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Understanding Decision-Making Styles of Part 135 Pilots in Remote Settings and Their Impact on Aviation Safety

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ABSTRACT

Aviation is a vital component of business transportation system, especially for the mining and the petroleum industries. Air transportation is frequently the only means to move goods, services, and people in inhospitable and inaccessible terrain where mining and petroleum exploration projects are undertaken. These operations are undertaken in compliance to regulations 14 C.F.R. Part 135. Historically, air taxi and non-scheduled/charter air operators (14 C.F.R. Part 135) form the bulk of service to these operations as also in support to remote communities and have poor operational safety records through high rates of accidents. The problem is still prevalent despite numerous initiatives by the Governments and Companies to reduce adverse safety events. Accident investigation reports have nominally attributed causal factors of these accidents to pilot error and at-risk behaviors such as violations. Extant research in aviation human factors suggest that optimal **A**eronautical **D**ecision-**M**aking (ADM) by pilots is essential for safe flight outcomes. There seems to be a paucity in literature that qualitatively explores factors influencing effective ADM of Part 135 pilots who fly in this operationally challenged domain. Documentary analysis of accident case studies and semi-structured interviews with a convenience sample of Part 135 pilots with varying experiences were conducted. Thematic analysis was used to extract salient themes that throw light on the problem statement. Findings suggest that mentorship, camaraderie, and positive relationships with senior management are essential for optimal ADM by these pilots, which auger well for operational safety. Investments in proactive organizational safety initiatives and improvements in aviation technology infrastructure were also highlighted by respondents as key to effective ADM. The study provides in-depth understanding of Part 135 pilot ADM during flight operations and helps to frame policies and practices for safer operations.

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CHAPTER I: INTRODUCTION

Rationale for the Study

Part 135, or Non-Scheduled aviation operations as they are also called, form a bulk of aviation operations undertaken by Petroleum and Mining industries. Most of the exploration sites, as well as a bulk of production facilities, are located in remote, inhospitable and inaccessible terrain.

Most of the air transport service providers are air taxi and small non-scheduled charter (i.e., on-demand) operators (C.F.R. Part 135) who facilitate the movement of goods and passengers for these companies and provide services like medical evacuation (medevac) and search and rescue. Other Part 135 applications like air tourism, hunting expeditions, aerial mapping, and humanitarian missions are also common in many remote communities around the world like in Africa, Australia, South America and Alaska. The flexibility of Part 135 certification allows large and small operators to coexist under the same regulations.

Part 135 operators can be certified to fly on-demand operations, which allow aircraft to operate with up to 30 seats and limited scheduled services. They can also be certified as commuter operations, which entails scheduled services in aircraft with nine seats or fewer. The scope of Part 135 operators varies. Organizations can be certified as single pilot, where only one pilot is on the operating certificate and the requirements for training manuals and departments are small, to Standard Part 135 operations, where there are no limits on the size and scope of an operation, but certain standards for training and management positions exist (Operating Requirements, 2020).

Despite the enormous socioeconomic contributions of these operators, the hazards and safety risks posed to aviation operations are amplified by the geography of the operational areas, which often features extreme weather and rugged terrain. The United States National Transportation Safety Board (NTSB) has identified the leading accident types in remote areas as controlled flight into terrain (CFIT) and loss of control in flight due to pilots certified to operate under visual flight rules (VFR) inadvertently or intentionally flying in instrument meteorological conditions (IMC) as leading accident types (Sumwalt, 2019). The FAA defined controlled flight into terrain as the impact of an airworthy aircraft with terrain, usually due to inadequate awareness on the part of the pilot (FAA, 2003). VFR into IMC refers to continued visual flight into instrument meteorological conditions; in many cases, CFIT is the result (FAA, 2003).

A sparse number of weather reporting systems located over a wide expanse of land and the limited number of technologically advanced ground-based navigational aids for aviation that exist (or do not exist) in these areas increases the accident potential for air operators (FAA, 2021b). Historically, the aviation safety record among Part 135 operators and general aviators has not been the best as compared to the rest of the world.

Figure 1 – 2020 Aviation Safety Statistics

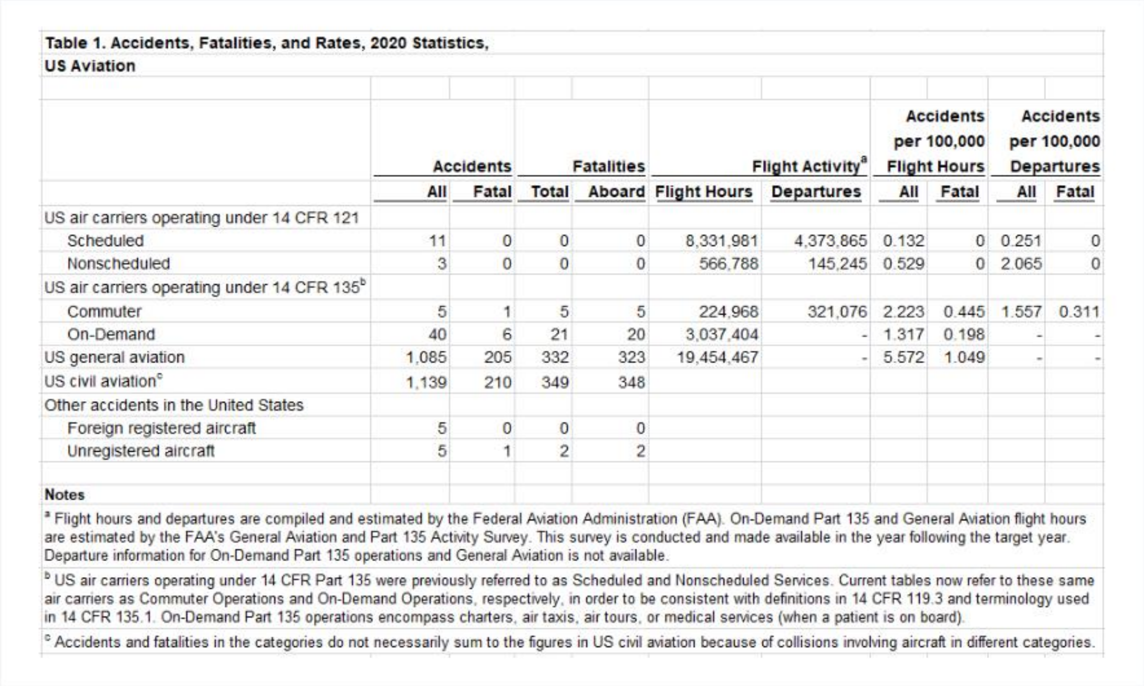


Table 1. Accidents, Fatalities, and Rates, 2020 Statistics,
US Aviation

	Accidents		Fatalities		Flight Activity[a]		Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
	All	Fatal	Total	Aboard	Flight Hours	Departures	All	Fatal	All	Fatal
US air carriers operating under 14 CFR 121										
Scheduled	11	0	0	0	8,331,981	4,373,865	0.132	0	0.251	0
Nonscheduled	3	0	0	0	566,788	145,245	0.529	0	2.065	0
US air carriers operating under 14 CFR 135[b]										
Commuter	5	1	5	5	224,968	321,076	2.223	0.445	1.557	0.311
On-Demand	40	6	21	20	3,037,404	-	1.317	0.198	-	-
US general aviation	1,085	205	332	323	19,454,467	-	5.572	1.049	-	-
US civil aviation[c]	1,139	210	349	348						
Other accidents in the United States										
Foreign registered aircraft	5	0	0	0						
Unregistered aircraft	5	1	2	2						

Notes

[a] Flight hours and departures are compiled and estimated by the Federal Aviation Administration (FAA). On-Demand Part 135 and General Aviation flight hours are estimated by the FAA's General Aviation and Part 135 Activity Survey. This survey is conducted and made available in the year following the target year. Departure information for On-Demand Part 135 operations and General Aviation is not available.

[b] US air carriers operating under 14 CFR Part 135 were previously referred to as Scheduled and Nonscheduled Services. Current tables now refer to these same air carriers as Commuter Operations and On-Demand Operations, respectively, in order to be consistent with definitions in 14 CFR 119.3 and terminology used in 14 CFR 135.1. On-Demand Part 135 operations encompass charters, air taxis, air tours, or medical services (when a patient is on board).

[c] Accidents and fatalities in the categories do not necessarily sum to the figures in US civil aviation because of collisions involving aircraft in different categories.

2020 Aviation Safety Statistics (Source: NTSB)

While the above data pertains only to the United States for the year 2020, the trend across the world is very similar. As can be seen, the accident rate per 100,000 flight hours for the Part 135 commuter flights stands at 2.223 and On-Demand at 1.317 against only 0.132 and 0.529 for the Part 121 scheduled and non-scheduled operations respectively.

Noting this vastly higher accident rate in Part 135 operations, eliciting the views of these key stakeholders through interviews may yield vital intelligence required for effective mitigation of this operational safety problem. Other contributory and less explored safety challenges, such as human factors and performance factors related to ineffective aeronautical decision-making (ADM) require deeper understanding using a qualitative research approach, since these factors can increase the accident potential of pilots (Williams, 2011).

Remote Aviation Operations (Part 135 Flying)

Operations that take place in isolated or inhospitable locations, or areas where air service is sparse, are the notable characteristic of majority of Part 135 flying (Johnston, 2021). In the United States, Alaska is perhaps the best example of where most of Part 135 flying normally occurs due to its remoteness, geography, and population. Michalski and Bearman (2014) suggested other areas where Part 135 flying activities are common, including Outback Australia, the tundra of Canada, the rainforests of South America, and tropical forest areas of Africa.

Most of these environments are well known for rainy instrument flight rules (IFR) weather year-round and for being a part of the temperate rainforest. Geographical features augment the challenge of flying in these regions, where fjords, narrow channels, and mountains combine with unpredictable coastal weather. Figure 1 below shows potential Part 135 areas in Africa and Australia and Figure 2 presents similar areas in Canada and South America.

Figure 2 – Tropical Forest Areas of Africa and Outback Australia

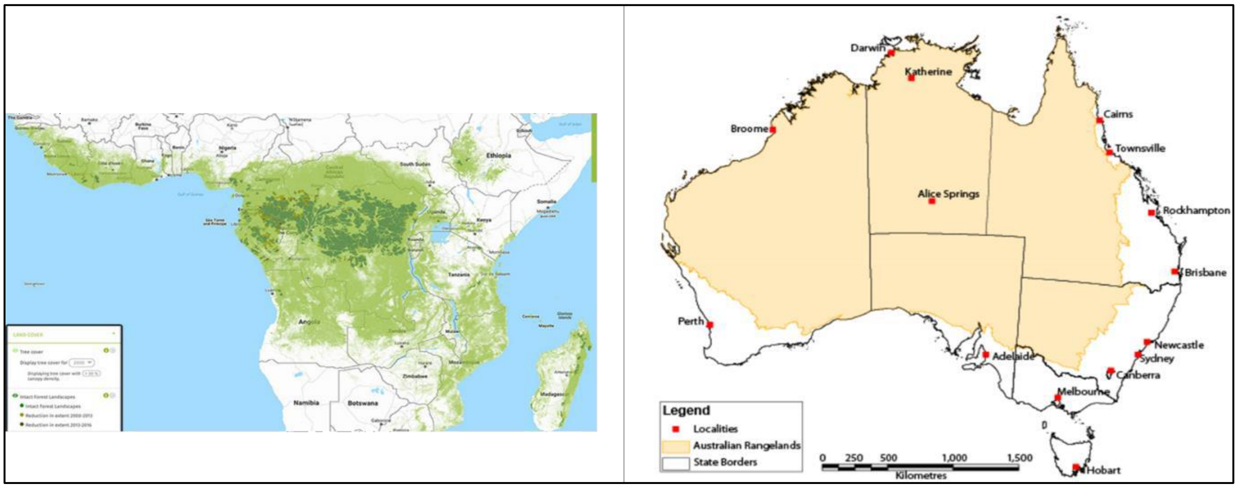


Figure 2 - Source: "The Congo Rainforest," by R. A. Butler, 2020, Mongabay (https://rainforests.mongabay.com/congo/). "Outback Australia – The Rangelands," by the Australian Government, Department of Agriculture, Water and the Environment, 2005 (https://www.awe.gov.au/agriculture-land/land/rangelands).

Figure 3 – Amazon Forest Areas of South America and the Canadian Tundra

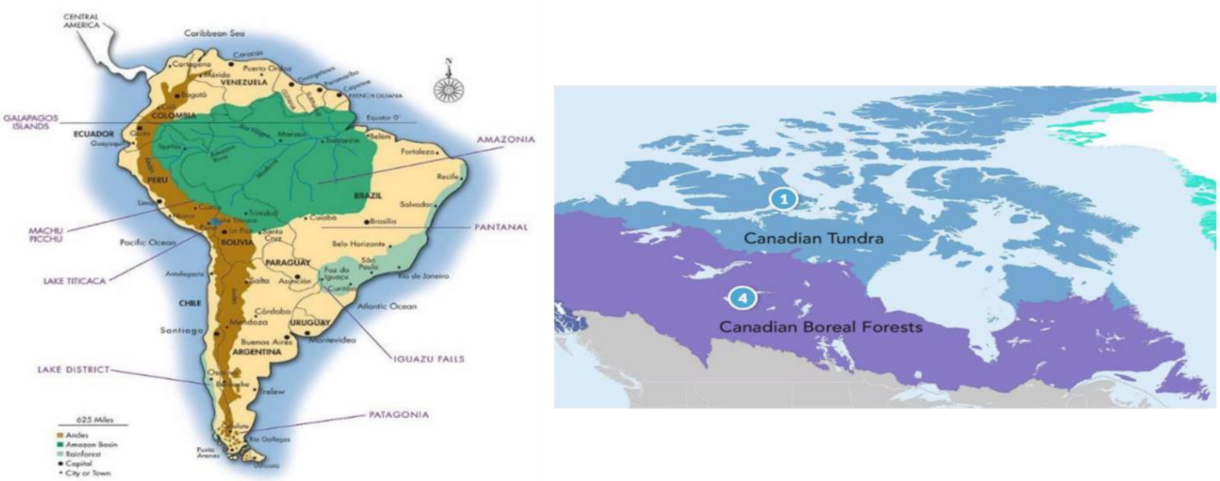


Figure 3 - Source: "Map of Amazon Planned for National Geographic Magazine," by the Amazon Biodiversity Center, 2014 (https://www.amazonbiodiversitycenter.org/single-post/2014/10/02/map-of-amazon-planned-for-national-geographic-magazine). From "Subarctic America," by One Earth, n.d. (https://www.oneearth.org/realms/subarctic-america/).

The majority (over 85%) of aircraft used for Part 135 flying in air taxi or commuter companies are single-engine aircraft (Conway et al., 2004; FAA, 2021a). The Cessna 208 Caravan, Cessna 207, de Havilland Beaver, and Piper Super-Cub are popular among operators (Johnston, 2021). Their multi-engine counterparts consist of aircraft like the Piper Navajo and the Beechcraft 1900 due to their ruggedness. While aircraft can be kept on wheels year-round, some choose to fly floats or skis seasonally, which requires a specific skill base for their pilots and an additional challenge to maintain proficiency (FAA, 2004). Aircraft are often modified to withstand harsh airport environments; many are equipped with larger tires, reinforced landing gear, and have been certified to operate at high-gross weights (Johnston, 2021). Figure below shows examples of popular aircraft used in the Part 135.

Figure 4 – Popular Part 135 Aircraft

PART 135 regulatory structure

Operators engaged in common carriage offer scheduled or nonscheduled flights. All cargo operations are always classified as on-demand operations. If the operator offers scheduled passenger service on a non-turbojet airplane with nine or fewer seats and 7,500 pounds or less payload capacity or on any rotorcraft that operates with a frequency of five or more round trips a week on at least one route, then the operation is classified as commuter part 135. If the operator offers scheduled passenger service on an airplane (excluding turbojet-powered airplanes) with nine or fewer seats and 7,500 pounds or less payload capacity or any rotorcraft that operates with a frequency of less than five round trips a week on at least one route, then the operation is classified as on-demand part 135.

Also included in the on-demand category are operations involving public charters under 14 CFR part 380, These operations may also include frequencies of five or more round trips per week on a city pair segment using aircraft with 30 or fewer seats, including turbojet aircraft. Such operations would generally require part 121 scheduled authority or part 135 commuter authority, depending on the type and size of the aircraft. However, under the regulatory definitions in § 110.2, these operations are specifically excluded from the definition of a scheduled operation and specifically included in the definition for on-demand operations. Public charter operations are a small but growing segment of on-demand operations.

As shown in Figure 5, all nonscheduled operations using aircraft meeting the listed criteria and all operators engaged in non-common carriage using aircraft meeting the listed criteria are classified as on-demand part 135.

Figure 5 – Part 135 Operating rules

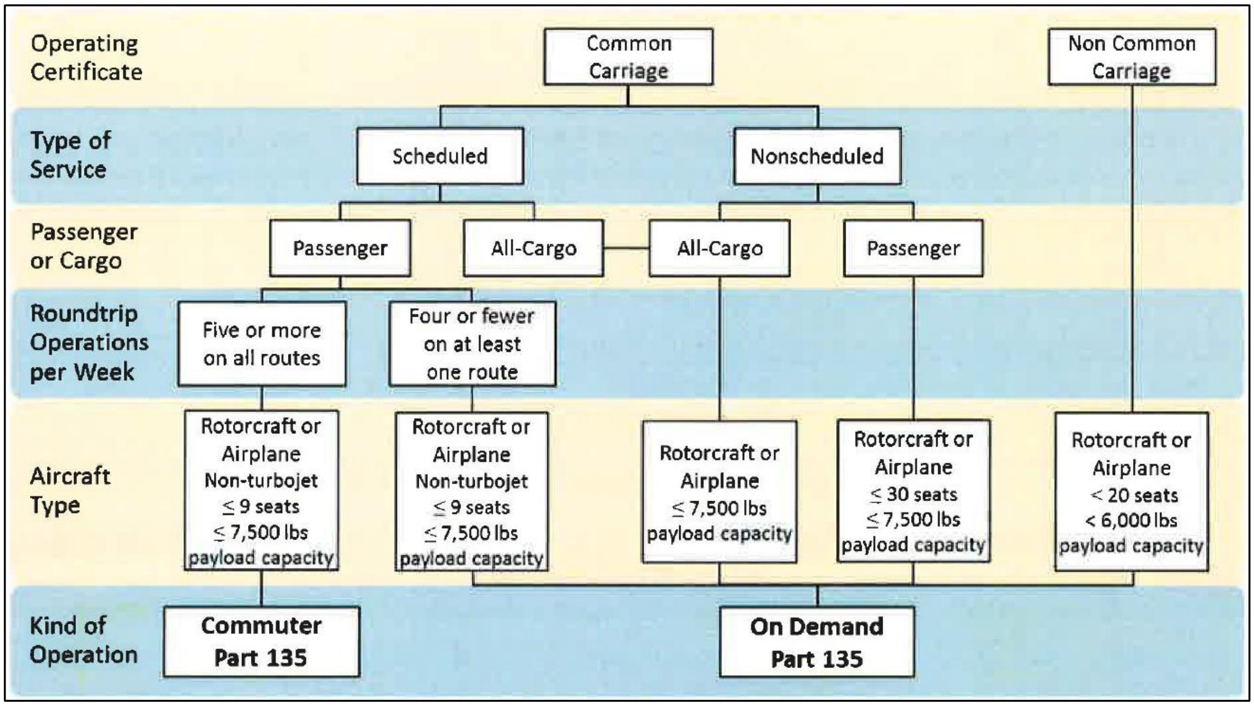
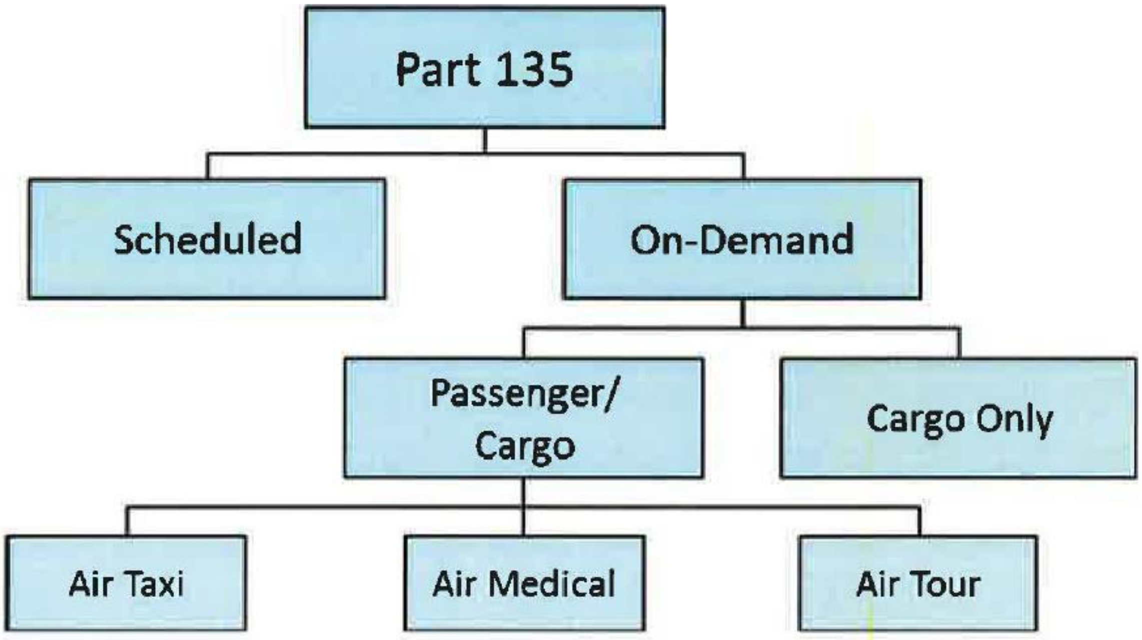


Figure 6 provides a diagram of the part 135 use categories. The main categories are scheduled and on-demand; the on-demand category is sub-divided into passenger/cargo operations and cargo only operations. The three categories of passenger/cargo operations are air taxi, air medical and air tour.

