSF website (http://flightsafety.org).

The research team analyzed the accident reports to determine the presence of a primary behavioral trap, then wherever applicable, any secondary behavioral traps that may have been contributory. The researchers also identified contributing situational factors, such as weather, training/CRM, maintenance, etc., that may have exacerbated the effect of the behavioral traps. The researchers employed *a priori* codes, specifically, the FAA-defined behavioral traps. Once the coding process was completed, the research team explored any relationships among them with the contributing factors. All the relevant information from the accident reports was entered into NVivo (v. 10), a computer-aided qualitative data analysis software. The use of such software allowed for a second stage of coding where themes began to emerge (e.g., contributing factors) in conjunction with the behavioral traps themselves.

Results

Descriptive Statistics

Table 2 shows the frequency with which behavioral traps were present in the 83 accident reports as either a primary or secondary behavior. A primary behavior is a flight crewmember action or inaction which is most closely related to the investigative agency's accident probable cause. Accidents are usually the result of a series of events that each add operational risk. Thus, secondary behavioral traps are actions contributing to the accident but not directly associated to the investigative agency's probable or primary cause statement. The three most prevalent traps were *Neglect of Flight Planning, Preflight Inspection and Checklist; Loss of Positional or Situational Awareness;* and *Getting Behind the Aircraft.*

While night was tracked separately, darkness can be considered a contributory factor and was included in Figure 1 showing the frequency of occurrence of the contributing factors. Results showed that *training inadequacies/lack of CRM*, *night*, or *low ceiling and/or visibility* compounded the effects of the unsafe attitudes; these conditions were found in 48%, 46%, and 42% of accidents, respectively. The *other* category included miscellaneous conditions such as medical issues, optical illusions, etc.

Table 2.
Frequency Count of Behavioral Traps in FSF Accident Reports.

Behavioral Trap	Primary	Secondary
00-Neglect of Flight Planning, Preflight Inspections, Checklists	32	30
01-Peer Pressure	2	1
02-MindSet	5	18
03-Get-There-It is	2	9
04-Duck-Under Syndrome	5	3
05-Scud Running	0	1
06-Continuing VFR into IMC	2	2
07-Getting Behind the Aircraft	12	28
08-Loss of Positional or Situational Awareness	19	34
09-Operating Without Adequate Fuel Reserves	1	0
10-Descent below the MEA	1	1
11-Flying outside the Envelope	2	7

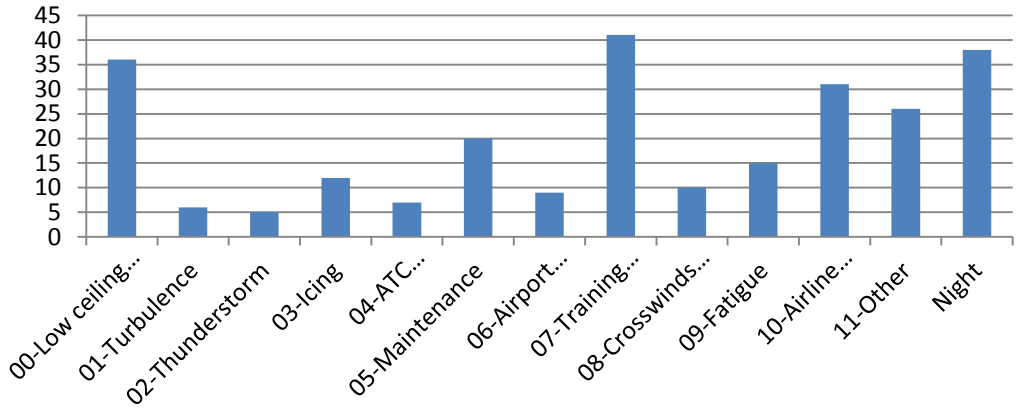

Figure 1. Contributory factors across all cases.

Relational Analysis Results

The research team became interested in exploring the relationships between the most prevalent behavioral traps and the contributing factors most present during the aviation accidents. Cluster analyses are good visualization tools based on the frequency with which words or coding are shared in the coded text. Figure 2 explored these relationships between the primary behavioral traps and low ceiling and/or visibility while Figure 3 explored the association between the primary behavioral traps and the crews' training inadequacies (lack of CRM).

The Figure 2 dendogram indicates how sources of information have coding similarities, which in turn could suggest relationships between two concepts. The proximity to, and color of codes within the diagram, suggest associations among the concepts. Low ceiling and/or low visibility is near, and shares the same color, to the behavioral trap known as *Loss of Positional or*

Situational Awareness. These connections are not difficult to comprehend since having restrictions to visibility could logically contribute to loss of positional awareness.

CRM is the ultimate expression of teamwork between flight crewmembers. Good CRM practices are predicated on following checklists, standard procedures, conducting good preflight, and engaging in proper flight planning to prepare for unexpected events. Not surprisingly, Figure 3 illustrated a relationship between training inadequacies (lack of CRM) and the behavioral trap known as *Neglect of Flight Planning, Preflight Inspection, and Checklists.*

Figure 2. Cluster analysis between low ceiling and/or visibility and the behavioral traps.

Figure 3. Cluster analysis between training inadequacies (lack of CRM) and the behavioral traps.

Discussion, Conclusions, and Recommendations

Behavioral traps were not present in a uniform distribution in the accident reports analyzed. In fact, three of them, *Neglect of Flight Planning, Preflight Inspection, and Checklist*, *Getting Behind the Aircraft*, and *Loss of Positional or Situational Awareness* accounted for 63 (over 75%) of the primary behavioral traps, and as secondary behavioral traps, they each appeared in over one-third of the cases. In all but three accidents considered, one or more contributing factors were present. One could infer that behavioral traps are exacerbated by adverse environmental factors.

The researchers found relationships between restrictions to vision (e.g., night conditions, low visibility/ceilings) with the behavioral trap known as *Loss of Positional or Situational Awareness.* The fact that restrictions to vision is still a factor in many accidents may prompt the FAA to research and develop training or public awareness on how to improve overall situational awareness during conditions such as these and study technological enhancements. The link found between training inadequacies and the trap known as *Neglect of Flight Planning, Preflight Inspection, and Checklists* suggests that some pilots are not employing effective teamwork practices, rules, and standard procedures.

From the standpoint of accident prevention, training and education focused on the top behavioral traps would likely prove to have the highest payoff. Knowledge of how these behavioral traps manifest themselves in crews can re-focus portions of CRM teaching to include cognitive biases training and/or hazardous behavior identification and modification techniques. Currently, the FAA lacks standardization for CRM training and guidelines concerning attitude management. The present study of behavioral traps could provide an excellent starting point.

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