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Hazardous Attitudes in Us Part 121 Airline Accidents

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The greater part of aviation accidents is often attributed to human error, with flight crew performance accounting for the majority of these mishaps. In 2016, the Federal Aviation Administration (FAA) published a rule to address pilot professionalism and to increase the likelihood that aviators adhere to standard procedures and prevent behavior that could lead to pilot errors in the airline domain. The FAA has identified 5 Hazardous Attitudes that afflict pilots: *macho, impulsivity, resignation, invulnerability, and anti-authority.* This study examined the FAA-defined Hazardous Attitudes and the regularity with which they occurred in the U.S. air carrier flight crew related accidents between 1991-2018. The top two Hazardous Attitudes were *anti-authority* and *invulnerability*, which were found in 92% and 68% of aviation accidents, respectively. The paper also explores the relationships among these Hazardous Attitudes and other contributing factors such as time of day, weather, flight conditions, and crew resource management, among others.

Literature Review

There are a multitude of factors that affect decision making and Crew Resource Management (CRM) within the cockpit. CRM is the proper use of all the available resources (human, hardware, and information) to conduct and complete a safe flight (FAA, 2004). Helmreich and Foushee found that the lack of CRM was responsible for more than 70% of the accidents during the period between 1959 and 1989 (1993). Furthermore, Wetmore and Lu studied general aviation (GA) accidents and found that Hazardous Attitudes have a great influence in the aeronautical decision making (ADM) process of pilots (Wetmore & Lu, 2005a, 2005b, 2006; Wetmore, Bos, & Lu, 2007).

An attitude is a predisposition to respond to an event in a given manner (FAA, 2009). Investigations have identified five Hazardous Attitudes, which interfere with the ability to make decisions and exercise authority properly (FAA, 2009). These Hazardous Attitudes are *macho*, *impulsivity*, *resignation*, *invulnerability*, and *anti-authority* (Table 1). Although they contribute to poor pilot judgment, they can be counteracted by saying the correct antidote (FAA, 2009).

Proposed Rulemaking (NPRM) by the Federal Aviation Administration (FAA) was published in 2016, to tipoff pilots to follow standards procedures and professionalism and to prevent behavior, which could lead to errors (81 FR 69908-Pilot Professional Development, 2016). Historically, most of the research on Hazardous Attitudes has focused on the GA population and the flight instruction environment (Hunter, Martinussen, Wiggins, and O'Hare

2011; Stewart, J. 2006, 2008; Wagener & Ison, 2014; Wetmore & Lu, 2005a, 2005b, 2006; Wetmore, Bos, & Lu, 2007). However, this study concentrated on the Hazardous Attitudes in the multi-crew environment and focuses on which ones were predominant in crew-related accidents. The specific research questions were:

1. Which Hazardous Attitudes are present, and with what regularity do these occur, in flight crew related accidents?
2. What relationships exist between the pilot Hazardous Attitudes and other contributing factors in these U.S. airline accidents?

Table 1.
Hazardous Attitudes Definitions and Antidotes as defined by FAA (2009, p. 2-5)

Hazardous Attitude	Definition	Antidote
Anti-Authority: (AA) "Don't tell me."	This attitude is found in people who do not like anyone telling them what to do. In a sense, they are saying, "No one can tell me what to do." They may be resentful of having someone tell them what to do, or may regard rules, regulations, and procedures as silly or unnecessary. However, it is always your prerogative to question authority if you feel it is in error.	"Follow the rules. They are usually right."
Impulsivity: (IM) "Do it quick."	This is the attitude of people who frequently feel the need to do something, anything, immediately. They do not stop to think about what they are about to do; they do not select the best alternative, and they do the first thing that comes to mind.	"No so fast. Think first."
Invulnerability: (IV) "It won't happen to me.	Many people feel that accidents happen to others, but never to them. They know accidents can happen, and they know that anyone can be affected. They never really feel or believe that they will be personally involved. Pilots who think this way are more likely to take chances and increase risk.	"It could happen to me."
Macho: (MA) "I can do it.	Pilots who are always trying to prove that they are better than anyone else are thinking, "I can do it – I'll show them." Pilots with this type of attitude will try to prove themselves by taking risks in order to impress others. While this pattern is thought to be a male characteristic, women are equally susceptible.	"Taking chances is foolish."
Resignation: (RE) "What's the use?"	Pilots who think, "What's the use?" do not see themselves as being able to make a great deal of difference in what happens to them. When things go well, the pilot is apt to think that it is good luck. When things go badly, the pilot may feel that someone is out to get me, or attribute it to bad luck. The pilot will leave the action to others, for better or worse. Sometimes, such pilots will even go along with unreasonable requests just to be a "nice guy."	"I'm not helpless. I can make a difference."