Figure 6 – Part 135 Use categories



Problem Statement

The critical nature of air transport petroleum and mining operations, as also in support of remote communities, means safety incidents and accidents have far-reaching effects. CFIT and VFR into IMC accidents have been endemic to aviation (Mode et al., 2012; NTSB, 2017a; 2018). In a study on the psychological factors affecting pilots' decisions to fly into deteriorating weather, authors Madhavan and Lacson (2006) suggested that causes of VFR into IMC accidents include a variety of human factors elements, such as situation assessment and risk perception, as well as intrinsic and extrinsic factors like social and motivational pressures. Decisions to fly VFR into IMC are made more dangerous due to the environment in the remote areas of operations, where weather reporting and IFR infrastructure are limited.

In June 2015, a flightseeing tour aircraft impacted terrain near Ketchikan, Alaska, and all passengers on board were killed (NTSB, 2017a). The NTSB investigation revealed that inadequate decision-making and organizational culture were contributory factors to the accident (NTSB, 2017a). The following year, in October 2016, a separate accident killed all three occupants of an aircraft when it impacted terrain near Togiak, Alaska (NTSB, 2018). The NTSB's (2018) final report listed inadequate aeronautical decision-making, along with inadequate regulatory and organizational oversight, as factors in the accident. In August 2021, yet another fatal accident occurred in Southeast Alaska, near Ketchikan, when a flightseeing tour impacted terrain in marginal weather conditions. The NTSB (2021b) is currently investigating the cause.

Bearman et al. (2009) conducted a qualitative study that sought to examine both direct and indirect operational pressures faced by pilots. Twenty-eight Part 135 pilots were interviewed, and the results from the study suggested that recurrent themes of organizational culture, organizational processes, and resource allocation influenced pilot decision-making. Bearman et al. focused on organizational variables in their initial analysis and did not probe into social and personal influences on decision-making among the study participants. Using the same interview data, Bearman et al. performed a secondary analysis to understand the role of motivations on pilot ADM. The results suggested that personal inconveniences could have significant influence over ADM.

From a more globalized perspective, Leigh and Raisanen (2010) used qualitative research data derived from interviews to evaluate the recruiting and training practices of pilots flying in remote parts of Africa. Their findings suggested that most negative motivational influences were related to environmental, behavioral, and cultural factors. Examples of these influences were the excessive difficulties of Part 135 flying, meeting passenger expectations, and pressure from customers and the pilots' organizations to break regulation. The results further reiterated that pressures to complete flights were due to management practices and in part to the pilots' personal self-motivations (Leigh & Raisanen, 2010).

Researchers Michalski and Bearman (2014) explored factors affecting the decision-making of pilots who fly in Outback Australia using semi-structured interviews with 12 participants. The authors suggested that organizational, social, and personal factors have a strong influence on pilots' decisions to accept flights. Weak organizational culture from low safety standards influenced pilots to make risky decisions. Personal and social influences, like career ambition and pressures from peers and customers, were significant to the pilots' decision- making (Michalski & Bearman, 2014).

The findings from qualitative studies emphasized that myriad different cultural and social factors are influential on Part 135 pilots' decision-making. Qualitatively, assessing and understanding how cultural and psychosocial factors influence ADM among Part 135 pilots can provide valuable insight for effective policies and practices to reduce adverse operational safety events. A paucity of current qualitative-based studies related to psychosocial and cultural factors influencing ADM among this group of pilots makes this study timely and relevant.

Purpose Statement

The purpose of this study is to explore the psychosocial and cultural influences on Part 135 flying. Extant studies suggest sociocultural factors influence decision-making in this group of pilots. Plan continuation errors are byproducts of emotion and stress that can bias decision-making toward riskier and less rational behavior (Causse et al., 2013). When risky behaviors are rewarded with successful outcomes, cultural norms may develop among pilot groups (Transport Canada, 2002).

Complex situations with opaque outcomes, time pressures, and influences from cultural norms also create obstacles toward decision-making (Strohschneider, 2002). Other factors, which include company and peer-based influence, along with pilot attitudes and motivations, may lead to poor decision-making during flight operations and explain factors in aviation accidents (Causse et al., 2013; Noort et al., 2021; Strohschneider, 2002; Transport Canada, 2002).

A qualitative inquiry was chosen to explore the perspectives of pilots. A qualitative analysis attempts to find patterns and describe their relationships through the use of documents, images, or observed behavior (Saldaña & Omasta, 2018). It was envisaged that the opinions of pilots relating to psychosocial and cultural factors affecting their decision-making during flight operations can provide important feedback needed for improving safety controls related to aviation safety.

To explore the psychosocial and cultural factors affecting Part 135 pilots, three aviation accident case studies and a descriptive documentary analysis of NTSB accident data from the years 2008 to 2018 was performed. The emergent themes derived from these analyses guided the item development for the final phase of the research which was a semi-structured interview. The semi-structured interview was chosen to keep consistency between interview participants yet allow each individual to respond organically.

Semi-structured interviews are valuable when exploring potentially new phenomena, as they allow each participant to voice individual opinions (Adams, 2015). Codes and emergent themes from the semi-structured interviews provided data which was analyzed to understand the operational roles of these Part 135 pilots and how psychosocial and cultural factors influence their decision-making styles. It was also envisaged that data triangulation derived from the three approaches will provide better perspective to the discussion of results.

Central Research Question

What psychosocial and organizational factors influence decision-making of 14 C.F.R. 135 pilots and contribute to incidents and accidents among this group of pilots?

Underlying Research Questions

What are the environmental and operational factors that make flight operations challenging for Part 135 pilots?

What are the organizational factors that influence decision-making among Part 135 pilots?

What are the psychosocial and cultural factors that influence decision-making among Part 135 pilots?

How do prior experiences and generational/age differences affect decision-making during operations among Part 135 pilots?

What is the perception of the safety culture among Part 135 pilots and how does it influence hazard identification and safety risk decisions?

CHAPTER II: LITERATURE REVIEW

The following literature review overviews extant literature on the operational, cultural, and psychosocial factors that affect pilot decision-making in Part 135 flying operations. Other factors that adversely affect pilot decision-making in remote or Part 135 locations are environmental factors (type of terrain and weather) and poor aviation infrastructure. Furthermore, there are specific psychological influences on pilots, which are discussed in the following section and provide a framework for this study.

Hazardous Attitudes and Pilot Personality

Attitude and personality are inherently different. Personality, intrinsic traits and enduring qualities of a person's demeanor, is relatively stagnant due to its development during childhood (Helmreich, 1984). There is debate in the literature on how effective personality characteristics are at predicting pilot ability (Besco, 1994; Hunter, 2005). However, studies on pilot personality have shown a trend in traits such as conscientiousness, achievement-striving, assertiveness, and general emotional stability among this group (Fitzgibbons et al., 2000). People possessing these personality traits may be drawn to the profession; however, personality is not a good determinant of pilot ability.

Attitude is a better target for pilot training and development. Attitudes are learned behaviors influenced by positive and negative reinforcements from the environment

(Hunter, 2005). “Attitude is a motivational predisposition to respond to people, situations, or events in a given manner,” and it is well-accepted that attitude is an influence on action and behavior (FAA, 2016b, p. 2-5). It more accurately describes common aviation pitfalls and can be mediated to produce reductions in safety concerns (Helmreich, 1984).

The FAA (2016b) identified five hazardous attitudes generally observed among pilots. These are *anti-authority*, *impulsiveness*, *invulnerability*, *macho*, and *resignation*. Invulnerability is the root cause of other hazardous attitudes; poor decision-making can be attributed to invulnerability, macho, and anti-authority almost exclusively (Murray, 1999). In a review of NTSB accident reports associated with Part 135 operations encompassing the period between 2008 and 2018, resignation was not an influential or contributory factor.

While the hazardous attitudes are simplistic in name, the nature of how these affect pilots’ decision-making can be complex. Comprehensive educational materials necessary for gaining knowledge and understanding of these hazardous attitudes are included in aviation training at all levels from private pilot curriculum to professional airline training across the globe (Lee & Park, 2016). This model has been so effective that it has crossed into medical and other high-reliability fields (Reason, 2008).

Anti-authority is a disregard for rules or regulations. It is characterized by a pilot’s unwillingness to accept that rules apply to their operational situation or themselves (FAA, 2016b). Anti-authority and other hazardous attitudes may influence the occurrence of violations among pilots (English & Branaghan, 2012). While there are many different taxonomies for classifying violations, behavior and attitudes are components of each (Rasmussen, 1982; Reason, 2008).

In a study on hazardous attitudes identified as causal factors in airline accidents, Nuñez et. al. (2019) emphasized how anti-authority and invulnerability erode effective cockpit communication. Anti-authority can especially influence pilots in the Part 135 when they are pressured by their company or their passengers to complete a flight. In a qualitative study on Part 135 pilot decision-making styles in the Australian Outback, researchers Michalski and Bearman (2014) interviewed 12 pilots, who reported making “*substandard decisions because they did not want to disappoint customers, . . . [pilots] also reported committing violations (such as flying lower than regulations allow) because of customer pressure*” (p. 292).

Antiauthority and invulnerability have been suggested as primers for regulatory violations which were nine times more likely to end in a fatal accident in remote Part 135 operations (Detwiler et al., 2006; 2008). These hazardous pilot attitudes and behaviors have resulted in continued VFR flight into IMC conditions and eventually CFIT which accounts for 80% of fatal accidents in Part 135 and general aviation (NTSB, 2020).

Contributing to anti-authority attitudes of pilots in Part 135 are invulnerability and macho. The Pilot's Handbook of Aeronautical Knowledge described a macho pilot as one who tries to prove himself to others (FAA, 2016b). Macho is closely linked to invulnerability and described as an expectation of being in control; it stems from machismo, a social construct where one tries to prove their manhood and self-sufficiency (Stewart, 2006). Despite the masculine connotations of macho, women can develop this attitude (Nuñez et al., 2019).

A social hierarchy exists in the Part 135. More experienced pilots may initiate younger pilots in a fraternity-like manner and have an illusion of control. New or inexperienced pilots flying with senior pilots exhibiting these at-risk attitudes may not voice safety concerns due to senior pilot authority and end up complying with risky directives and suggestions (Michalski & Bearman, 2014; Noort et al., 2021). Pilots who exhibit macho attitudes tend to be overconfident and may attempt tasks for the admiration they will receive from their peers (Murray, 1999).

Invulnerability describes an attitude where a pilot feels they are immune to accidents or will never be personally involved in an adverse safety event (Adhikari, 2015). This trait can lead to a "cavalier" attitude toward safety and a "consequent laxity in following safety precautions," (Stewart, 2006, p. 14). Pilots who show characteristics of invulnerability may accept flights regardless of risk. Makarowski et al. (2016) discussed personality and risk tolerance in a study of 112 airline pilots. They suggested that pilots with the most experience adopt a higher risk tolerance; they become more willing to accept flights in “very difficult and perilous” weather conditions and embody attitudes of invulnerability (Makarowski et al., 2016, p. 304).

This finding by Makarowski et al. (2016) is affirmed by Hunter (2002) who in a study on pilot risk perception and risk tolerance posited that pilots who do not recognize the risks associated with adverse weather are more likely to engage in risky behavior associated with weather decision-making. Furthermore, pilots who have successfully flown VFR into IMC are more likely to repeat the behavior (Wiggins et al., 2012). Even though safety in remote environments depends on “the sensitivity of employees to conditions that can lead to danger,” pilots with high-risk appetite may ignore, or disregard, hazards that are present in operations of such nature (Bearman et al., 2009, p. 1057).

Impulsiveness is the final hazardous attitude the FAA described. It is characterized by pilots who act before thinking and often choose the first action that comes to mind (FAA, 2016b). Impulsiveness is incorporated in discussions on the Big Five personality traits as they relate to pilot personalities (Fitzgibbons et al., 2000). Low conscientiousness is a significant precursor to impulsiveness and anti-authority. Clarke and Robinson (2005) discussed several personality traits associated with accident involvement: (a) carelessness and lack of self-control, impulsiveness, and (c) a lack of respect for authority. Impulsivity is highly correlated to accident involvement and can be a predictor of risky decision-making (Causse et al., 2013).

Ego and its Place in the Cockpit

Ego has been suggested as having a natural place in the cockpit; “pilots are affected by their ego and the need to protect it” (O’Bryan, 2011, p. 11). Throughout the course of a pilot’s career, they are evaluated almost constantly through organizational and social means. Formal evaluations like recurrent training and line checks have explicit job-related outcomes. Socially, pilots are evaluated against their peers and sometimes the evaluations can be harsh (Leigh & Rissanen, 2018). In most situations, casual or formal, pilots do not like to look bad (Paletz et al., 2009).

Murray (1999) provides clarity on a concept called “loss of face” and discussed specifically its influences on pilots. Murray (1999) further states that an individual’s assessment of how others view him is face (Murray, 1999).

Participants in a study on Alaskan pilots showed aversion to social disapproval; “this reluctance . . . was at times not very subtle, such as in situations in which the pilot might ‘lose face’ or admit defeat in front of his or her peers” (Paletz et al., 2009). To protect from a loss of face situation, pilots take risk, and furthermore, may not disclose safety-relevant information or concerns (Noort et al., 2021). In a study on the immediate actions taken by pilots who become lost or temporarily uncertain of their geographic position, some general aviation pilots were unwilling to call for help, as it would “broadcast their failure as pilots” (Gilbey & Hill, 2012, p. 785).

Protecting one’s ego frequently means withholding information that could be beneficial for the pilot group as a whole. Face must be considered in both an individual and group setting (Murray, 1999). In a crew environment, “the most dangerous aspect of ego may be how it affects communications” (O’Bryan, 2011, p. 11). In a cross-sectional study on error, stress, and teamwork, Sexton et al. (2000) compared the attitudes of airline pilots and intensive care medical personnel. More than half of the study participants had difficulty discussing mistakes due to various factors, including personal reputation, expectations, and ego of other team members (Sexton et al., 2000). Other variables, like pride in their job, may also lead some pilots to withhold valuable safety information from their peers (Transport Canada, 2002).

Ego and narcissism may be linked due to their characteristics to protect or inflate a sense of self (Gilliam, 2019; Ju et al., 2017). A 2017 study on Chinese aviation students linked a high score of narcissism to a tendency to underestimate risk and participants’ vulnerability to it. The findings suggest a pilot’s narcissism, or ego, may predispose them pilot to unrealistic optimism in their risk perception (Ju et al., 2017). The unrealistic optimism creates an illusion of minimal risk of negative safety outcomes and may lead to a greater willingness to take risks, especially when compared to peers (Gilliam, 2019). Such pilots may not participate in safety-related meetings or follow procedures due to their attitudes toward risk (Gilliam, 2019).

Goal Seduction and Plan Continuation Errors

“Concepts from the social psychology literature may illuminate the subtle ways in which even highly trained, conscientious, and responsible pilots are led into situations in which unsafe acts may occur” (Paletz et al., 2009, p. 437). Goal seduction, the persuasion of a desired outcome to influence a pilot’s decision, is a factor in Part 135 flying (Bearman et al., 2009). Goal seduction may lead to errors when the target outcome or goal has too much influence on decision-making (Bearman & Bremner, 2013). In a study on firefighters’ use of personal protective equipment, Maglio et al. (2016) described how goal seduction leads to “misaligned priorities” (p. 562). It is a pressure toward an unsafe decision at the expense of safety, often made to meet productivity goals like on-time performance, to outperform competition, to fit in socially, or to get paid (Maglio et al., 2016).

Operational and social factors put pressure on pilots to reach outcomes with a “foot-in-the-door” approach. This is a persuasive technique in which compliance is obtained by getting a pilot to agree to a small request (Dolinski, 2012). Once the person has agreed, they are far more likely to agree to further and more complicated tasks (Dolinski, 2012). Management and peers may make such requests. Pilots are more likely to continue flights in deteriorating conditions knowing peers had completed the same routes successfully, or if they had completed flights in similar conditions, demonstrating an example of social pressures on pilots (Paletz et al., 2009).

Foot-in-the-door persuasion may influence plan continuation error. Plan continuation error is the tendency to remain fixed on the original course of action and can be associated with the strong negative consequences caused by changing current plan trajectory away from the initial goal (Causse et al., 2011; Velazquez, 2018). In aviation, several behavioral traps are attributed to plan continuation error, including “get-there-itis" and VFR into IMC, one of the leading causes of fatal accidents (Velazquez, 2018).

In a 2013 study on pilots’ decisions to conduct a go-around, organizational goals and incentive programs contributed to their decision to land in adverse conditions and participate in more risky behavior (Causse et al., 2013). These findings were affirmed in a study on general aviation pilots’ behaviors when flying near thunderstorms; the majority of pilots elected to continue when they had made it past the midpoint of their flights (Boyd, 2017).

In a French study on military aviation accidents and incidents, three key factors influencing pilots’ susceptibility to plan continuation error were discussed: (a) the pilots’ perceived ability to overcome an adverse situation, (b) inadequate company or procedural training, and (c) lack of experience (Bourgeon et al., 2011). Furthermore, inability to appropriately perceive the risk associated with changing scenarios was significant in perpetuating plan continuation errors among pilots (Léonore et al., 2009).

Rescue mission operations, like medical evacuations or search and rescue, are even more susceptible to goal seduction, foot-in-the-door persuasion, and plan continuation error. Pilots in Bearman et al.'s (2009) study on pilot decision-making admitted to taking more risk than usual in these scenarios: "When you think you're in search and rescue mode, when you think that you're going to save somebody, you'll push things" (p. 558).

Helicopter emergency medical services is one of the most dangerous occupations in civilian aviation; the percentage of fatal accidents compared to nonfatal accidents is higher than all other subsets in the aviation industry (Greenhaw & Jamali, 2021). Night flying, marginal weather conditions, and rough terrain contribute to the rate of helicopter emergency medical services accidents (Greenhaw & Jamali, 2021). While most medevac flights take place in fixed-wing aircraft, similar risks apply to helicopter flights also:

"*Medevac pilots may be particularly susceptible to the influence of social psychological pressures because they often fly in marginal, ambiguous, and deteriorating weather conditions; work within minimal infrastructure; and fly missions that others rely on for basic necessities*" (Paletz et al., 2009).

To be certified by the Commission on the Accreditation of Medical Transport Systems (2018), operators comply with directives that restrict patient information available to pilots to mitigate these pressures.

Social Theories

Social cognitive theory is a representation of human decision-making that encompasses reciprocal interactions between three pressures: behavioral, environmental, and personal. These influences are bidirectional; as a result, people are products and producers of the environment (Schunk & DiBenedetto, 2020; Wood & Bandura, 1989). This theory emphasizes observed behavior: “Virtually all learning phenomena resulting from direct experience can occur vicariously by observing people’s behavior and the consequences of it” (Wood & Bandura, 1989). The more someone relates to the person they are observing, the more likely they are to model their behavior (Schunk & DiBenedetto, 2020). Additionally, positive outcomes more strongly influence modeled behavior than negative outcomes deter it (Wood & Bandura, 1989).

Self-efficacy is a key factor of social cognitive theory. It is an individual’s belief that they can execute a task toward specific performance related results (Bandura, 2001). Individual accomplishments, and also observed accomplishments, can raise the individual’s self-efficacy and further motivate them to accomplish goal-related tasks (Schunk & DiBenedetto, 2020).

Applying social cognitive theory concepts (i.e., self-efficacy) to health sciences showed promise of patient progress in retaining behaviors to improve physical movement and diet change as patients saw their peers’ improvement (Anderson et al., 2007; Stacey et al., 2015). In the aviation field, a study on pilot training found that a person's self-efficacy was a good predictor of success in further training and transfer to the flight line (Davis et al., 2000). Furthermore, self-efficacy had a direct, positive effect on both safety compliance and safety participation among collegiate aviation pilots (Adjekum, 2017).

Social identity theory describes how a person defines themselves based on their membership in certain groups (McLeod, 2019). A social group is where members have the same characteristics or belong to the same social category (Stets & Burke, 2000). These groups could be related to social class, family, education status, and so on, and they give a sense of identity and belonging to social contexts (McLeod, 2019). Belonging to a group is an important aspect of a person's self-image (Tajfel, 1974). The group a person identifies with is considered the "in- group" and is associated with strong positive connotations and feelings from the membership. The "out-group" receives negative bias, and differences between the in- and out-groups are highlighted (Stets & Burke, 2000).

To belong to a group, a person must meet certain characteristics and "fit" (Burford, 2012; Korte, 2007). The person then "adopts the norms" and "alters their personal behavior" to conform to the group identity (Korte, 2007, p. 169). Decision-making is therefore influenced by group behavior and values. Important learning occurs during indoctrination in new positions and roles as an individual attempts to find their fit into the group (Korte, 2007). The transition from trainee to qualified employee was a significant distinction in the medical field and accelerated the “adoption of the professional identity” and the resources that came with it (Burford, 2012, p. 146). The experiences and teachings of the group to a newcomer may be more influential than policy (“Social Identity is Key to Human Resources Development,” 2007).

In the aviation sector, many complex subgroups exist between pilots, flight attendants, dispatchers, management, and maintenance personnel, to name a few (Ford et al., 2013). Emphasizing belonging to an organization, instead of a group like “pilot” or “flight attendant,” can mitigate risk factors and barriers to communication during emergency situations, especially when a shared goal is desired and emphasized (Ford et al., 2013). Tangential findings from the medical field highlight the necessity for managing miscommunication between in- and out- groups during patient care (Burford, 2012).

CHAPTER III: METHODOLOGY

This ethnographic research intends to answer questions about factors that influence Part 135 pilot decision-making. Specifically, the method used was to explore how psychosocial and organizational factors impact Part 135 pilots' decision-making during flight operations. It was envisaged that significant findings from this study could influence recommendations that can positively influence policy and practices promoting safety in 135 operations. This research adds to the existing literature of Part 135 pilots.

The findings from this research provide potential benefits to other high-risk organizations that operate in remote settings, such as mining and oil and gas exploration and production. Due to the similarities of risk and human behavior in these industries, an understanding of cultural and psychosocial factors that influence decision-making can provide critical safety intelligence for developing effective and proactive safety controls.

Conceptual Framework

Pilot error is often cited as a major cause of accidents in the aviation industry (FAA, 2016b, p. 2-1). Reason (2008) suggested that aviation accidents are complex phenomena that are the result of a combination of latent hazards and unsafe acts that continue to happen in a sequential way. Environmental as well as organizational effects play a role when there are weaknesses in safety barriers and defenses along the timeline of the events (i.e., contributing factors). Therefore, solely attributing the cause of an aviation accident to pilot error does not help to explain all the variables leading to the accident; controls are needed to prevent such future events (Dekker, 2014). The new view of human factors research, presented by Dekker (2014), focuses on human error as a symptom rather than a cause. It seeks to understand why people make decisions and why it made sense to them at the time (Dekker, 2014). Hollnagel (2014), explored two contrasting views on safety — those where things rarely go wrong, and those where outcomes are almost always positive (Hollnagel, 2014). The different perspectives of Safety I and Safety II result in processes that are either reactive or proactive, respectively. Using this framework, human error research focuses on how things usually go right, but occasionally go wrong, and attempts to provide answers for why (Hollnagel, 2014).

Researcher's Position and Worldview.

The researcher has specific interest in Part 135 operations. The researcher was employed as a Helicopter External Load pilot in South America and operated in various Oil & Gas as well as Mining projects under Part 135 rules for several years. The researcher also flew for the Military as a Search & Rescue pilot. The researcher is also a certified Aircraft Accident Investigator and has been involved in investigation of several aircraft accidents.

This involvement in aircraft accident investigations further influenced the researcher's decision to explore and gain a more in-depth understanding of how company organizational culture and other psychosocial factors influence decision-making styles among Part 135 pilots. As a SAR pilot, the researcher’s passengers were occasionally victims of aircraft accidents themselves. The researcher has listened to years of hangar talk and heard how ego and hazardous attitudes can manifest themselves in pilots.

The researcher took a constructivist approach to this research due to its focus on the contexts in which people live and work. In contrast to other theoretical frameworks that attempt to verify theories, this approach seeks understanding of the historical and cultural perspectives of participants (Creswell & Creswell, 2018). In this paradigm, efforts are made to “understand the viewpoints of the subject being observed” (Kivunja & Kuyini, 2017, p. 33). Other research paradigms, such as the post-positivist worldview, focus on theory verification and empirical measurement often best suited to quantitative research.

The transformative and pragmatic viewpoints focus on political and problem-centered approaches, respectively, and were not suitable for this study (Creswell & Creswell, 2018). The constructivist premise is that “*humans must interact with and reflect on social life in order to know and understand it*” (Saldaña & Omasta, 2018, p. 143). This approach emphasizes the importance of social inquiry and helps explore how pilots interact based on the history and social context of their environment.

Data Collection Methods

Three recent accidents were presented as case studies for the content analysis in this study. The case study accidents were chosen due to their recency and impact on aviation safety. Additional NTSB data encompassing the 10-year period between 2008 and 2018 were analyzed from the NTSB accident database. Significant themes were derived from both case studies and content analysis of NTSB accident data. These themes were instructive in formulating items for the primary research instrument which was a semi-structured interview with relevant respondents.

Each participant interview lasted approximately 1-hour and was conducted via the electronic video platform Zoom due to the Covid-19 Pandemic restricting in-person meetings. This platform also eased the difficulty of scheduling in-person meetings around multiple pilot schedules. Eight interviews were completed and lasted an average of 58 minutes. The interviews were recorded and stored in a password-protected file on the interviewer’s computer. Manual transcriptions were completed following the interviews. These interviews were then condensed for clarity and to ease the coding process.

The semi-structured format consisted of open-ended questions to give participants the latitude to respond organically. It was the researcher’s goal to avoid leading questions. Follow- up questions were developed after a practice interview with the researcher’s peer. The data from this practice interview was not used in the analysis of this study but helped to gauge potential responses and draft possible follow-up questions. Follow-up questions were useful to direct the flow of the conversation and to further discuss information the participants felt was important.

The beta-testing of these question items allowed the researcher to move indirections best fit to the participants’ answers but was structured enough to keep consistency between them. The draft semi-structured questions began with basic information about participants and gradually transitioned into more detailed questions about the participants’ beliefs and experiences flying Part 135 operations.

Research Ethics

Vulnerable groups are not a focus of this study, and all participants were legally adults and could provide individual consent to participate. All potentially identifying information was redacted from the transcriptions. Names of people and companies, aircraft types, and in some cases, locations were removed when the researcher felt someone familiar with Part 135 operations could identify the company or individual participant. If an accident or incident was brought up that had been high-profile or discussed in the media, the information remained in the transcript.

The study was considered low risk for all the participants and consent forms were signed. These consent forms will be kept for 3 years following the completion of the research. Afterwards, they will be disposed. Each participant received a copy of the consent form, which detailed procedures of the study and contact information should the participant wish to reach out to the researcher for more information.

Participant Selection

Participants were selected using purposive, multi-case sampling in which a breadth of age, experience, and type of operating experience was desired and sought out among the many Part 135 operators through the researcher's professional network. Initial contact was made via email with a brief overview of the study and the researcher's contact information.

Follow-up questions, scheduling, and interview declines were done via email or telephone. Of 13 people contacted, eight agreed to be interviewed.

Extant literature on qualitative research tends to avoid suggesting a concrete number of participants required to ensure data saturation (Guest et al., 2006; Saunders & Townsend, 2016). Data saturation has been reached in similar (albeit larger scale) studies with between 12 and 28 participants (Bearman et al., 2009; Michalski & Bearman, 2014). For the scope of this research, eight participants were interviewed. The potential to interview additional participants (up to 12) was considered; however, data saturation was reached with eight participants.

Interviews were conducted between April and June of 2022. After agreeing to participate in the study, interview dates were selected, and the IRB-approved consent form was distributed. The signed consent form was received prior to starting any interviews. Each interview began with a brief overview of the study. In this overview, the researcher confirmed that participants consented to being recorded. The researcher explained the interview process and emphasized that participation was voluntary. They could end, pause, or skip questions as they wished. The researcher then answered any questions before the interview began.

Participant Data

The participants represented a cross section of Part 135 operators. Their employers ranged from small operations with 12 pilots to larger organizations with over 60 pilots. Operationally, these pilots supported freight, passenger, medevac, private contractors, and tourism and lodge industries. Geographically, the collective participants flew across the entire Americas, with particular emphasis in regions such as the Alaska, Canada, Ecuador and Mexico. Their experience was diverse— one pilot was just beginning their career, where others have been flying for over 10 to up to 20 years. Outside of Part 135-line pilot duties, previous experience included Part 91 and 121 operations, air traffic control, Chief Pilot, and management positions. Participants ranged in age from 22 to 57 years old, with a mean age of 34.375 years.

Their experience ranged from 1 year of commercial experience and 550 hours to 20 years and over 13,000 hours. Two of the eight interviewees were female.

Data Analysis Methods

Ethnographic methods were used in this study. “The literature may be deficient in actually knowing how the group works because the group is not in the mainstream. Its ways are so different that readers may not identify with the group” (Creswell & Poth, 2018). An ethnographic design was chosen due to its emphasis on cultural themes of the participant group and the limitations with existing human factors literature on Part 135 pilots.

Three case studies were presented to highlight recent accidents. These case studies were subject to a thematic analysis, which helped to guide the development of interview questions. The case study analysis, along with the NTSB accident data, was used to form a base for the remainder of the study, which used participant perceptions and opinions. The NTSB historical data analysis involved content theming of personnel, organizational, or environmental influences that were contributory to accidents. The analysis further explored the relationships among these factors. The themes from the NTSB historical data analysis were used to support findings from the case studies and interview data during the data triangulation for the discussion section.

Interview data were segmented into different themes as required. Data were coded using value and descriptive methods, then compared. Value coding is particularly appropriate to explore “cultural values intrapersonal and interpersonal participant experiences and actions in case studies, oral history, critical ethnography, psychology, and sociology” (Saldaña & Omasta, 2018). Descriptive coding helped to analyze physical environments and classify participants’ actions and routines (Saldaña & Omasta, 2018). Themes derived from the interview data were triangulated with results from the case study and NTSB data analysis which helped to postulate theories about factors that influence part 135 pilots’ decision-making in the operational environment.

CHAPTER IV: FINDINGS

Research on aviation safety has focused on historical accident reports and primarily used quantitative analysis. Organizations such as the FAA and the National Institute of Occupational Safety and Health have published materials on the safety hazards of aviation (Bailey et al., 2000; FAA, 2021b; The National Institute for Occupational Safety and Health, 2018). These publications highlighted risks associated with the challenging and diverse environment, whose weather is unpredictable and whose terrain is unforgiving.

Other studies looked at operational pressures and the impact they have on pilot decision-making (Bearman et al., 2009; Conway et al., 2005; Michalski & Bearman, 2014). These studies were some of the first that utilized pilot interviews as their main data collection method. Results of these studies were influential in the development and organization of this research, which provides an analysis of current trends in the aviation pilot group and answers questions regarding the psychosocial and organizational influences on pilot decision-making. The central research question is as follows:

What psychosocial and organizational factors influence decision-making of 14 CFR 135 pilots and contribute to incidents and accidents among this group of pilots?

Further underlying research questions were explored as a critical supplement to the central research question. They are as follows:

What are the environmental and operational factors that make flight operations challenging for Part 135 pilots?

What are the organizational factors that influence decision-making among Part 135 pilots?

What are the psychosocial and cultural factors that influence decision-making among Part 135 pilots?

How do prior experiences and generational/age differences affect decision- making during operations among Part 135 pilots?

What is the perception of the safety culture among Part 135 pilots and how does it influence hazard identification and safety risk decisions?

Findings from three case studies on recent accidents are summarized below to highlight the continuing need for research aimed at improving operational safety aviation. The themes gathered from the case studies helped guide the development of interview questions and were triangulated with the NTSB accident data content analysis.

Case Studies

Three cases studies are presented as part of the content analysis on Part 135 operators. All three accidents highlight operational deficiencies regarding safety culture among operators and provides insight into pilot decision-making during operational activities. The three accidents were thoroughly investigated by the NTSB, and the information presented is condensed from the final NTSB reports. Two of these accidents occurred between the 2008 and 2018 period used for the brief analysis of historical accident data in this study. The third occurred in 2019 and highlights a continuing need for investigation of accident factors among Part 135 operators.

Promech Aviation CFIT

On 25 June 2015, a turbine-powered, float-equipped DHC-3 (Otter) collided with terrain 24 NM east northeast of Ketchikan, Alaska. The commercial pilot and all eight passengers were killed in the accident. The flight was being operated as a flightseeing tour in conjunction with a cruise ship for passenger excursions. The operator, Promech Air, of Ketchikan, Alaska, was a Part 135 operator conducting on-demand sightseeing tours. At the time of the accident, marginal visual flight rules (MVFR) conditions were reported in the area (NTSB, 2017a).

Ketchikan is one of the largest cruise ship hubs. Cruise lines offer package deals with flightseeing operators during the stopovers in Ketchikan Harbor. For this particular incident, the tour was sold as part of a “cruise/fly” package where passengers embark on a boat ride out to a cove in Rudyerd Bay, and then they fly back to Ketchikan Harbor via float plane to meet the cruise ship before its departure for the next port. If tour operators failed to get passengers back to the dock by the “all-aboard” time, they became responsible for costs associated with transporting the passengers to the next port of call. The passengers were scheduled to reach the float dock at Rudyerd Bay for an 11:45 am departure back to Ketchikan Harbor (NTSB, 2017a).

Four float planes operated by Promech departed Rudyerd Bay in 5-minute intervals. Passengers had a 12:30 pm all-aboard time for the cruise ship departure. The first three aircraft carried passengers and the fourth was a repositioning flight. All four aircraft were running behind schedule. The accident airplane departed Rudyerd Bay at 12:07 pm and was the third aircraft in queue. Pilots were able to choose their routing back to Ketchikan from two routes. The long route took approximately 30 minutes and was the preferred route when the weather was low due to its location over the water.

Pilots along this route were able to descend beneath cloud layers and have options for landing sites, as the aircraft were on floats. The short route took approximately 25 minutes and was selected by the accident pilot. The short route was more popular due to the scenic nature of the area. The first and fourth aircraft also took the short route, while the second elected to take the long route back to Ketchikan Harbor. The tours showcased the channels, fjords, and mountainous terrain of Southeast Alaska. Figure 7 shows the various flight paths on the day of the accident.

Figure 7 – Short, Long, and Accident Flight Paths on the Day of the Accident

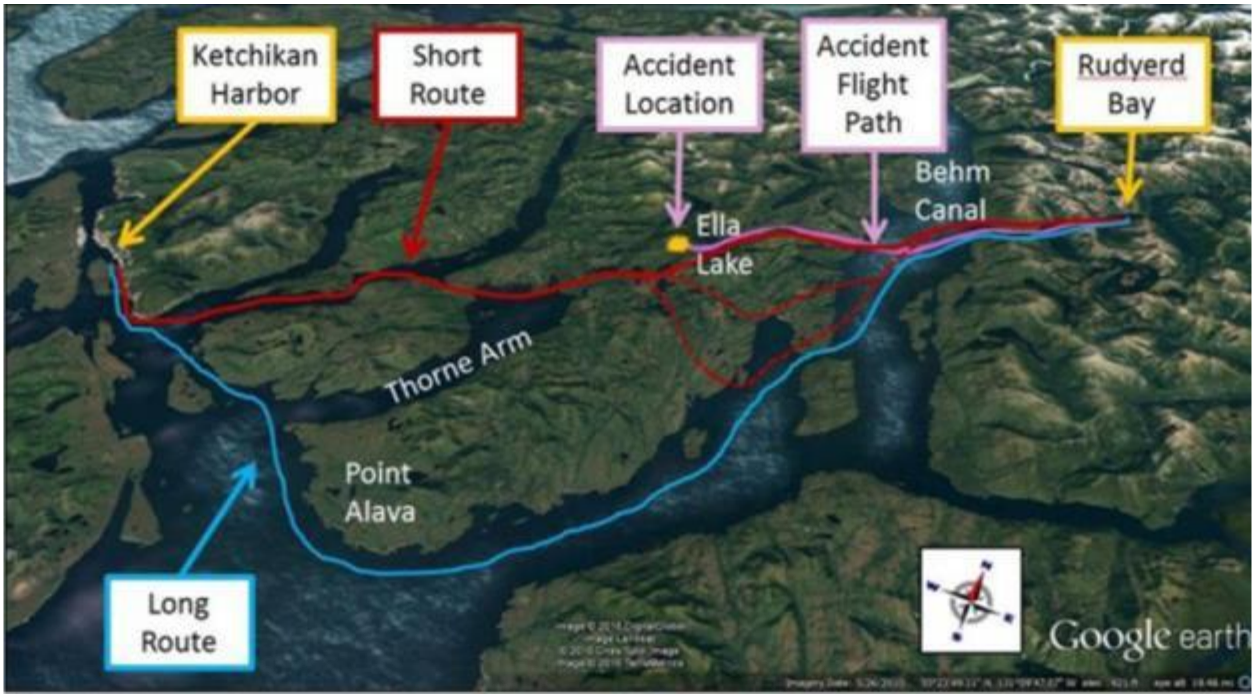


Figure 7 - From "Collision With Terrain, Promech Air, Inc. de Havilland DHC-3, N270PA, Ketchikan, AK. June 25, 2015. (Aircraft Accident Report No. NTSB/AAR-17/02)," by the National Transportation Safety Board, 2017, p. 2

When the accident aircraft failed to return to Ketchikan Harbor, the operator began a search effort to locate the aircraft. An emergency locator transmitter signal was detected, and a helicopter from a local operator was dispatched to locate the downed aircraft. After waiting for the weather to lift, the pilot of the helicopter confirmed that the aircraft had crashed near Ella Lake. Search and rescue volunteers reached the site later that afternoon and confirmed all occupants of the aircraft had been killed in the accident.

Data recovered from the aircraft's Chelton electronic flight information system (EFIS), in conjunction with digital photographs recovered from passengers' phones and cameras, provided information about the accident. The aircraft did not have a cockpit voice recorder system to aid in the investigation (NTSB, 2017a).