Methodology

The study used archival methods to explore the Hazardous Attitudes contributing to U.S. Part 121 flight crew accidents. The primary data source was the Embry-Riddle Aeronautical University (ERAU) National Transportation Safety Board (NTSB) database blue cover accidents reports. Research focused on NTSB Accident Reports periodical, which cataloged 37 accidents from 1991 to 2018. Excluded were all accidents with undetermined causes or those attributed to terrorism. All 37 accidents, that fit the above-mentioned characteristics, were analyzed by 5 subject matter experts (SMEs) so as to identify any Hazardous Attitudes and the contributing factors in the accidents.

The research team analyzed the accident reports to determine the presence of Hazardous Attitudes that may have been influential. The researchers also identified contributing situational factors, such as weather, CRM, airline management, flight rules, etc., that may have exacerbated the effect of the Hazardous Attitude. A priori codes were used; specifically, the FAA-defined Hazardous Attitudes. After the identification process was completed, the SMEs tried to find any connections between the Hazardous Attitude and the other contributing factors. All the relevant information from the accident reports was entered into NVivo (v. 12), 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., additional contributing factors) in conjunction with the Hazardous Attitudes themselves.

Results

Descriptive Statistics

Table 2 and shows the regularity with which the Hazardous Attitudes were found in the analyzed accidents. The number represented under "Yes" means the number of accidents in which the Hazardous Attitude was found. Conversely, the number under "No" means the number of accidents in which the Hazardous Attitude was not found. The top two Hazardous Attitudes were *Anti-authority* and *Invulnerability*; these two were found in 34 and 25 accidents, respectively. In addition, each Hazardous Attitude was further analyzed in fatal accidents. These results are demonstrated in Table 3.

Table 2.
Frequency Count of Hazardous Attitudes in all Accidents

Hazardous Attitudes Total Accidents					
	AA	IM	MA	IV	RE
Yes	34	15	9	25	12
No	3	22	28	12	25
Totals	37	37	37	37	37

Table 3.
Hazardous Attitudes Frequency Count in Fatal Accidents

Hazardous Attitudes in Fatal Accidents					
	AA	IM	MA	IV	RE
Yes	13	3	3	10	4
No	1	11	11	4	10
Totals	14	14	14	14	14

Relational Analysis Results

Figure 3 represents a Cluster Analysis performed by NVivo. NVivo can attempt relational analyses through a dendogram such as this one. Cluster analyses are good visualization tools based on the frequency with which words or coding are shared in the text. This figure explores that relationship with word similarity. The dendogram indicates how sources of information have word similarities, which in turn could suggest relationships between two concepts. The proximity to, and color of codes within the diagram, suggests associations among the concepts.

Anti-authority and *Invulnerability* share the same color, and are near, to CRM issues. This result suggests that these Hazardous Attitudes are similar and are having an impact on the ability of crews to perform well together. Both Hazardous Attitudes (i.e., *Anti-authority* and *Invulnerability*) may lead to the bypassing of procedures and teamwork efforts, which ultimately affect CRM. No other relationships between factors and attitudes were established by the research team.