Pilot Information

The pilot held a commercial certificate and was properly certified to operate this flight for Promech. He was 64 years old and had a current medical. The pilot had approximately 4,070 flight hours, 500 of which were in the DHC-2 and 50 of which were in the DHC-3. He had 1,200 hours flying and 152 hours of flying time with Promech at the time of the accident.

Information collected from his roommates and wife showed that he had plenty of sleep opportunity the night before the accident. Alcohol or other toxicology was not a factor (NTSB, 2017a). Most of his colleagues described him as a competent, conservative decision maker. A few outliers, however, "raised questions about the pilot's judgement regarding weather-related decisions" (NTSB, 2017a, p. 8). One pilot stated that he displayed invincible attitudes and that he had trouble with IMC/CFIT escape maneuvers. Another pilot described an incident when the pilot disregarded warnings about low weather. He eventually had to backtrack and ran low on fuel prior to landing back in Ketchikan Harbor. Both of these pilots recalled a separate incident when strong downdrafts in Rudyerd Bay prohibited them from landing—the accident pilot landed anyway and his subsequent logbook entry read: "Misty trip, thought I was dead" (NTSB, 2017a, p. 8).

The pilot was a seasonal worker and resident of Idaho. He rented a house with two other Promech pilots and one's wife. They described him as a cheerful and pleasant person. The accident pilot's wife said that on the day of the accident he was planning to move to an apartment he found as he had some personality disagreements with another colleague and preferred to live alone.

Route

The accident aircraft departed Rudyerd Bay at 12:07 pm for Ketchikan Harbor. The pilot chose to take the short route. This route was over Ella Narrows, a low-lying valley at 100 to 300 ft with surrounding mountains between 2,000 and 2,500 ft. The pilot entered the narrows at 1,300 ft and data recovered from the EFIS showed that the aircraft descended rapidly to 1,000 ft before climbing again to 1,300 ft. The route flew over Ella Lake where, at the far end, after passing two similar looking mountains, the pilots would normally turn slightly right to continue to Ketchikan. The accident aircraft passed over a ridge on the Western shore of the lake at 1,500 ft.

After crossing the ridge, the pilot maintained heading and, 2 seconds prior to impact, he pitched up rapidly, pulling 2+ G on the aircraft. Photographs captured by a passenger's cell phone showed weather conditions prior to impact with the second mountain. Low clouds and fog had obscured the surrounding terrain, and the pilot turned west after passing the first of the two similar looking mountains. Had he continued further down the lake before turning, he would have cleared the terrain at his selected altitude. Figures 8 and 9 show pictures taken by the passengers prior to the crash.

This was the third tour of the day for the accident pilot. He flew the first aircraft in the first tour group, electing to take the short route. Aside from isolated rain showers along the route, he reported good weather. The other two pilots in the group elected to take the long route to Rudyerd Bay. On the return leg, all three attempted the short route but ultimately diverted off their course to join the long route back to Ketchikan Harbor. On this leg, the accident pilot departed 15 minutes prior to the other two pilots and flew a circuitous route including “course reversals and substantial changes in altitude” (NTSB, 2017a, p. 31).

On the second tour, the accident pilot was the fourth of six airplanes. All of the aircraft flew the long route, and all but one aircraft descended below 500 ft above ground level (AGL) on the outbound leg to avoid weather. The accident pilot and the company president/CEO both flew below 400 ft AGL. Another pilot on the flight expressed concern about the weather before departing, yet ultimately flew that tour. On arrival back in Ketchikan, he reported he was relieved to be done with tours for the day (NTSB, 2017a). Figure 10 shows the accident flight path recreated by the NTSB.

Figure 8 - Photo Captured from Passenger’s Cell Phone 28 Seconds Prior to Impact

Figure 8 – From Aircraft Accident Report No. NTSB/AAR-17/02,” by the National Transportation Safety Board, 2017, p. 5 (AccidentReports/Reports/AAR1702.pdf)

Figure 9 - Photo Captured From Passenger’s Cell Phone 21 Seconds Prior to Impact

Figure 9 - From Aircraft Accident Report No. NTSB/AAR-17/02,” by the National Transportation Safety Board, 2017, p. 5 (AccidentReports/Reports/AAR1702.pdf)

Figure 10 - Accident Flight Path Recreated With Data From the Aircraft EFIS

Figure 10 – Source: Aircraft Accident Report No. NTSB/AAR-17/02," by the National Transportation Safety Board, 2017, p. 6 (AccidentReports/Reports/AAR1702.pdf)

Meteorological Information

National Weather Service forecasts at the time of the accident called for scattered layers at 2,500 ft and broken to overcast layers at 5,000 to 25,000 ft. Isolated ceilings below 1,000 ft were forecast for the area, and visibility was forecast between 3 and 5 mi with light rain and mist. Airman's meteorological information (AIRMET) data for mountain obscuration was forecast. Ketchikan International Airport (PAKT) was the nearest weather reporting station and was 24 mi southwest of the accident site. The station was reporting winds 15 gusting 23 kt, 6 mi visibility with rain and mist, few clouds at 800 ft, broken clouds at 1,200 ft, and overcast at 2,700 ft. The Terminal Aerodrome Forecast called for increasing winds and a period of lower ceilings of 1,000 ft. MVFR and IFR conditions prevailed throughout the forecast.

An FAA weather camera facing the direction of the accident site showed ceilings obscuring higher terrain at the time of the accident. Photographs taken from passengers in the first flight to depart Rudyerd Bay (approximately 10 minutes before the accident aircraft) show the entrance to Ella Narrows. Additional photographs, along with information gathered from the pilots of the first and fourth Promech aircraft, were analyzed to paint a picture of conditions along the flight path.

The first and fourth pilots described flying underneath cloud layers at 1,600 to 1,700 ft and 1,200 to 1,300 ft respectively. Both encountered rain, and visibility was reduced due to mist, but the fourth Promech pilot stated that visibility never dropped below 2 mi over the lake. When shown a photograph of the accident location, he recalled that visibility looked to be less than 2 mi in that area at the time of the accident. He told investigators that he did not feel comfortable turning to the west to continue the flight toward Ketchikan until he was 2 to 3 mi clear of terrain due to the reduced visibility of 1 to 2 mi.

An analysis of photographs taken from passengers in the first aircraft determined that the pilot was flying at an altitude of 300 to 400 ft AGL. In one photograph, the accident site is shown in the background and terrain is obscured above 1,000 ft. Other Ketchikan area operators cancelled flights for the day citing weather concerns. However, in Figure

11, a competitor's aircraft is visible in the upper right corner of the photograph.

Figure 11 - Photo Taken by Passenger on First Promech Flight

Figure 11 – Source: "Collision With Terrain, Promech Air, Inc. de Havilland DHC-3, N270PA, Ketchikan, AK. June 25, 2015. (Aircraft Accident Report No. NTSB/AAR-17/02)," by the National Transportation Safety Board, 2017, p. 21 (https://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1702.pdf).

Aircraft Information

The aircraft used in this flight, a de Havilland DHC-3 Otter, is a popular aircraft for air tours across the state of Alaska. This aircraft was modified with a turbine engine and was equipped with floats. Maintenance on the aircraft was performed in accordance with FAA guidelines and the investigation found no reason to believe maintenance discrepancies were associated with the accident.

A Chelton EFIS provided flight data to the pilots en route. The system included a primary flight display that showed airspeed and altitude information. The multifunction display (MFD) could be configured to show a moving map, aircraft position, and navigation information. The Chelton EFIS was first-generation technology used in the Capstone project. This project provided operators free, advanced avionics to reduce accident rates in the state. According to the NTSB (2017a) investigation, almost all operators with similar missions in Southeast Alaska used the Chelton EFIS.

The Chelton EFIS had an integrated terrain awareness and warning system (TAWS). The TAWS had forward-looking terrain awareness, which was displayed on the moving map via a color display. An integrated caution system provided aural and visual flags to alert the pilot to potential terrain hazards. The Chelton TAWS met FAA guidelines that each turbine-powered operator is required to be equipped with a TAWS.

Pilots for Promech used it as a primary tool for identifying terrain along their flight routing. However, multiple pilots have described how the color-coded overlay from the TAWS obscured terrain features and inhibited their ability to accurately identify hazards along their route. Additionally, during takeoffs and landings, nuisance alerts were common. Outside of Ketchikan, all takeoffs and landings were made off-airport in areas surrounded by terrain. The nuisance alerts prompted Promech pilots to frequently inhibit the TAWS using a toggle switch on the instrument panel. In the accident aircraft wreckage, the switch was set to “inhibit.” A passenger photograph confirmed the switch was in the inhibit position during flight.

In 2007, database improvements were made to the Chelton navigation system. The accident aircraft had data cards from an old 2003 update. This information is significant because inland bodies of water were not depicted on the MFD in that version; rather, they appeared as terrain. Despite this, pilots interviewed following the accident described the system as a useful tool for terrain awareness.

Organizational Information

At the time of the accident, 90% of Promech's operations were on-demand tours. The fall prior, the company decided to end its scheduled services due to loss of revenue over the previous few years. In addition to its operation in Ketchikan, AK, Promech had a satellite operation in Key West, Florida, where the chief pilot was based. Other operational personnel, including the assistant chief pilot, the director of operations, the director of maintenance, and the company president/CEO were all based in Ketchikan (NTSB, 2017a).

The director of operations (DO) self-described his position as a "jack of all trades." Per their general operations manual (GOM), he was responsible for encouraging and promoting safety within the company. He was also responsible for the oversight of training for flight and ground support personnel. He flew the line approximately 3 to 4 times per week (NTSB, 2017a).

The assistant chief pilot had been promoted from within the company. He was responsible for flying the line, maintaining pilot records, and assisting with pilot training. He had recently become a company check airman (NTSB, 2017a).

Promech had no formal safety program. Their GOM outlined procedures for safety reporting, stating that “any employee who witnesses an unsafe condition or procedure is responsible to report the unsafe condition/procedure to his/her supervisor” (NTSB, 2017a, p. 25). The GOM also had a safety reporting form where employees could describe concerns and write corrective actions. This form could be submitted anonymously using the safety reporting box, a physical drop box in the employee lounge.

There was no non-punitive program to protect pilots from retaliatory actions. When interviewed, the DO stated that he believed the small nature of the company created a safety culture where pilots were able to voice their concerns directly to the DO. A verbal report was much more likely than a written report. Their company bulletin board, outside of the dispatch offices, was the main method for communicating safety-relevant data to the pilot group and employees. The DO had previously been part of formal safety programs yet felt Promech could be successful using their informal techniques.

Despite the DO’s confidence in the safety culture and reporting at Promech, management was unaware that the accident pilot had previously struck trees with his floats on landing. They were also unaware that the pilot had turned around due to poor weather along the short route the morning of the accident. Two other Promech pilots were forced to find alternate routing around the Ella Lake area during morning tours the day of the accident.

When interviewed by the NTSB, there was confusion among the Promech pilot group when asked who was responsible for company safety programs. The interviews also unearthed the varied attitude toward the company's safety culture—some pilots thought they were "safety conscious and felt at ease bringing up any safety concerns" (NTSB, 2017a, p. 26). Others, however, described conditions in which management pressured them to fly through marginal weather:

> He expressed concern to Promech's President/CEO that the weather conditions were not good enough to fly. He stated that the response he received was, "That's just Alaska weather," so he flew the tour. This pilot also reported that he overheard the company President/CEO expressing frustration in the company office when he saw (using the company's ADS-B display) that one of the pilots was returning from the accident tour via the long route. He also stated that, during initial training, the Assistant Chief Pilot, when talking about weather minimums, told him and a group of other Promech pilots that they had to bend the rules because they were operating. He said that the Assistant Chief Pilot also said that, if one pilot turned around while the others made it through, he and that pilot were going to "have a conversation." This pilot, who had not previously flown commercially before working for Promech, said he just assumed "that's the

culture. It’s like, ‘we push through, we push through.’” (NTSB, 2017a, p. 27)

A different pilot described an event where, after he saw the accident pilot disappear into the clouds on an unrelated flight, he radioed the pilot to ask how the weather was, saying it looked IFR. After hearing the exchange on company radio, management threatened to fire him if he ever mentioned “IFR” on the radio again (NTSB, 2017a).

Operational Control

Per the Promech GOM, the chief pilot, assistant chief pilot, director of operations, company president, and director of maintenance all had operational control. Limited operational control could be granted in part to the flight schedulers and the pilots. Operational control refers to initiating and terminating flights. In instances where operational control was delegated to the flight schedulers and the pilots, both had to agree conditions were safe to dispatch a flight. They were expected to monitor and communicate changing weather conditions, and either could terminate a flight at any time.

On the day of the accident, the flight scheduler said she had no conversations with the accident pilot other than pleasantries in the morning. He gave a weather report to her when he was outbound on his first flight for the day. The company president/CEO was the only member of management on duty that morning, and he had no substantial interactions with the accident pilot. Operational control had been delegated to the flight scheduler. She had worked at Promech for 5 years and as a scheduler for three summers. She had not received any recurrent training since her initial training.

Training

Pilots participated in a voluntary CFIT avoidance training program. The material for this program was based on NTSB Safety Recommendation A-08-61. It was created in conjunction with local Ketchikan area operators, the NTSB, the National Institute of Occupational Safety and Health, FAA Juneau Flight Standards District Office (FSDO), and the Medallion Foundation.

The Promech CFIT Avoidance Manual was created with Medallion Foundation resources and consisted of ground and simulator training in an FAA-approved aviation training device. Scenarios in the course required pilots to recognize and escape from an inadvertent IMC encounter. The usefulness of this experience with the aviation training device was up for debate. Other local area operators discussed that nothing was comparable to real experience and that juggling other tasks while trying to fly through mountain passes was not replicable in the simulator. The DO and another company pilot differed in their assessment of the accident pilot’s skills when asked to demonstrate escape maneuvers as part of flight training. The DO had confidence in his abilities. The other pilot questioned them and said he thought the pilot transitioned from the DHC-2 to the DHC-3 before he was ready.

Findings and Analysis

The final NTSB (2017a) report discussed the different factors influencing the accident in depth, as they are abbreviated above. A focus on outdated navigational equipment in the EFIS and lack of appropriate use of the inhibit switch on the TAWS were discussed in the accident findings. Schedule pressures to meet cruise ship all-aboard times, in addition to flying pressures among competitors in the area, influenced the pilot's decision to continue the flight.

Cultural and peer-based pressures, such as the company president/CEO flying lower than VFR minimums on the day of the accident and the pilot's attempt to emulate the behavior of more experienced and skilled pilots contributed to the company safety culture of Promech and ultimately to the accident. The CFIT training conducted by Promech was inadequate to properly prepare pilots for actual real-world encounters with lower-than-expected weather. This, combined with the pilot's performance in training, was significant.

Finally, operational control was cited as a factor in this flight. Had the flight scheduler received proper training or been more experienced, she would have had the opportunity to cancel the flight when there was no proper conference between her and the pilot before departure (NTSB, 2017a). This combination of factors, among others discussed above, resulted in the following probable cause from the NTSB:

> The National Transportation Safety Board determines that the probable cause of this accident was (1) the pilot's decision to continue visual flight into an area of instrument meteorological conditions, which resulted in his geographic disorientation and controlled flight into terrain; and (2) Promech's company culture, which tacitly endorsed flying in hazardous weather and failed to manage the risks associated with the competitive pressures affecting Ketchikan-area air tour operators; its lack of a formal safety program; and its inadequate operational control of flight releases. (NTSB, 2017a, p. 68)

Table 1 - Themes from Promech Aviation CFIT Accident

Case study	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Promech Aviation CFIT	Inadequate training	Company culture	Inappropriate use of equipment	Inadequate safety programs	Operational control

Togiak CFIT

On 2 October 2016, a Cessna 208B Grand Caravan collided with terrain approximately 10 NM northwest of Togiak Airport (PATG). The two commercial pilots and sole passenger were killed in the accident, and the aircraft was destroyed. The flight was operated by Hageland Aviation Services, Inc., doing business as (d/b/a) Ravn Connect, Flight 3153. The flight was operated under 14 C.F.R. Part 135 rules and was a scheduled commuter flight. The crew was operating under VFR at the time of the accident (NTSB, 2018).

The flight from Quinhagak, Alaska (PAGH) to Togiak, Alaska (PATG), was the third leg out of five for the day. The crew started the first leg around 09:30 am Alaskan Standard Time (AKST) and flew from Bethel, Alaska (PABE) to Togiak (PATG). They then departed Togiak around 10:44 am for Quinhagak (PAGH). The crew flew the second leg at approximately 4,500 ft mean sea level (MSL). After offloading cargo and loading their passenger, the crew departed back to Togiak at 11:33 am AKST along the same route. On the accident leg, they flew at 1,000 ft MSL. This altitude gave the crew between 500 and 700 ft of terrain clearance for the majority of the flight. A mountain ridge approximately 10 NM northwest of the Togiak Airport intersected the direct route between PAQH and PATG. The highest elevation of this ridge was approximately 2,485 ft (NTSB, 2018).

A second Ravn Connect flight departed PAQH for PATG 2 minutes after Flight 3153. The pilots of this flight initially flew a similar route to Flight 3153; however, citing weather concerns, they altered their course farther south to avoid “the unexpected presence of valley fog” (NTSB, 2018, p. 2). This course change allowed the aircraft to avoid the weather and stay over lower terrain along their route. When the second aircraft landed in Togiak, they noticed that the accident aircraft had not yet arrived despite their earlier departure time. They recalled no radio communications from the accident aircraft and did not see the accident aircraft while they were traversing the mountains.

Figure 12 – Accident Aircraft Flight Path

Figure 12 – Accident aircraft flight path in red, second aircraft flight path in blue. Large dots represent Spidertracks data. The solid blue is a series of close ADS-B data points. From "Collision With Terrain, Hageland Aviation Services, Inc. d/b/a Ravn Connect Flight 3153, Cessna N208SD, Togiak, Alaska. October 2, 2016 (Report No. NTSB/AAR-18/02)," by the National Transportation Safety Board, 2018, p. 2 https://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1802.pdf). From [Google Maps directions for flying from Quinhagak, Alaska to Togiak, Alaska], by Google, n.d. (https://goo.gl/).

The search and rescue coordinator from the Air Force Rescue Coordination Center notified the Hageland DO of an emergency locator transmitter signal from the accident aircraft at approximately 1214 AKST. The company then pulled the Spidertracks data (a satellite tracking device) and realized it had not been updated in over 20 minutes. The second aircraft was re- dispatched to search for Flight 3153 but was unable to locate them due to obscuring clouds. After a weather delay, the Alaska State Trooper helicopter was able to locate the wreckage. The accident site was accessed on foot shortly thereafter (NTSB, 2018).

Wreckage found at the scene of the accident indicated that the aircraft struck a ridge at approximately 2,300 ft MSL in an extreme nose-up attitude. The fuselage of the aircraft came to rest on the other side of the ridge at 1,500 ft MSL. The right wing rested approximately 200 ft below it.

Figure 13 – Impact and Wreckage

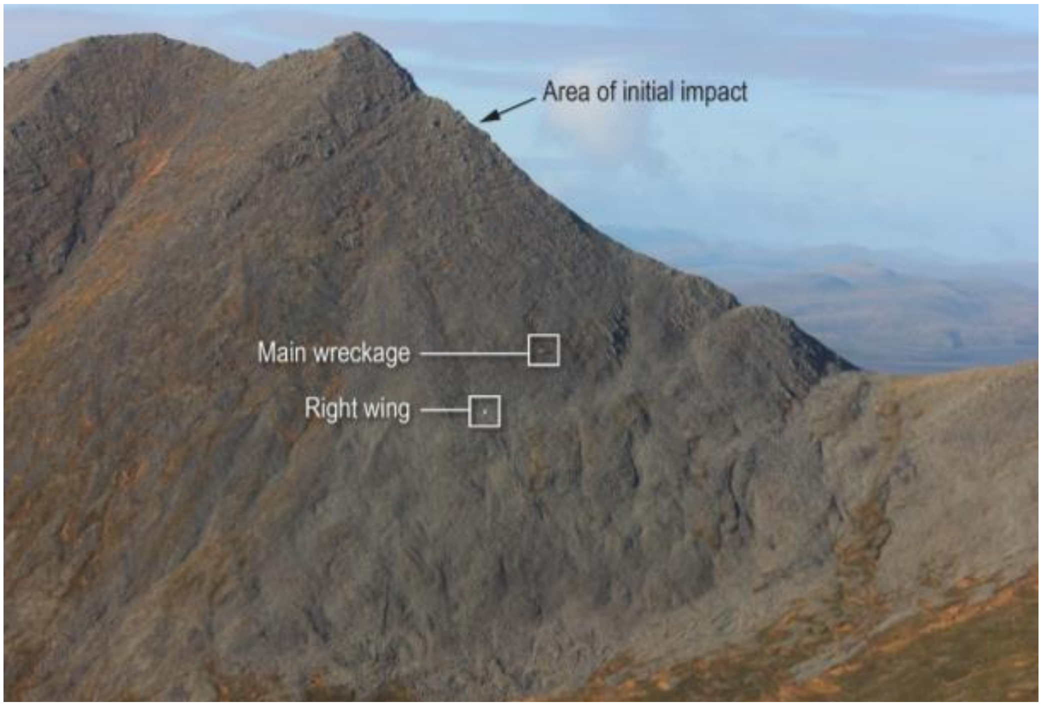


Figure 13 – From "Collision With Terrain, Hageland Aviation Services, Inc. d/b/a Ravn Connect Flight 3153, Cessna N208SD, Togiak, Alaska. October 2, 2016 (Report No. NTSB/AAR-18/02)," by the National Transportation Safety Board, 2018, p. 4 (https://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1802.pdf).

Pilot Information

The pilot in command (PIC) was a commercial-rated pilot with flight instructor certificates (CFI, CFII, MEI). He had been flying for Hageland for 11 months and had a total of 6,465 hours of flight time, over 75% of which was as a PIC. The second in command (SIC) had been employed by Hageland for 2.5 months. He was hired with 189 hours, and at the time of the accident, he had accumulated 84 hours in the C208B for a new total time of 274 hours. The PIC had been issued a certificate for CFIT avoidance; however, there was no record that the SIC had completed any simulator CFIT training. In conversations with his girlfriend, the SIC expressed that flying for Hageland was like "'the wild west,' flying in low visibility and below minimums" (NTSB, 2018, p. 6).

Meteorological Information

The closest weather station was located at Togiak Airport (PATG). About the time of the accident, at 1156 AKST, the automated station was reporting calm wind, 7 mi visibility, light rain, scattered clouds at 3,900 ft, overcast clouds at 4700 ft, and a temperature/dew point spread of 7/6 °C. The weather station was approximately 10 NM southwest of the accident site. Additionally, weather camera photographs from the time of the accident showed mostly obscured terrain approximately 7 mi away (NTSB, 2018).

The second flight crew changed course due to weather. Before they diverted, "[their] route and altitude were similar to those of the accident flight. The accident flight crew had likely passed, about five minutes earlier, the location where the second crew chose to divert" (NTSB, 2018, p. 42). After realizing the accident flight may have likely crashed, the second aircraft departed PATG, yet were unable to locate the aircraft due to clouds obscuring the mountains along the route. They reached the site within 1 hour of the accident (NTSB, 2018).

Aircraft Information

The aircraft, a Cessna 208B Grand Caravan, is a popular model for cargo and passenger flights in rural Alaska. At the time of the accident, there were no open minimum equipment list items aside from the aircraft's ADS-B system (NTSB, 2018). The accident aircraft was GPS- capable and equipped with a multi-function (MFD) that provided a variety of data to the pilot.

The aircraft was also equipped with a ground proximity warning system and a terrain awareness and warning system (TAWS). One display choice on the MFD was a map feature, which used color to differentiate between water and terrain. This page would display terrain in shades green, brown, or blue. Yellow or red would be displayed if terrain was 1,000 or 100 ft below the aircraft, respectively. When using this feature, a terrain inset would appear in the corner of the display to notify the pilot of any 'red' terrain within a 5 NM radius of the aircraft. On different display options, an advisory flag would illuminate and flash in the corner of the display for 10 seconds when the aircraft was within 100 ft or 2 minutes of any terrain or obstacle (NTSB, 2018).

The TAWS, which was independent of the MFD system, had an internal GPS and terrain database. The TAWS was a look-ahead system (forward-looking terrain avoidance), which enabled it to look at lateral and vertical flight paths. This system had an en route required terrain clearance of 700 ft AGL. Below this altitude, the system would alert the pilot unless the aircraft was within a local airport area. The accident aircraft flew the majority of the route between 500 and 700 ft AGL, within the cautionary range of the TAWS. Caution messages (aural and visual) would begin 1 minute from impact with terrain or an obstacle (“CAUTION TERRAIN”), and warning messages (aural and visual) would begin 30 seconds from impact (“TERRAIN, TERRAIN, PULL UP”; NTSB, 2018).

Because the TAWS and ground proximity warning system were separate, no TAWS warnings were displayed on the MFD. Instead, a smaller display was installed as part of the TAWS at the top of the dash. This display included amber and red visual alerts to the pilots and featured a TAWS inhibit switch. When selected, aural and visual alerts were inhibited from alerting the pilot of any possible terrain conflicts. This would stay inhibited until the pilot deselected the TAWS inhibit switch. White text “TERR INHB” was backlit to display the selection of the switch (NTSB, 2018).

Organizational Information

Hageland, d/b/a Ravn Connect, was certified as a Part 135 operator who provided scheduled and on-demand charters around the State of Alaska. They employed 120 pilots and operated 56 aircraft (NTSB, 2018). Typical to many Alaska Part 135 operators, Hageland's pilots worked a 2 weeks on, 2 weeks off schedule and were based across the state. Pilot housing was provided. Each pilot had around a 14-hour duty day.

The accident aircraft, the Cessna 208B, was certified for single-pilot operations and its checklist was approved accordingly. When flying single-pilot, an 8-hour flight time limit was imposed. With the addition of a second in command (SIC) or safety pilot, the company was approved to extend the flight time limit to 10 hours. This was common practice at Hageland, as it allowed for better schedule utilization. The SICs were expected to act as crewmembers during flight and help to offload passengers and cargo (NTSB, 2018).

Per Hageland's operation specifications, pilots were authorized to fly special VFR when visibility was 2 miles or greater and ceilings were at or above 600 ft. VFR flights were common; pilots were limited to fly no lower than 500 ft AGL, and per the company GOM, were expected to fly the shortest safe route to the destination airport. During the investigative hearing on the accident, the chief pilot discussed how the IFR infrastructure did not support Hageland's operations. She noted that IFR approaches were available; however, they were unable to be used due to the lack of weather reporting stations across the state (NTSB, 2018). Flying at altitudes lower than 1,000 ft was habitual and oftentimes necessary when weather precluded pilots from flying higher (NTSB, 2018).

At the time of the accident, Hageland did not have a formal SMS. Their GOM described procedures for reporting safety events, which included a list of mandatory reports. Reports could be submitted anonymously through a web-based reporting system, or a company hotline, both of which were managed by the Medallion Foundation. Following the accident, the DO was asked to describe the safety culture at Hageland:

> *I would say that the safety culture at Hageland is—it is—I believe we are still in a reactive phase of safety culture, but we're moving towards a proactive phase and the employees are actively participating in the safety program. They don't in my experience cover things up that are safety issues. They would rather identify them and get them repaired. So, I would say in general the safety culture is very healthy.* (NTSB, 2018, p. 29)

Training

Training on crew resource management (CRM) techniques was required by company manuals. These computer-based training modules were part of initial and recurrent training at Hageland. Their focus was to enhance communication among crew members to promote better decision-making. The training defined PIC duties for the captains and "follower" duties for the SICs, which included monitoring, supporting, and respecting the leader (NTSB, 2018, p. 18). There was no documented training material that described pilot flying versus pilot monitoring duties (NTSB, 2018).

Though not required by Part 135 regulations, Hageland provided CFIT training to their pilots in initial and recurrent ground school using a simulator and classroom lessons. Hageland used Medallion Foundation resources to create their training program and were participants in the Shield Program. The CFIT avoidance training was not included in the company training manuals and thus was not subject to FAA oversight. There was no record that the SIC on the accident flight had completed the simulator CFIT avoidance lesson. The training in the computer-based training module was taken from a Flight Safety Foundation training aid published in 1995—it was outdated for operations with GPS. Additionally, the training was not tailored to Hageland's operations (NTSB, 2018).

The Hageland operating manuals had no instruction for the use of the TAWS inhibit switch. During the investigative hearing following the accident, the chief pilot stated that pilots were authorized to inhibit TAWS when flying in visual meteorological conditions (VMC) and when they were able to see terrain conflicts. Pilots were not authorized to use the terrain inhibit during flight in IMC conditions (NTSB, 2018). Company policy allowed pilots to fly as low as 500 ft AGL, an altitude below the alert limits of the TAWS (700 ft AGL). Due to this, pilots frequently inhibited the TAWS on VFR flights to reduce nuisance alerts.

The SIC of the second flight described how they had TAWS inhibited to remove nuisance alerts for portions of their flight. She could not specifically remember when they uninhibited the TAWS (NTSB, 2018). The company had no procedure or checklist item regarding the use of the TAWS inhibit switch; different company pilots had different techniques for its use. When asked how hard it was to ignore the terrain inhibit annunciator, the chief pilot described the location as prominent in the pilot's scan—the white light was very bright and difficult to ignore (NTSB, 2018).

Operational Control

The DO was responsible for operational control. He had the ability to delegate operational control to approved persons described in company Operation Specifications (OpsSpecs) and operation manuals. Operational control agents (OCAs) and approved pilots could have joint operational control. Flights could be released with concurrence between both. Each flight (which could consist of multiple legs) went through a risk assessment before dispatch. The pilot and OCA would look at elements like weather, terrain, VFR versus IFR, maintenance deferrals, and so on, to determine a risk number for the flight. Anything above Risk 3 required management approval. Risk Level 4 prohibited dispatch (NTSB, 2018). OCAs would contact pilots periodically throughout flights to update them on weather. Due to terrain and communication infrastructure, the OCAs would frequently relay messages through the departure control agent (DCA; i.e., local station agents), and at times, the DCA would relay that message through another pilot to finally reach the intended aircraft. The DCAs and OCAs were in frequent contact as weather, passenger counts, cargo loads, and departure times changed throughout the day (NTSB, 2018).

On the day of the accident flight, the OCA suggested the flight depart on an IFR flight plan. The PIC discussed the weather with the OCA, and they ultimately determined operating under VFR would be appropriate for weather conditions and meet regulatory and operational limitations. The flight departed Risk 2 due to inoperative ADS-B equipment. During the flight, the OCA did not contact the accident crew, as there were no further weather updates.

The OCA was responsible for monitoring the progress of the flight and notifying the DO or his delegate if the aircraft exceeded its estimated arrival time. On the day of the accident, the operational control center was not aware of the late arrival despite Spidertracks position not updating for 20 minutes. They were first notified when the DO received a call from the Air Force Rescue Coordination Center notifying him of the emergency locator transmitter signal (NTSB, 2018).

Hageland Safety History

During the period between 3 December 2012 and 8 April 2014, Hageland had five accidents and one runway excursion:

3 December 2012: forced landing following lost engine power.

4 March 2013: runway excursion attributed to the crew's attempt to land in IMC

with excessive crosswinds and tailwind.

4 May 2013: CFIT under VFR with a single pilot.

22 November 2013: a touchdown short of the runway in IMC conditions while operating VFR.

29 November 2013: VFR into IMC, CFIT. Pilot and three passengers were killed, six more were seriously injured.

8 April 2014: fatal accident during training event, both crew members killed. (NTSB, 2018, p.31).

Between the various accidents listed above, Hageland's principal operations inspector and the FAA sent various safety requests to Hageland. Following the 4 March 2013 event, the principal operations inspector requested that flights not be released in adverse weather. His letter questioned the ability for persons with operational control to oversee such a large operation and whether flight crew training was appropriate. (NTSB, 2018).

After the 4 May 2013 accident, the FAA met with Hageland to discuss their risk assessment tool and requested follow-up documentation on their progress later that summer. After the 29 November 2013 accident, the FAA suspended the training program for approximately 1 month and outlined requirements to regain approval to restart training. Lastly, after the fatal accident on 8 April 2014, the NTSB issued an urgent safety recommendation, indicating “that the recommended action required immediate action to avoid an imminent loss from a similar accident” (NTSB, 2018, p. 32).

The NTSB recommendations asked the FAA to conduct an audit of multiple facets of Hageland’s operation, among them maintenance, training, and operational control. The team performing this audit was to be from outside Alaska. In addition, a separate audit of FAA oversight was to be performed, also with investigators from outside Alaska. Both NTSB safety recommendations were eventually closed with acceptable actions. The FAA evaluated key components of Hageland’s operation and issued corrective actions following the audit. None of their resolutions involved pilot training, and the FAA noted, “*The training program design meets all the requirements of . . . Part 135, but only the minimum for approval*” (NTSB, 2018, p. 33). In regard to FAA oversight, a new certificate management office was established in the Alaska region to provide additional oversight of large Part 135 carriers (NTSB, 2018).

Findings and Analysis

Following this accident, the NTSB conducted an investigative hearing to gather data from key witnesses and personnel in Hageland’s organization. The 1-day event highlighted topics such as operational control, pilot training related to weather, and safety management conditions relevant to the Alaskan environment as a whole (NTSB, 2017). In conjunction with the investigation completed by NTSB investigators on scene, the hearing gathered factual evidence used in the final report.

An emphasis on the PIC's decision to continue VFR into IMC and his failure to attempt an escape maneuver, the company's inadequate training program on CFIT and CRM, the unmonitored use of the TAWS inhibit switch, and poor FAA oversight of Hageland's operations were factors in the final NTSB report (NTSB, 2018). The NTSB determined the probable cause of the accident was:

> *The flight crew's decision to continue the visual flight rules flight into deteriorating visibility and their failure to perform an immediate escape maneuver after entry into instrument meteorological conditions, which resulted in controlled flight into terrain (CFIT). Contributing to the accident were (1) Hageland's allowance of routine use of the terrain inhibit switch for inhibiting the terrain awareness and warning system alerts and inadequate guidance for uninhibiting the alerts, which reduced the margin of safety, particularly in deteriorating visibility; (2) Hageland's inadequate CRM training; (3) the Federal Aviation Administration's failure to ensure that Hageland's approved CRM training contained all the required elements of Title 14 Code of Federal Regulations 135.330; and (4) Hageland's CFIT-avoidance ground training, which was not tailored to the company's operations and did not address current CFIT-avoidance technologies.* (NTSB, 2018, p. xi)

Table 2 – Themes from Togiak CFIT Accident

Case study	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Togiak CFIT	Inadequate training	Company culture	Inappropriate use of equipment	Inadequate safety programs	Operational control

Ketchikan Midair

On 19 May 2019, two float-equipped aircraft collided midair near Ketchikan, Alaska. Both aircraft, a DHC-2 (Beaver) and a DHC-3 (Otter), had been conducting sightseeing flights near a waterfall in Misty Fjords National Monument, approximately 8 NM northeast of Ketchikan. The DHC-2 was destroyed in the collision and the pilot and all four passengers were killed. The DHC-3 sustained substantial damage, the pilot had minor injuries, 9 passengers had serious injuries, and one passenger was killed. Both aircraft were operating under visual flight rules in VMC conditions at the time of the accident (NTSB, 2021).

ADS-B data provided by the FAA shows the flight paths of both aircraft starting at approximately 1213 local time. As the aircraft converged on the waterfall, the DHC-3 descended from an altitude of 4,000 ft, while the DHC-2 began a climb from 3,175 ft. The DHC-2 stopped its climb at 3,350 ft on a 255-degree track. The DHC-3 continued its descent on a 210-degree track until the two aircraft collided at 3,350 ft at 1221:14 local time (NTSB, 2021). Figure 14 shows the flight paths of aircraft with time and altitude stamps depicted.

Figure 14 - Aircraft Flight Paths Including Time and Altitude Stamps

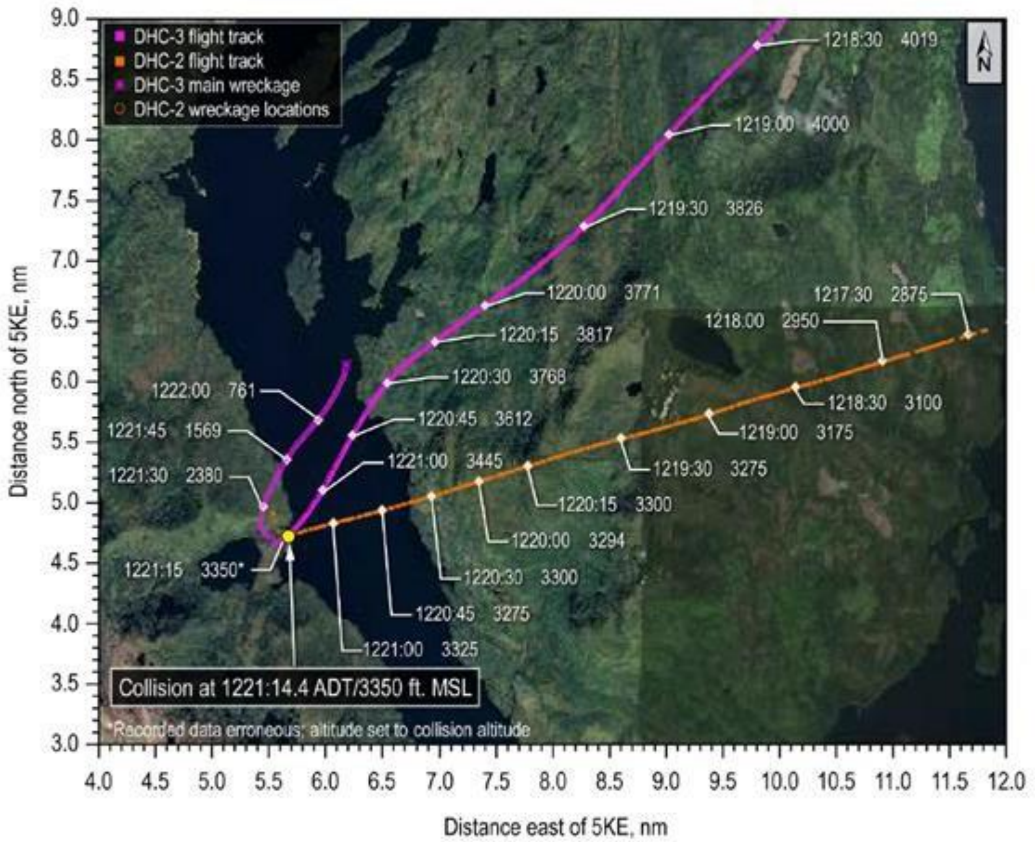


Figure 14 - (NTSB, 2021).

Wreckage from the DHC-2 was found on land and in the water near the collision site. Mechanical cuts from the propellor of the DHC-3 tracked inboard from a position midway on the right wing, which was completely separated from the aircraft at the wreckage site. The occupants of the DHC-2 were ejected from the aircraft during the collision.

The DHC-3 sustained substantial damage from the collision and subsequent impact with the water. The floats separated from the aircraft during the crash landing. The propellor of the DHC-3 showed severe rotational gouging, consistent with the wreckage from the DHC-2. The portion of the aircraft forward of the main passenger cabin (including the cockpit and firewall forward) was mostly separated from the fuselage. Both portions remained mostly intact (NTSB, 2021).

After impacting the water, the pilot of the DHC-3 was able to swim out of the wreckage and help 9 out of 10 passengers through the rear aircraft door. The tenth passenger, who was sitting in the co-pilot seat, was slumped over the pilot seat with her seatbelt fastened. Her cause of death was blunt force trauma. Drowning was a contributing factor to her death. Despite a thorough briefing by the pilot on the use and location of the life vests, only one passenger took theirs during the evacuation. The surviving passengers were towed to shore by a passing good Samaritan and taken to the hospital by the U.S. Coast Guard (NTSB, 2021). Figure 21 shows the DHC-2 wing recovered from the accident showing mechanical cuts.