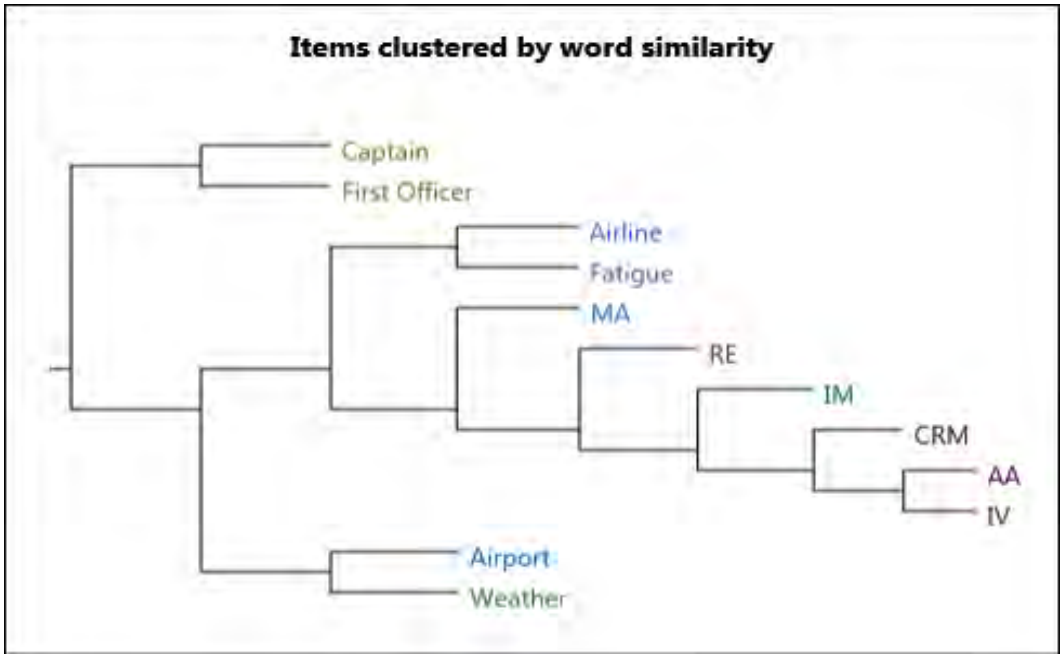

Figure 3. Cluster Analysis between CRM and the predominant Hazardous Attitudes.

Discussion, Conclusions, and Recommendations

All of the Hazardous Attitudes were found in the reports analyzed; however, the two more dominant ones were *Anti-authority* and *Invulnerability*. Anti-authority appeared in 92% of the accidents analyzed; meanwhile Invulnerability was found in 68% of the accidents. In addition, a relationship between these two Hazardous Attitudes and CRM was clearly established by NVivo. Thus, it is unsurprising that both Attitudes were the top two in total and fatal accidents.

As it was evidenced, the Hazardous Attitudes are affecting crew related operations and performance. The results of this study, where *Anti-authority* is the top Hazardous Attitude is aligned with Velazquez (2018) where he found *Neglect of Flight Planning, Preflight Inspections, and Checklists* to be the top Behavioral Trap. Also known as Operational Pitfalls, Behavioral Traps are accident-inducing attitudes that equally affect decision making (FAA, 2009). In both examples of negative behaviors, pilots bypass rules and procedures, fail to follow checklists, federal aviation regulations, and manufacturer recommended practices. Moreover, all of these studies justify the FAA's efforts to increase pilot professionalism in the U.S. Part 121 environment. Perhaps, it is time CRM training include a psychological element in which pilots identify and manage behavioral factors such as Hazardous Attitudes. This training can include scenarios and Hazardous Attitude modification techniques.

The FAA could implement more rigorously the NPRM (81 FR 69908-Pilot Professional Development, 2016). It is highly recommended that pilots be monitored, mentored, and well trained in CRM operations to avoid failures. After all, as Michael Huertas said, "We have some of the best pilots in the world and should take full advantage of our pilot's wealth of experience to raise professional standards and cockpit discipline" (FAA, 2016, para 2). Every time pilots enter an airline he or she should be briefed on how and why the majority of the accidents have occurred. In addition, besides observing the operations inside the cockpit, the pilot should be assigned to identify as many hazards as they can. This form of risk management should include behavioral hazards. Once the crew is on the ground, all pilots involved should be instructed on how to avoid them.

It will always be almost impossible to reduce human errors to 0% in an environment that relies heavily on humans for its operation. However, these studies help identify the shortcomings so that all involved can focus on improving safety and accident prevention.

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