Figure 15 – DHC-2 Wing Recovered From Accident Site Shows Mechanical Cuts

Figure 15 - (NTSB, 2021).

Operator Information

The DHC-2 was operated by Mountain Air Service, LLC under Part 135 on-demand regulations. They provided flightseeing tours for the Ketchikan area. The pilot was the owner and sole pilot for the company. The NTSB found no airman qualifications or personal factors to be causal factors in this accident (NTSB, 2021). The pilot had flown for numerous operators and had accumulated approximately 11,000 hours of flight time.

The DHC-3 was registered to Pantechnicon Aviation, LTD out of Minden, NV, and operated by Venture Travel, LLC, d/b/a Taquan Air. The flight operated under Part 135 on-demand regulations and also flew tours. The pilot had been flying with Taquan since summer 2018 and passed his PIC checkride earlier in 2019. He accumulated over 25,000 hours, 15,000 of which were as PIC (NTSB, 2021).

At the time of the accident, neither company had a formal SMS. Taquan's management started the process for SMS approval, stating that they wanted to give their customers the highest level of confidence in their business (NTSB, 2021). The NTSB has continually recommended to the FAA that SMS become mandatory for passenger-carrying Part 135 operators. Currently, SMS is optional (NTSB, 2021).

Aircraft Information

The DHC-2 was compliant with all FAA-required inspections—aircraft condition was not a factor in this accident (NTSB, 2021). The DHC-2 had an ADS-B in-and-out system in its avionics package. The system had three components (a transceiver, controller, and Wi-Fi interfacing device), which worked to provide ADS-B information to the pilot via an iPad equipped with ForeFlight™. The iPad was mounted in the center of the panel below the power levers/controls and could display a moving map.

The ForeFlight™ application generated visual and aural traffic alerts to the pilot. Traffic targets were displayed as a filled, cyan triangle. When a traffic target became a traffic alert (within 1.8 NM and +/- 1200 ft), the triangle became yellow, and a pop-up alert displayed the direction, distance, and altitude of the target. Aural alerts could be transmitted through the pilot’s headset (if connected via Bluetooth) or through the iPad speaker.

Similarly, the NTSB found no outstanding maintenance issues with the DHC-3 aircraft. The DHC-3 was equipped with the same ADS-B transceiver as the DHC-2. To provide altitude information to the transceiver, the associated Garmin control panel must be selected “ON” via the control knob and selected to the “ALT” mode. Two Chelton EFISs comprised the primary flight display and MFD of the DHC-3.

The Chelton EFIS worked with the ADS-B transceiver to provide traffic information to the pilot on the EFIS displays. The EFIS displays were located centrally in front of the pilot seat, and the Garmin control panel was located on the right-hand side of the cockpit, in front of the co- pilot seat. Though the Chelton EFIS had the capability to display traffic alerts, the ADS-B transceiver could not provide alerts, and the DHC-3 did not have the capabilities to provide its pilot with aural or visual warnings.

Findings and Analysis

The aircraft were operating under VFR in VMC conditions. Clear skies below 12,000 ft and visibility of 10 NM was reported at PAKT. The pilots were relying primarily on the “see- and-avoid” concept. A cockpit visibility study created using passenger photos, aircraft specifications, and sun angles was conducted by the NTSB to determine the feasibility of either pilot sighting the other aircraft before impact. It was determined that, due to the flight path of the DHC-2 and the structure of the cockpit, the pilot “would not have had the opportunity to see the DHC-3 (which was above and behind his aircraft), by visually scanning the outside environment” (NTSB, 2021).

The pilot of the DHC-3 had the opportunity to see the DHC-2 for approximately 1 minute 20 seconds prior to impact. However, the relative size of the aircraft would have been “about one sixth the height of a thumbnail held at arm’s length” (NTSB, 2021, p. 18). The size would have gradually increased as the aircraft got nearer; however, the majority of the DHC-2 would have been concealed by the window post up until impact. This accident highlights inefficiencies in see-and-avoid techniques. The NTSB concluded that “collision geometry, obscuration by aircraft structures, and limitations of human performance can make it difficult to see nearby aircraft,” (NTSB, 2021, p. 34).

Following the accident, both ADS-B systems were removed from the aircraft and sent to their manufacturer for testing. The system in the DHC-2 was operational; however, the system from the DHC-3 sustained substantial damage from the accident and could not be analyzed.

ADS-B data from the FAA showed both ADS-B transceivers were on and transmitting data to the nearest ground stations. Data from the DHC-3, however, was missing pressure altitude and a valid transponder code. The last time the aircraft had transmitted this data was 29 April 2019. This information indicated that the Garmin control head was in the “OFF” position, thus preventing the information from being transmitted out to other aircraft (NTSB, 2021).

The pilot of the DHC-3 was not aware that the Garmin control head was in the “OFF” position. His pre-flight routine was to leave the control in the last position; he assumed that turning it would disable the avionics equipment. He stated that the display appeared functional and that he could see other aircraft on his display during the accident flight.

As part of the analysis for this accident, the NTSB used ADS-B data to simulate various traffic information displayed prior to the collision. For the DHC-3, the DHC-2 would have appeared as a filled cyan triangle. It would have been displayed approximately 4 minutes prior to impact and remained there until the collision. Simulations were compared to a DO-317-B compliant device. This requirement specifies the aural warning, color, and shape of traffic symbols on the cockpit display of traffic information (CDTI). On this display, the DHC-2 target would have changed to a yellow symbol and been accompanied with an aural alert describing the location of the traffic (NTSB, 2021).

Three simulations were made for the DHC-2. The most likely scenario assumed pressure altitude reporting from the DHC-3 was turned off. In this case, the traffic symbol for the DHC-3 would have appeared as a filled cyan triangle on a converging course.

However, no aural or visual alerts would have been provided due to the lack of altitude information from the DHC-3. This simulation assumed the “hide distant traffic” function was turned off; had it been enabled, the DHC-3 would not have appeared on the DHC-2 iPad at all.

The second simulation assumed the DHC-3 was broadcasting pressure altitude information. In this case, the ForeFlight simulation would have shown the DHC-3 as a yellow symbol. Accompanying aural traffic alerts would have sounded, starting from 1 minute 44 seconds until impact. The final simulation was with a CDTI device compliant with DO-317B and assumed the DHC-3 was broadcasting pressure altitude. In this scenario, the DHC-3 would have appeared 1 minute 44 seconds before impact as a cyan arrowhead. It would have changed to a yellow arrowhead 35 seconds prior to impact and come with an accompanying aural alert. An additional aural alert would have sounded 29 seconds prior to impact (NTSB, 2021).

The NTSB has underscored limitations on see-and-avoid in previous accidents and emphasized the reliability of CDTI devices in preventing midair collisions (NTSB, 2021). Because there were no aural alerts, effectiveness of the CDTI devices relied on the pilots incorporating their respective devices into their instrument scan. Due to the limitations on human performance when under high workload (i.e., navigating the visual environment), their visual scan was ineffective in preventing this accident (NTSB, 2021).

In high-traffic tour areas, a CDTI with aural and visual alerting systems can draw attention to possible traffic conflicts when the pilot is under high visual workload. When used as part of the normal scan, the CDTI brings more general awareness to the location of other aircraft.

Frequent monitoring increases situational awareness of the pilot. Clarity on the CDTI display can help pilots to quickly find traffic visually, which enhances see-and-avoid techniques. A well- designed electronic interface is a valuable tool in high-traffic, high-workload areas, especially when operating single-pilot.

Probable Cause

The NTSB determined the probable cause of this accident to be:

The inherent limitations of the see-and-avoid concept, which prevented the two pilots from seeing the other airplane before the collision, and the absence of visual and aural alerts from both airplanes' traffic display systems, while operating in a geographic area with a high concentration of air tour activity. Contributing to the accident were (1) the Federal Aviation Administration's provision of new transceivers that lacked alerting capability to Capstone Program operators without adequately mitigating the increased risk associated with the consequent loss of the previously available alerting capability and (2) the absence of a requirement for airborne traffic advisory systems with aural alerting among operators who carry passengers for hire. (NTSB, 2021, p. 49)

Table 3 - Themes from Ketchikan Midair Accident

Case study	Theme 1	Theme 2	Theme 3
Ketchikan midair	Inappropriate use of equipment	Inadequate safety programs	External environment

NTSB Accident Data

A brief content analysis of NTSB accident data is included in this section. The accidents from the 10-year range from 2008 to 2018 were analyzed to determine how contributing factors to accidents correlate to case study themes, interview data, and participant feelings toward air safety. The data included all Part 135 airplane accidents in the date range. Accidents were excluded if the final results were not yet published, findings were undetermined, or where there was missing information.

The data was classified using accident severity. Per the NTSB definitions, a fatal accident is one where death occurs within 30 days of the accident. Serious accidents are those which include:

> hospitalization more than 48 hours commencing within 7 days after the accident, fractured bones (excluding fingers and toes), severe hemorrhages, nerve, muscle, or tendon damage, involves any internal organ, or involves second- or third-degree burns, or any burn covering more than 5% of the body. (NTSB, Definitions,

2010)

As part of the content analysis, descriptive statistics of contributing factors referenced in the accident reports (percentage) are highlighted in Table 4. Most accidents have multiple contributing factors and the most impactful are listed.

Table 4 - NTSB Accident Data: Part 135 Accidents, 2008–2018

	Fatal	Serious	Minor	None
Number of accidents	20	16	26	104
Age (mean)	41	51	43	47
Experience (mean hours)	7,769	10,930	6,089	10,307
ATP	40%	75%	35%	52%
Commercial	60%	25%	65%	48%
Crew	20%	0%	12%	8%
Contributing factors				
PI-Decision-making/judgement	65%	56%	38%	23%
PI-Aircraft control	20%	13%	27%	30%
PI-Lack/delay/incorrect of action	0%	6%	19%	10%
PI-Situation awareness/orientation/recognition	20%	6%	12%	12%
PI-Complacency	0%	0%	4%	10%
ORG-Oversight	30%	13%	0%	1%
ORG-Policy/procedures	35%	6%	4%	10%

ORG-Safety/pressures/demands	15%	0%	0%	0%
EI-Weather (ceilings/visibility/icing)	25%	38%	27%	5%
EI-Weather (wind/gusts/turbulence)	5%	13%	15%	17%
EI-Terrain	15%	31%	0%	0%
EI-Runway/landing environment	0%	13%	27%	35%
MX	0%	19%	15%	20%
Other	0%	0%	0%	10%

Participant Interviews

A qualitative interview analysis was the main research instrument for this study. Themes and information gathered from the case study review and NTSB accident data analysis showed areas where further qualitative analysis was required to further explain the psychosocial and organizational influences on Part 135 pilot decision-making. The content analysis helped guide the development of interview questions to assess the viewpoints of eight different Part 135 pilots.

Participants were interviewed in a semi-structured format. The main objective during the interviews was to create an environment where each participant felt at ease sharing their unfiltered opinions on their careers in the state. Participants had a variety of experience ranging from over 20 years and 13,000 hours operating, to a first job as a commercial pilot with 350 hours of total flight time. This diversity of experience was invaluable during the research process. Table 5 shows the descriptive statistics of research participants' age, experiences, highest pilot certifications, and interview length.

Table 5 – Participant Data

Participant	Age	Years of experience	Highest certificate	Interview length
1	22	1	Commercial	57:01:00
2	57	7.5	ATP	48:11:00
3	28	3	Commercial	48:28:00
4	26	3.5	Commercial	61:08:00
5	29	10	ATP	57:22:00
6	39	6	ATP	65:12:00
7	40	20	ATP	64:36:00
8	34	15	ATP	67:31:00
Mean	34.4	8.25		58:41:08

The semi-structured interviews were manually transcribed and edited to remove any identifying information such as company name, tail numbers, and so on, and then condensed to remove technical recording glitches and speech tics (e.g., "Can you still hear me? How about now?" "Ummm, yeah, so…"). Manual deductive coding was used to categorize the interview data to find themes and patterns recurring between the eight interviews. The researcher used deductive thinking to check the themes against participant data (Creswell & Poth, 2018). The following section describes six themes that emerged from the research data.

Pilot Relationships

As one of the main focuses of this study, interpersonal relationships between pilot peers was a critical element explored during the interviews and its importance was evident during data analysis. Numerous codes were identified in the data across all eight interviews. The importance of interpersonal relationships for Part 135 pilots is recurring in other themes, such as skill enhancement and organizational factors. Table 6 shows the prevalence of the associated codes among the interviews as a percentage of the interviews in which the themes emerged (i.e., coverage).

Table 6 - Theme 1: Pilot Relationships

Code	Description	Coverage
Camaraderie	Developing friendships, trust between colleagues, mutual respect of others' boundaries/decision-making, team dynamics	75%

Cockpit relationship (CRM)	Relationship between a captain and a first officer, cockpit relationship dynamics, superior/inferior power balance	87.5%
Peer pressure	Positive or negative influence on decision-making	50%

Participants discussed the importance of CRM even in companies that fly single-pilot. Local knowledge, which entails sharing information unique to the operational environment, is important for their decision-making, especially as weather and runway conditions can change rapidly. Likewise, the dynamic of crewed cockpits changes the experience of a flight. The two quotes below highlight the importance of CRM in both single-pilot and two-pilot operations, respectively:

> *I made a lot of really good friends and a lot of these guys. We rely on each other. Whoever goes in there first, we're relying on a PIREP [pilot report] from those guys. We also make decisions together. There are a few pilots I legitimately trust. We'd be talking on the radio on the way down to who knows where, all these little, tiny villages, which may or may not have an approach. We're discussing the different options based upon the weather and everything we saw this morning or the morning of the flight. Try to figure out what the best way was to try and get in there. Talking to each other is huge. But then there are*

> *other pilots that I never ask an opinion of.*
>
> *I really love the attitude where you're a team. It's not, I mean it is a captain and an FO [first officer], but I feel for me like it's more of a team. I had some captains like that and that was amazing. And then I had some captains that were like "I am the captain, you're just a warm body in the seat" and I know how that made me feel.*

Participants discussed the importance of being able to work together outside of the cockpit. The unique working environment often means that pilots are on shifts together in pilot housing, typically in remote parts of the state. In situations where these respondents work together, eat together, share a living space, and spend their free time together, the respondents highlighted the importance of having compatible personalities to minimize conflicts. A respondent with 20 years and approximately 13,000 hours of experience flying explained the importance of being able to fit in with peers in a pilot community:

> *In 135 operations, the nature of working with and around the same people all the time. You either fit into the team or you don't last. People, this is a harsh thing to say, but the people who can't get along in that circumstance and who can't contribute, they get run off.*

The results suggest that the relationships pilots form with their peers influences their decision-making and highlights the role of peer pressure and group effects. While some participants perceived positive influences of peer pressure (i.e., encouraging safe decision- making and canceling flights when appropriate), others stated that the behaviors of their peers negatively pressure pilots to fly outside of their comfort zone. The dynamic of pilot bases in rural Alaska contributes to elements of peer pressure, and the following quote provides an example of when newer, inexperienced pilots may have been influenced to fly outside of their limits due to peer pressure stemming from operationally experienced pilots:

> *I think one of the things I've seen that's problematic in places that I go that have larger pilot bases was a classic example where we had 14 pilots on shift. We had some really experienced pilots and then we had people that were on their first commercial job. It seemed like one person was making the decision for that whole base that it's flyable. "We're good everybody. Everybody to your planes." Whereas after, I went where there was one [Aircraft Type A] driver, one [Aircraft Type B] driver. I was paired up with a really experienced driver and I was a fairly new commercial driver, but that was better because I didn't feel the pressure of these other drivers all running to their planes.*

Participants indicated that the best 135 pilots are the ones who are able to stick to their own personal limitations with regard to off-airport operations and flying in marginal or windy weather conditions. A respondent with 20 years of experience emphasized that safety in Part 135 flying often depends on the manual flying skills of the pilot, their ability to interpret their environment (e.g., a float pilot needs to read the water), and their willingness to gradually expand their flying skills by incrementally increasing the challenge level of their operations.

Another participant discussed two accidents in which they thought the pilot had pushed outside of his personal limitations due to influences from other pilots. Negative peer pressure in this environment is often subconscious:

> *You have to understand risk management, you have to understand your own limitations and you have to be willing to stand up for your limitations. Don't be pushed into something. It's one thing to expand your knowledge base and to work on your craft but it's another thing to go beyond what you feel is safe just because someone else feels it's safe.*

Pilot Attitudes

During the interviews, five respondents, each with more than 6 years of operational experiences flying, opined that individual personality attributes had an overall impact on interpersonal relationships among Part 135 pilots. The participants further suggested that, as part of individual attitudes and interpersonal relationships, some pilots misconstrued ego and confidence, which had adverse effects on personal risk tolerance in their community. Table 7 shows codes and emergent themes associated with these opinions on pilot attitudes.

Table 7 – Theme 2: Pilot Attitudes

Code	Description	Coverage
Ego	Sense of self-importance, boastfulness, comparison against other pilots	87.5
Confidence	Comfort in skills, self-pride, self-assurance	87.5
Risk tolerance	Pilot's willingness to accept risk, to accomplish dangerous tasks	87.5

The affective construct of ego was mentioned by almost all the respondents (87.5%) as an attitudinal trait acquired naturally by Part 135 pilots. The results from the interviews also suggested that some current Part 135 pilots displayed behavioral tendencies of overconfidence in their flying abilities:

> *The pilot is required to have an attitude of "I want to broaden my horizons; I want to push my boundaries." But then a cockiness or an overconfidence or a feeling that I can do anything is taking that too far and that can have disastrous*

> *results as well.*

Seven out of 8 pilots interviewed discussed an element of ego negatively affecting relationships with their coworkers, some even mentioning how their own ego has evolved with experience. The quote below depicts one participant's views on how pilots "proving themselves" can be manifested as ego:

> *There's a part of it that's just pilot ego. Each one of us has a touch of that if we're honest with ourselves. The longer I fly the less I feel like I have. The more you know, the more you realize you don't know.*

Participants note that ego most frequently manifested when discussing events that had happened out flying, or during episodes of hangar talk. Participants contrast these pilots with those who share experiences to provide cautionary tales. One participant elucidates the difference between sharing stories to boost themselves and sharing experiences to better inform the pilot group:

> *Stories are kind of like an ego boost. Bragging, "This is the weather I flew in VFR today, you'll never believe this," "This is how much ice I built up on this flight I couldn't believe it." Then the sharing experiences is more like, "Hey, you know I had this failure today, this type of system failure," or "I had this happen on touchdown," or "This mountain at a certain airport causes this type of wind*

> *pattern to come over so watch it when you go in there, I haven't seen it before."*

Participants recognized that, for every pilot who displayed self-serving egotistical tendencies, there were twice as many who used their learned experiences to teach or mentor. A respondent candidly explained the reaction of most pilots in their community to the issue of pilots with at-risk egotistical tendencies:

> *I'd say it's positive. It's not a dick measuring contest.There's people like that, but they get run off. People just kind of say, "Hey watch out for this guy" or "Whatever, he's a blowhard." The vast majority of those stories it's we don't want to have to see someone else learn the hard way.*

Participants suggest that the most frequently recurring quality of 135 pilots is risk tolerance. Most participants emphasized that, to be successful as a pilot, one must have commensurate risk tolerance for flight missions. Respondents further stated that playing it "too safe" is unrealistic and that flying regardless of consequence can result in disaster. These are some relevant quotes to buttress their opinions:

> *Unfortunately, if you wait for huge margins or everything, you're not going to make it work half the time.*

> *He was the epitome of a cowboy. He was the extreme edge of that. I don't think*

> *most people fall on the extremes one way or the other. He was the exact . . . like when you heard that he had run into the side of the mountain in bad weather it was like, "It was only a matter of time."*

As stated earlier by a respondent with almost 8 years of flight experience, most pilots are neither prohibitively risk averse nor dangerously accepting of flights. Rather, they fall somewhere in the middle. Finding the balance between playing it unnecessarily safe and taking all flights regardless of internal and external risk factors is critical to being successful. Most participants reiterated that pilots must display professionalism and good judgement by assessing their flying skills (manual and cognitive) with the limitations posed by variables such as weather, aviation infrastructure, and aircraft capabilities. Consequently, this means that sometimes a particular pilot would be more appropriate for a flight. This could be due to experience or skill.

For example, one pilot discussed an interaction he had with a colleague:

> *It's crazy to me to hear people who go in there day in and day out versus people who still go in there a fair amount—how their approach to it is different. When I'm hearing these things and weighing "how comfortable am I with this airport?" it really makes you think. I've turned down a few flights in the Southeast that maybe someone else wouldn't have. Not because he could do it any safer than I could, but he just knew something a little more what to expect. So that's an*

> *interesting point, and I think that's true in a lot of different places. If people are comfortable going into that place, they're accepting of that flight.*

Skill Enhancement

There were many components of skill enhancement discussed by participants. The codes generated touch on internal development, external relationships between coworkers, and formal training provided by the organization. Skill enhancement was mentioned by all eight participants to varying degrees. The associated codes are listed in Table 8.

Table 8 – Theme 3: Skill Enhancement

Code	Description	Coverage
Mentorship	The relationship between a pilot and a mentor, especially someone respected in the company or the aviation industry	62.5%
Pilot development training	Company-provided training; professional development provided by the organization. Could include ground school, computer-based training, initial	62.5%

	operating experience (IOE), training on the flight line.	
Skill enhancement		50%

All eight participants discussed how the methods by which pilots gain experience operating are crucial to their safety. The reasons cited for this include the vast diversity of terrain, extreme weather, and the intensity of flying. It was common to hear participants discuss how important experience was to being successful. One participant described how they were able to gain experience and provided insight for best practices to train pilots new to Part 135.

> *Experience is the only thing that is truly going to make a 135 pilot. You come up here and, no matter how good a stick you are, there's nothing that can really prepare you for everything that the environment is going to throw at you until you experience it. That's why I think having mentors, having people who you can actually fly along with before you get thrown into the deep end by yourself is so crucial. There are many, many instances where I just learned from trial and error, or I experienced things by myself for the first time.*

Three participants, each with over 3 years flying, discussed how unqualified they felt when they were hired. Another, who was raised, discussed how elements of remote area operations that were natural to them were obstacles to overcome during training for their peers. See one participant’s retroactive view on this matter:

> *Looking back on my starting years, I really had no business flying, coming in from the Midwest doing long flat flights to nice airports with nice lighting. But I had a lot of multi-time, and that’s the only reason I got hired up I really had no expectation for what I was getting into, and the experience is definitely a must. I’ve seen that kind of bite people at some established companies*.

For a pilot to maintain a positive safety record, respondents opined that they must be honest about their prior flight experience and willing to learn new skills (e.g., manual flying and decision-making techniques) commonly used. Management’s approach to hiring should take prior flight experience into consideration. A pilot with no previous experience flying should not be expected to perform the same tasks as a pilot who has previous experience until they develop skills relevant to the environment and the operation. These pilots need to be weaned onto the flight line incrementally, gradually getting exposure to new and more challenging operations.

It was a general opinion from most participants that this strategy of incremental exposure helps build confidence, which makes the pilots safer and self-aware. Two participants, one with 20 and one with 6 years of experience, stated that actions management can take include increased time on initial operating experience (IOE), pairing new first officers (FOs) with experienced captains, gradually giving more challenging flights to the pilot, and reviewing safety hazards associated with the operation. Critically, the approach an organization takes to building experience is instrumental to avoiding incidents and accidents. The following is a quote to highlight the points of participants:

> *If you take a brand-new pilot, and you send them on one of the most challenging operations, it's almost a guarantee that they're going to wreck the airplane. Maybe not on that one, but if that's your operational philosophy, that any pilot can do anything that we have regardless of if they're brand new or they've been there forever . . . I'll just restate what I've said before, I've seen that result in a lot of accidents up here.*

Participants discussed how attitude is a great predisposition for learning operational skills. Alaska is challenging and unique, and a thirst for new knowledge is how a pilot will learn.

Five participants were unanimous that satisfaction with mediocrity and an unwillingness to further improve skills and knowledge may be operationally detrimental to pilots and detracts from their ability to form camaraderie with other pilots. A willingness to want to learn more and become more skilled was the only way to actually improve. The quote below highlights the concerns stated earlier:

> *You have to be willing to listen to other people and gain experience slowly and methodically, but also push your boundaries. Equally important was learning from the experience of other pilots. Participants were asked about hangar talk and the attitudes surrounding how pilots share stories. The concept of mentorship repeatedly emerged during participant interviews. When asked about the type of pilot that participants most respect, four participants described pilots who were keen to share their experience for the purpose of teaching and who shared mistakes and lessons learned. This was a valuable method of gaining knowledge through the experience of others.*

One interviewee was just starting their career and emphasized how impactful the openness and honesty of their captains and more experienced coworkers was in building their comfort in their position. Positive hangar talk sessions were a powerful tool for creating camaraderie among pilots, learning from second-hand experience, and building confidence.

Each participant that spoke about mentorship had a specific pilot in mind who gave them valuable insights into Part 135 flying. A core attribute was that their mentors would share all experiences, even those that were embarrassing or unsafe, for the purpose of teaching their mentee. There was no formal mentorship program available to any of the participants, rather a natural bond formed between pilots who were keen to pass on knowledge.

As participants gained experience of their own, they needed the advice of others less and began to share their own experiences with the younger generation of pilots. In the opinions of the interviewees, this mentorship cycle helps change the social culture of 135 pilots. The attitudes gradually start to shift and encourage camaraderie and openness about safety critical events that can be shared for learning instead of showboating. One participant who has been flying for 15 years summed up their experience with mentorship:

> *I think for us up here there's a lot of respect for the people that have experience operating up here. You hear someone's story, and you hear their experience and you're like, "Oh yeah I wouldn't have thought of that before . . ." They either reiterate what you already knew or cause you to think in a way that you probably hadn't thought before. . ..In general, there's kind of a wealth of knowledge that's open and available. I'd say from [the beginning] to where I am now it's slowly decreased just because the need has decreased. Now I feel like I find myself on the other end of the spectrum, sharing knowledge that you've learned either from other mentors or from firsthand experiences or mistakes.*

Five of the participants discussed their company training. In general, these participants emphasized that on-the-job training was more valuable than classroom training and check ride preparation. Part 135 training is required to cover items like aircraft systems, company procedures, operations specifications, and contains a flight-related portion where new hires learn how the company operates their aircraft. Until the training is put into practice, it is often difficult to see how to connect all the elements. One participant working their first job as a commercial pilot had recently completed training and described their experience:

> *My training wasn't very involved. The check ride wasn't very involved. I don't know if this is common in Part 135 operations. It's kind of like the check ride was the first training flight. "Here's how you do this and you're ready for the test and now you start learning." They kind of throw you into it. Other than that, most of the training and the flying all happens on the clock, so to speak.*

All eight participants discussed how local knowledge enhanced their decision-making abilities and described it as "hugely, hugely important," and "invaluable." Two participants discussed how they felt gathering local knowledge was more relevant than classroom study and company procedure. Local knowledge includes elements like runway conditions, frequency dead spots, and weather patterns. This information could be important to making go or no-go decisions and was more frequently referenced than the information from ground school. The length of time flying exposed pilots to a variety of situations and allowed them to slowly build their local knowledge. Two participants discussed the relevance of local knowledge:

> *So much of what we do here, so many of the landings and takeoffs that we do here are really at your own risk. You don't have a government entity saying that "Yeah this landing surface is good, you can take that to the bank." That doesn't exist on a river, that doesn't exist on a pond someplace or in a remote region of Alaska. That's a huge part of the aeronautical decision-making. If I've never been there before I'm going to talk to somebody who has.*

> *I think it's invaluable. It sets you up to be ahead of the game. You know what to expect, you know what's coming, and you know what to look out for versus just blasting off and not knowing and then getting caught off guard. So I think, especially operating, you need to have as many tricks in your back pocket as possible and hopefully you don't run out of them in the process.*

Infrastructure Limitations

A theme that was frequently mentioned in participant interviews was the numerous infrastructure limitations and their impact on operations, specifically regarding safety of flights. Participants mentioned a need for self-reliance with the absence of services and in the abundance of intense flying scenarios encountered. Table 9 shows the themes associated with the infrastructure limitations.

Table 9 – Theme 4: Infrastructure Limitations

Code	Description	Coverage
Lack of services	IFR infrastructure, navigation aids, communication with ATC, NOTAMs, reliability of weather reporting, weather cameras, in-flight services	87.5%
Flying intensity	Extreme weather, varied terrain, difficulty with communication, aircraft condition, etc.	87.5%
Self-reliance	Necessity to gather own information, make decisions without the help of dispatch, company, etc. Formulate own plans, survive in harsh environments	75%

One of the most common elements discussed among participants was a lack of infrastructure. This ranged from navigational aids, instrument approaches, weather reporting stations, and airport condition reports, to sparse radio communication and radar coverage with air traffic control. For many operators to fly legally under the IFR system, each component needs to be working properly for pilots to dispatch. For example, an airport might have an instrument approach procedure for available runways but no weather reporting system on the airport.

Many airports rely on neighboring airports to provide weather information. If weather conditions at the time of the flight require the pilot to fly an instrument approach to land, the crew must be provided with or have access to an accurate and timely weather report provided by the neighboring airport as published on the approach procedure to legally initiate the approach. Participants explained what often happens in the circumstance where an airport doesn't have a certified approach procedure.

Pilots will fly an approach to a proximal airport other than their destination, and once clear of the weather, cancel their IFR flight plan and continue VFR (scud run) underneath the cloud layer by following visual landmarks to their intended destination. A participant described a technique where pilots create their own approach when the destination airport doesn't have one and weather is below VFR minimums:

> *Basically direct-enter-enter, fly the synthetic vision on their screen, build themselves an approach as they fly the video game all the way down to the runway.*

Part 135 operators also operate extensively under VFR rules. One participant discusses a near miss they had with another aircraft while flying through a mountain pass in marginal visual flight rules (MVFR) conditions, that is, weather that doesn’t necessitate an IFR flight plan but has lower ceiling and visibility requirements than VFR:

> *I was going to follow a certain river to the lodge. I was hearing reports of [the weather] being better past [redacted] Lodge. I don’t remember how far I was from it and [the visibility] just kept getting worse and worse and I’m talking to these guys who are on the other side, and they say it’s perfectly good. It got down to, we’ll just say really low. And it was just after that I was a little bit farther and I saw this 185 on amphibs emerge out of this cloud right in front of me, right above me. I was like, “50 to 75 ft different that could have been the end of it. We’re turning around right now.” And that was an eye opener. But you know it’s one of those things where your mind wants you to think that you’re fine, you’ll pass through it, you’re talking to guys on the other side of it. Then reality hits where it’s like, “We’re right here, we’re right now, this is the situation.” It doesn’t matter what it is 5 mi ahead; if you can’t make it another mile, none of it matters.*

Three participants discussed how sometimes the options are to bend the rules or not fly at all; this attitude has remained relatively constant through the career of those participants. Three different pilots noticed a positive trend away from this behavior. These were the three participants with the longest experience (20, 15, and 10 years).

They noted that more regulatory oversight and improvements to IFR infrastructure and weather reporting have contributed to the positive trend. Despite this, participants emphasized that there is still a need for further infrastructure development (e.g., more usable approaches, widespread weather reporting systems, and better radar coverage were discussed).

The limitations of the IFR system are augmented by limitations of the air traffic management system which is composed of aircraft and weather radar, aerodrome and local airport area controls, and may include resources like flight following and surveillance. Large swaths of 135 operations are not in radar coverage, and even more limiting, not under radio communication. Participants highlight that it is not uncommon to experience severe challenges when contacting air traffic control to get or cancel a clearance. Participants say using techniques like departing VFR or receiving a through clearance to multiple airports are common and essential to function in the limited IFR environment. One participant discussed operational obstacles to flying:

> *From learning how to land, to getting in and out legally with the IFR system's deficiencies. You can't just file IFR. What do you do when you get to mins and can't contact Center? Or your airplane is iced up and the boots don't work. If you land and are covered in ice, what are you going to do? Chip it off? There is no equipment.*
>
> *Operators rely on good information to make safe decisions regarding where they*

> *can land. In the absence of this information, pilots are forced to make decisions in the blind. Participants spoke about unreliable information regarding runway conditions. In smaller communities, local tradespeople are hired to do runway maintenance and inspections.*

Inappropriate equipment for snow clearing, grating, and runway servicing, means that runways are often unusable. One participant discussed the lengths they go to get any information regarding airport conditions:

> *I would say probably half of the places we go it's pretty unreliable. There are only some airports up here that are attended at all hours of the night and DOT is out there plowing or looking at the runway conditions. So sometimes we're lucky that they go out and do that and let us know if there's birds on the runway, or snow on the runway, or ice, and what it looks like to them before we land. There's a lot of places that we go that we don't get that information. And at least a lot of the people that accept our cargo, and some of the radio people . . . she can't tell us exactly what the conditions are, but she can tell us if she has had to scrape off her car window because it was frosty or if she had a foot of snow on her car or not.*

Participants say that challenging infrastructure is only part of what makes flying difficult; the geography and weather patterns of the state itself are factors to contend with. Each participant shared stories that stood out to them regarding weather or terrain. One summed up their experience flying:

> *I think as a pilot you should already be ready for anything to happen. It's almost more extreme here. You have to be ready for everything here, if that makes sense. How many things could go wrong that could kill you, and it happens very often here. I think a lot more often than it does happen down south. It seems like there's an endless list of things that I need to be concerned about up here. I'm still learning and I'm still adding things to that list every day. We have so many things that could cause problems, like the weather and terrain, you know, mud on the runway, landing out in the Part 135, in the villages.*

Participants mention that self-reliance is critical to having a safe and incident-free career.

With minimal services in the Part 135, pilots need to think ahead of every variable and be able to operate without support. The lack of services compounds this, and as participants have said, some information like runway reports or airport notices to airmen (NOTAMs) may not be up to date or trustworthy. The participants further highlighted the importance of local knowledge by intimating that it provides insights into the intricacies of specific locales and best practices for operation. Respondents suggest that pilots learn this information by discussing flights with peers, forming mentorship and camaraderie-like relationships, and by gaining experience slowly and methodically. The intensity of flying requires pilots to be extra mindful about many things' pilots in scheduled operations may take for granted, like access to shelter and basic facilities. A quote highlighting a participant's perspectives on self- reliance is provided below:

> *There are extremes even before you get in the air you're having to think about. What do you have on you? Where are you going to go, who are you going to talk to? I've never thought before I came up to Alaska that I would be shooting approaches to airports without talking to people. I had no concept of that. It truly is a unique place because the pilot has to think through everything of their day. Not just the flight and getting on the ground but after I get on the ground. How do I keep us warm? How do I keep us going? How do I get a hold of somebody to cancel flight plan, tell them we made it? All sorts of strange things.*

Organizational Factors

Organizational factors emerged as a theme discussed by all eight participants. The emergent codes were on management relationships, competition, and efficiency (see Table 10). These codes highlighted organizational impact on employees' attitudes and factors that influence pilot decision-making.

Table 10 – Theme 5: Organizational Factors

Code	Description	Coverage
Management	Interactions with management, attitudes surrounding operating principles, managerial culture, management- employee relationships	75%
Competition	Competition between companies or among employees	37.5%
Efficiency	Completing tasks on-time, meeting customer demands, scheduling demands, duty days	100%

Only two participants had strong negative opinions about the leadership at their company. Overall, 75% of pilots interviewed said they had a good relationship with management. They felt management was generally easy to reach out to and supported the pilots' decision-making.

Interpersonally, the relationships were good, and participants liked their supervisors. Despite this, participants also indicated that management would emphasize the need to get the job done and assign pilots to flights who were more likely to bend rules. This was stressed by one participant, who said:

> *Unfortunately, management knows some guys are willing to do anything to get in no matter the weather. If I go missed, they'll just send someone else.*

Some participants felt that management needed to play a more active role in daily operations. Managers were out of touch with the type and amount of work that employees were being asked to do. One of the interviewees suggested that management personnel occasionally ride-along on normal revenue flights. They would then see the high physical demand of loading/unloading cargo and the fatigue that accompanies multi-leg days. High pilot turnover in some companies could be avoided if pay and hours were increased and decreased respectively. A quote from an interviewee confirmed this:

> *I think we need to start saying, "I'm sorry, I can't do that." If people flew with us, they would say, "Wow." If they had to do it, they would think differently. If they compensated people, they would stay longer. People come here to get experience and leave.*

Five participants discussed the prevalence of company efficiency. Pilots understand that, in order for the company to make money, they need to be flying. This push to fly is one factor that could lead to poor or rushed decision-making. According to the experiences of participants, personnel like management, other pilots, passengers, and representatives in the outstations would push for flights to depart. One participant noted that passengers and station representatives are pushy about flying:

> *Sometimes communities expect too much out of pilots as far as why they're not flying or getting in. There are base managers who aren't pilots who expect you to work miracles.*

Another highlighted how this affects their decision-making:

> *Thinking, "Hey, this is work, we're still trying to get flights done." That has pushed me more out of safety than anything else. "Know the rules but know we're trying to get it done." That has happened, pushing you to do something. I've seen it a lot.*

Despite pressures from company personnel to complete flying, one participant highlighted the dichotomy between efficiency and safety and discussed how pilots are ultimately in control of finding that balance. Read their comments below:

> *The number one priority is to get the job done, but not at the compromise of safety. In 135, your job is to get the job done, and the responsibility of making all the decisions falls on the pilot. Ultimately you can say no.*

Flying requires creativity. If your default is ‘no’ when asked to get a job done, you won’t be successful up here. The default answer needs to be, ‘Let me try to figure out a solution.’

Participants recognized that company reputation is important, yet underscored the effects external time-related pressures have on creating a culture where pilots fly at all costs. This goes hand in hand with competition between companies. If one company is flying, there is more pressure for the other local operators to be flying, too. Participants noted that this pressure exists, but the individual pilots at other companies are keen to share advice and information about weather and runway conditions. In other words, competition doesn’t withhold safety-critical information. To sum up the relationship between competitors:

> *For the most part, everyone is looking out for each other.*

Regulatory Oversight

A common theme emergent in the interviews with respondents was operating in the Part 135 environment within the bounds of regulation and company policies. Table 11 lists codes associated with the theme.

Table 11 – Theme 6: Regulatory Oversight

Code	Description	Coverage
Legality	Regulations, rule-bending, working within the 135 regulatory sphere	87.5%
Oversight	FAA oversight, safety reporting	50%

A reoccurring theme among participants was the concept of decisions that are safe and decisions that are legal. Participants stated that the inadequate IFR infrastructure (e.g., navigational aids, weather reporting systems, radar coverage) may limit safety when pilots are forced to make decisions that are safe but not necessarily legal.

Working with infrastructure deficiencies requires creativity to accomplish both, and today there are circumstances where the pilot needs to choose one option. The legal option may not be the most safe, efficient, or reliable. Participants who have flown longest noted that there has been improvement in this regard and reiterated that 20 years ago, safety-critical flight decisions that were legally questionable were routine but today are less frequent. Despite this improvement, even the newest participant noted the occasional blurred lines between task completion and legality:

> *Sometimes you need to make decisions that are illegal to save you. That happens a lot in Part 135. I think any pilot would choose that. Sometimes legal doesn't mean safe.*

Company culture is important surrounding the "safe versus legal" conversation.

Participants said that safety reporting can be difficult when everyone knows everyone at smaller companies. Anonymity is a luxury reserved for large pilot groups. Because of this, pilots are less likely to share information with management through their safety reporting systems. Pilots talking among themselves and sharing local knowledge and stories was a more effective way to create a good safety culture among the pilot group.

Within a minority of companies, participants say that their internal safety reporting system consisted of a paper drop box in the break room, which was infrequently, if ever, used. The best ways to share and disseminate information was to encourage openness among the pilot group, share relevant information from management, and to establish non-punitive, anonymous reporting systems. A participant buttressed this point with the following quote:

> *People are laissez faire and honest about what they share in hangar talk versus on the record.*

CHAPTER V: DISCUSSION

This research sought to answer questions concerning factors affecting the decision-making of Part 135 pilots. Many communities are accessible only by air and rely on the safety and efficiency of aviation to provide them with goods, services, and transportation. The remoteness, coupled with harsh terrain and weather, creates challenges that aviators of large companies do not encounter. The accident rate has been improving over the past few decades; however, recent high-profile accidents have highlighted the continuing need for research on factors affecting Part 135 pilots.

This qualitative study used semi-structured interviews with current Part 135 pilots as its main instrument. They were asked questions regarding the attitudes on safety in their peer groups, factors affecting their ability to complete flights, as well as to share any stories that stuck out to them from their experiences. Six themes were identified as crucial to their decision-making. These themes, along with important subthemes from the interview data, were interrelated. The relationships are shown in Figure 16.

Figure 16 – The Relationship Between External Themes and Internal Themes

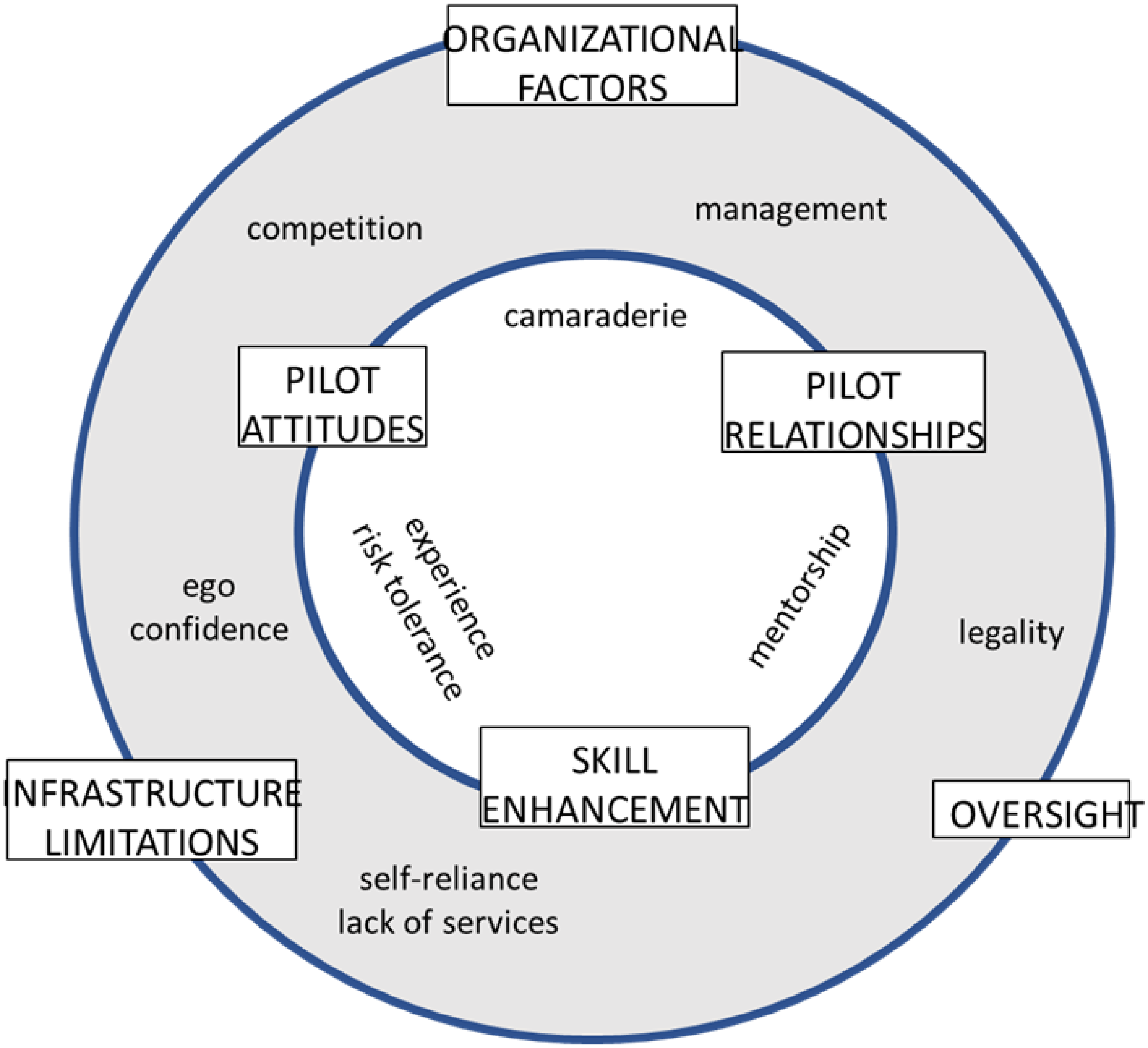


Figure 16 – Author's diagram. Outside ring = external themes. Inside ring = internal themes

Three themes were identified that are considered external factors: organizational factors, oversight, and infrastructure limitations. The remaining three, pilot attitude, pilot relationships, and skill enhancement, are internal factors. During the analysis, strong links were drawn between all six themes. Relationships were discussed at length by pilots in the interviews.

The participants discussed the importance of camaraderie among the pilot group, yet also discussed how important it was for management (organizational factors) to understand each pilot’s specific role and challenges of their environment. Relationships also included those between a pilot and their mentor. Mentorship was the most commonly occurring method for skill enhancement. This was a surprising finding since mentorship had not been mentioned in previous literature on 135 pilots yet was clearly important to the participants when they discussed their social environment.

While mentorship was crucial to cultivate an environment of second-hand earning for decision-making (hangar talk is an invaluable instrument), experience operating and working with the infrastructure limitations and regulatory hurdles was a necessary component to being successful as a pilot. Developing this skillset requires intentional practice and gradually taking on more challenging flights, something management should carefully encourage. Extensive discussions on the five research sub-questions developed to capture the culture and limitations of working as a pilot are provided in this section.

Research Question 1

What are the environmental and operational factors that make flight operations challenging for Part 135 pilots?

The findings show that there are numerous environmental factors that make flight operations challenging. The expansive geography, varied terrain, and differences between regions contribute to these factors. Weather, which can change quickly, often limits pilots from completing flights. There are extreme swings in weather patterns between seasons that pilots are forced to contend with.

Weather specifically challenging includes

(a) areas of white-out conditions,

(b) large expenses of IMC,

(c) long darkness in winter months, and

(d) extreme cold temperatures.

NTSB accident data shows how low ceilings and visibility were more prevalent in serious and fatal accidents than in accidents with no injuries. On the contrary, aircraft accidents with wind patterns as a main causal factor seemed to be more associated with lesser severity in aircraft occupant injury.

Airport facilities, information, and conditions make flight operations challenging. Most airports used by respondents are not required to adhere to Part 139 certification standards. Part 139 defines requirements for airports that serve scheduled passenger-serving operations of more than nine seats or unscheduled operations configured with 31 or more seats. These regulations set standards for (a) snow and ice removal; (b) airport rescue and firefighting; (c) airport condition reporting; and (d) airport signs, markings, and lights; among others. Airports are exempt when they only serve small air carriers with 30 or fewer seats (Certification of Airports, 2013).

In some cases, information on runway status at airports is difficult to obtain and sometimes unavailable. In instances where pilots are landing off-airport, they rely on local knowledge and their abilities to adequately read environmental conditions prior to landing. In the event of an aircraft mechanical malfunction, maintenance services are difficult to find outside of large city centers. It was interesting to note from the perspectives of the interviewees that many airports they operated to or from lacked basic support services such as fuel, pilot rest facilities, or shelter.

This basic lack of services support for flight operations at airports indicated that the remoteness of operational areas contributed to specific job-related concerns for pilots and confirmed findings of previous studies which suggested that reliable flight-related information may be difficult to find (FAA, 2021b). Participants intimated that initiatives such as the weather camera project and Capstone program have contributed to decreasing the positive trends in the rates of accidents and incidents. They, however, emphasized that accessing reliable flight-related information is still a large hurdle in their decision-making.

Due to the varied nature of Part 135 operations, different types of aircraft equipment are utilized frequently. Aircraft are often modified with skis, floats, or to withstand off-airport landings. These types of operations require additional training and skillsets to safely complete flights. Pilots are often drawn to the job due to the varied nature of operations and opportunity to do this unique type of flying. In off-airport operations, there is no published information regarding landing zone condition, weather, or services, since the pilots are working outside of any airport environment.

Operationally, pilots work within a limited IFR system. Navigational aids, weather reporting systems, and gaps in radar and communication coverage make operating in the IFR system challenging. Pilots rely on these types of resources to safely fly IFR across the diverse geographical regions. Pilots often choose to fly VFR as a way to circumvent limitations with weather reporting, IFR navigational aids, and approaches, despite marginal weather conditions.

Research Question 2

What are the organizational factors that influence decision-making among Part 135 pilots?

Findings from this study suggest that organizational factors have an impact on decision-making and have contributed to accidents. The interview data validates results from extant research that pressures from management, like the needs to make money, to build or maintain a reputation, and to be efficient, influence pilots (Bearman et al., 2009).

Participants suggest that, in addition to management, outstation representatives and passengers are often “pushy” and explicitly encourage pilots to make flights in marginal conditions. This could be due to a general misunderstanding of the requirements to safely and legally complete flights.

Despite the generally strong interpersonal relationships between pilots, findings from the interviews show that managerial relationships need improvement. This could be due to a disconnect between management and the pilot group on the reality of day-to-day operations. A positive relationship between pilots and management allows pilots to make decisions in the best interest of safety. Pilots are more likely to turn down flights in which they do not see a successful outcome when management will back them. The influence of theoretical concepts like goal seduction may be lessened when pilots have more support from management to delay or cancel flights.

Mitigating strategies suggested by participants, such as ride-alongs by management to observe the working environment of the pilot group, may help close this gap and create better employee–employer relationships. Despite this, findings from participant interviews and themes gathered from the accident case studies suggest that pilots are susceptible to foot-in-the-door persuasion, as management occasionally selects specific pilots to make flights in marginal conditions. Results highlight the continued importance of creating a work culture where a pilot’s ability to turn down a flight is emphasized within a company.

The results from the case studies and the brief review of NTSB accident data indicate that there was a significant effect of organizational oversight on accident outcomes, though it was surprising that this was not a significant finding from participant interviews. The brief review of NTSB accident data shows that, of the fatal accidents, inadequate oversight or inadequate policies and procedures were contributing factors in up to 30% of accidents.

Causal factors gathered from the case studies presented in this study corroborate this data. Despite efforts from programs like the Medallion Foundation to strengthen operational policy, it was also interesting to note that interview participants valued the advice and knowledge gleaned from mentors and pilot peers with almost equal importance.

Research Question 3

What are the psychosocial and cultural factors that influence decision-making among Part 135 pilots?

Findings show that relationships between pilots are influential in decision-making during flight operations. Results from participant interviews suggest that psychosocial factors like camaraderie may positively influence decision-making and contribute to a safety-centered culture. Many companies have small pilot groups or pilot bases where relationships between crew members are developed. In these close-knit environments, it is natural that relationships influence decision-making, which may be due to theories of modeled behavior from concepts like social cognitive theory.

A stronger sense of camaraderie may lead to organizational change. Findings show that these relationships are generally positive, and camaraderie and mentorship help to instill a safety- positive attitude. This is contrary to previous studies where interview participants suggested that negative peer pressure was more influential on decision-making than camaraderie (Bearman et al., 2009; Michalski & Bearman, 2014). Those pilots who either can't get along or who don't fit in eventually leave. "Fit" within a peer group may be attributed to concepts from social identity theory.

Mentorship was one of the most important factors when determining which group constructs influence pilots. The utility of mentorship, as emphasized by participants in this study, is corroborated by research on the utility of mentorship in STEMM (science, technology, education, mathematics, medicine) fields to developing confidence in skill and successful navigation of work culture (Committee on Effective Mentoring in STEMM, 2019). However, a study on the effects of mentorship for female Airline Transport Pilots did not yield results that mentorship was significant to study participants' feelings of success (Cline, 2017).

The unique environment of Part 135 aviation may contribute to the differences between these two studies. Regardless, mentorship is a significant part of Part 135 pilot culture and may be successful due to its informal implementation. By creating an environment where pilots learn from one another and use the advice of others, safety culture may improve and lead to a reduction of incidents and accidents in the state.

The natural camaraderie that forms among pilots with similar positive safety mindsets helps to instill a safety-conscious attitude in the pilot group. There are outliers within any group of people and the general perception is that pilots who show up and do their job safely are mostly respected. It was inferred from the interview responses that ego was not an admirable trait, especially when it influences the safety of an organization, and that these characteristics were becoming less prevalent in Part 135 operations.

Research Question 4

How do prior experiences and generational/age differences affect decision-making during operations among Part 135 pilots?

The findings show that operational flying experience was one of the most influential qualities when determining the manual flying skill and risk tolerance of a pilot. Findings also suggest that experience is paramount to quality decision-making. It is rather interesting that, based on the opinions of the participants, it could be inferred that biological age had minimal impact on pilot decision-making compared to operational flight experiences. This could be due to exposure to different operational and environmental challenges like weather, terrain, and mechanical malfunctions that may only be gathered from firsthand experience. Sometimes participants may not have direct exposure to challenging situations but will hear secondhand the advice and suggestions from colleagues who have.

Emphasizing the free flow of flight-related information using strategies like hangar talk sessions and safety report dissemination may be particularly valuable for less experienced pilots. These results were similar to findings from the literature that suggested observed behavior may be as influential as firsthand experience in shaping decision-making, especially when considering the strengthened effect of observing behavior with positive outcomes (Wood & Bandura, 1989).

Research Question 5

What is the perception of the safety culture among Part 135 pilots and how does it influence hazard identification and safety risk decisions?

The perception of safety culture among Part 135 pilots is generally positive. Findings show that pilots are willing to share their operational experiences for the benefit of the larger pilot group. SMSs may be difficult to implement in small organizations without proper infrastructure and scaling (FAA, 2021b). The attitude toward these systems is positive; however, findings show there are noticeable areas in which they can be improved.

Interview participants from small companies exposed challenges in implementing truly anonymous reporting systems. One participant with experience in management suggested it is difficult to have true anonymity when the pilot group is close-knit and small. Participants in other companies described how they still use simple and non-online methods (pen and paper in a drop-box) to gather safety reports and how these methods are not taken seriously. The Aviation Safety Action Program, which uses zero-fault incident reports to bolster safety programs, was effective in a survey on Alaska aviation safety (FAA, 2021b). The general perception of these programs is that they could be effective, yet participants reiterated the need for assurances that they are non-punitive and will be treated anonymously.

Based on the opinions from the research participants it could be inferred that the information passed or share between Part 135 pilots has more relevance to the day-to-day jobs than information from their company top management personnel. This could be due to the importance of casual mentorship relationships and strong camaraderie among these pilots.

Hangar talk and sharing local knowledge was more valuable for participants' decision-making in their opinions. The disconnect between the top management perspectives on operational safety and pilot groups must be addressed to further develop a proactive safety culture among 135 pilots and serve as a bedrock for any future SMS implementation.

Implications

Findings from this study emphasize the importance of developing and sustaining a cadre of Part 135 pilots who can operate safely and efficiently within the aviation environment. This will also reduce the prevalent aviation accident rates. The major themes from this study highlight existing issues with infrastructure, oversight, and relationships between organizations and their employees.

Experience was a large component in the effectiveness of aeronautical decision-making. Findings from this study highlight the effectiveness of mentorship and could be used to create programs in Part 135 operations that pair experienced and safety-conscious pilots with new pilots. This mentorship relationship can strengthen camaraderie, and overall social and safety culture within companies. Tapping into the experience of seasoned and safety-conscious pilots and understanding their perspectives could help shape policy as it is implemented within organizations.

Findings suggest that sharing safety-critical information is most effective in a casual setting among some of the Part 135 operators. By understanding this, organizations can decide how best to implement new safety measures, share critical information, and train their pilots for the unique environment in which they fly. Further research on the effectiveness of hangar talk and similar casual types of information sharing could be beneficial in influencing practices for operators. The findings on the importance of local knowledge could guide FAA initiatives to gather and disseminate this information through informal but widespread and accessible means.

A push for continuing infrastructure developments from local and federal sources that address shortcomings in weather reporting, navigational aids, and radar coverage will help give pilots options and provide information that may ultimately prevent accidents. The FAA Alaska Aviation Safety Initiative Final Report, published in October 2021, underscored the need for improvement to this infrastructure (FAA, 2021b). Continuing improvement, despite the monetary challenges, is the most forthright change to improve safety.

Limitations

A limitation was the possibility that information was withheld that could cause embarrassment or loss-of-face due to social-desirability biases and self-serving biases on the part of the participants. In an informal setting, most pilots are keen to engage in hangar talk and share their experiences. The formal setting of the interviews may have contributed to feelings that participants could not speak freely of their experiences due to these factors. To mitigate these limitations, an emphasis on participant confidentiality was asserted and the researcher attempted to maintain a casual rapport with participants. The semi-structured format of the interviews allowed pilots the opportunity to spend time discussing what they felt was most important to the culture of Part 135 pilots.

The scale and scope of Part 135 operations is wide. Individual pilots can apply for Part 135 operating certificates and organizations with hundreds of pilots also operate under the same regulations. This study used a cross section of pilots from various Part 135 operations. It is possible that further studies on small or large Part 135 companies will reveal more precise and rich results for each subset of the Part 135 industry.

Another limitation is personal and expectation bias due to the researcher's preconceived notions and experiences as a Part 135 pilot. The researcher's research interests stemmed from those experiences and the fatal accident involving multiple colleagues. The researcher's experiences were valuable in creating an environment during interviews where participants could feel understood and relate to the interviewer. Interview data was audited by an external reviewer and the researcher's graduate researcher advisor to ensure potential elements related to such personal biases were identified and objectively addressed. Member checking in the form of allowing the participants to authenticate transcripts prior to final theming and analysis was done to minimize potential biases and issues with trustworthiness.

Conclusion

This study was an ethnographic analysis of the psychosocial and organizational factors that influence Part 135 pilot decision-making. The study explored the perspectives of eight Part 135 pilots who currently fly using semi-structured interviews. NTSB accident data from the period of 2008 to 2018 was used to corroborate findings from the interviews, along with three case studies of recent fatal accidents.

Significant findings include themes from the semi-structured interviews that highlight the importance of internal factors on pilot decision-making. These themes were (a) pilot relationships, (b) pilot attitudes, and (c) skill enhancement. Results show that strong positive relationships can be formed through mentorship, developing camaraderie, sharing experience, and cultivating cockpit relationships, which contribute to the decision-making skills of pilots.

The theme related to pilot attitudes and culture suggested that bravado, daring, and risk- taking used to be valued among Part 135 pilots some 20 years ago. Currently, the trends are shifting and to earn respect among peers, pilots must demonstrate desired attributes such as honesty, humility, and openness. Findings also suggest that Part 135 pilots become more safety-risk conscious and develop better ADM skills through advice from peers and their own personal flight experiences.

The other major themes culled from pilot interviews emphasize the impactful external factors affecting pilots: (a) infrastructure limitations, (b) organizational factors (including management relationships and efficiency), and (c) regulatory oversight. Infrastructure limitations are reoccurring obstacles in Part 135 pilot decision-making. Pilot relationships with top-level management would benefit from a more active role by managers in the day-to-day of the employees. From a regulatory standpoint, results show pilots may sometimes be faced with difficult decisions regarding legal options due to infrastructure limitations like inadequate weather reporting and navigational tools.

This study adds to a paucity in existing literature on Part 135 pilots' ADM during operational activities. This study also fills a gap in studies related to aviation safety issues This study is timely for the Alaskan aviation sector as there have been some recent fatal accident despite a general downward aircraft accident rate. Findings from this study may provide an empirical basis in formulating procedures that emphasize a safety-centered approach to decision-making. From a regulatory standpoint, findings further illuminate the viewpoints of essential stakeholders (pilots) on how the limitations posed by technically obsolete or inadequate aviation infrastructure leads to regulatory violations and compromises operational safety.

Further studies using a quantitative or mixed methods approach with a larger sample is highly recommended to further understand how the challenges of psychosocial factors impact decision-making among the diverse population of Part 135 pilots. Longitudinal studies with cohorts of Part 135 pilots as they operate within that environment may be an excellent empirical approach to holistically understand the interrelationships of the study variables over time.

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