July 24, 2024 Aviation Investigation Report AIR-24-03

Special Investigation Report

Safety and Industry Data Improvements for Part 135 Operations

Abstract: This report discusses the National Transportation Safety Board's review of the investigation reports for the 116 fatal accidents and 460 nonfatal accidents involving flights operated under Title 14 *Code of Federal Regulations* Part 135 that occurred from 2010 to 2022. The safety issues identified in this report include operational control and flight-locating deficiencies that can be addressed by using certificated dispatchers; weight and balance concerns with single-engine aircraft operations that can be addressed by using a load manifest; and the importance of organizational risk management strategies, such as an appropriately scaled safety management system and a flight data monitoring program. This report also addresses needed improvements in the collection and reporting of aircraft accident and flight activity data. Three recommendations are made to the Federal Aviation Administration (FAA). In addition, two previously issued recommendations to the FAA are reiterated, and two previously issued recommendations to the FAA are classified Closed—Acceptable Action.

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Acronyms and Abbreviations

AC	advisory circular
CAROL	Case Analysis and Reporting Online
CFR	*Code of Federal Regulations*
CG	center of gravity
FAA	Federal Aviation Administration
FDM	flight data monitoring
HAA	helicopter air ambulance
IFR	instrument flight rules
IMC	instrument meteorological conditions
NPRM	notice of proposed rulemaking
NTSB	National Transportation Safety Board
PIC	pilot-in-command
SAFTI	System for Analysis of Federal Transportation Investigations
SAS	safety assurance system
SMS	safety management system
TAWS	terrain awareness and warning systems
VFR	visual flight rules

Executive Summary

Title 14 *Code of Federal Regulations* (*CFR*) Part 135 applies to a wide variety of commercial aviation operations of all sizes providing diverse types of services for hire. These range from single-pilot operators that conduct limited operations using one single-engine airplane, to small fleet air tour operators, to larger and more complex operations, such as commuter air carriers, air ambulance services, jet charters, and essential passenger, cargo, and mail-carrying operations for remote areas. Different limitations and requirements apply to different segments of the industry based on the Part 135 operator's certificate type, operating authority, and scope.

Historically, accident rates for Part 135 operations have remained higher than the accident rates for commercial airline operations operated under 14 *CFR* Part 121, which are subject to the Federal Aviation Administration's (FAA's) highest level of regulation and oversight. However, the diverse mission demands of some segments of the Part 135 industry may inherently involve unique risks that typically do not exist for Part 121 operations. Closing the safety gap for these segments of Part 135 must involve targeted solutions that effectively mitigate unique risks without hindering operators' ability to provide their services.

In December 2022, the National Transportation Safety Board (NTSB) initiated this special investigation of Part 135 operations after our investigations of several accidents in recent years highlighted similar deficiencies, suggesting a need for a more comprehensive review of the industry. This special investigation identified 116 fatal accidents and 460 nonfatal accidents involving flights operated under Part 135 that occurred from 2010 to 2022. We sought to identify any trends or similarities in the types of deficiencies that led to the accidents; evaluate the circumstances of each accident in the context of applicable regulations and potential mitigations that could prevent similar accidents; and review accident and flight activity data to determine whether those data could support an assessment of any trends in the historic accident rates for different industry segments based on certificate type, operating authority, and scope.

What We Found

We identified 12 accidents involving Part 135 operators that highlighted operational control or flight-locating deficiencies and resulted in 45 fatalities and 13 serious injuries. These deficiencies could all be addressed through the required use of certificated dispatchers. The defined operational control responsibilities and the standardized certification criteria, initial and recurrent training, and competency checks required of certificated dispatchers can help ensure that dispatchers, as part of their joint responsibility for the safety of the flight, would effectively support pilots

with their preflight and in-flight decision-making, including recognizing and avoiding high-risk situations.

We identified 5 accidents that involved Part 135 operations of single-engine aircraft with weight and balance concerns, which resulted in 11 fatalities and 6 serious injuries. These accidents suggest persistent, systemic operational pressures or deficiencies related to single-engine aircraft loading. Requiring load manifests and record-keeping for single-engine aircraft operated under Part 135 would not only help pilots detect and correct unsafe loading conditions but also provide operators and FAA inspectors the information needed to support proactive, comprehensive assessments to identify any related operational risk areas that may influence improper aircraft loading and mitigate them before an accident occurs.

We identified additional accidents that further support requiring Part 135 operators to implement a safety management system (SMS), as we recommended to the FAA in 2016. SMS provides a process by which operators can incorporate a formal, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. On April 26, 2024, the FAA issued a final rule to require SMS for all Part 135 operators, which is responsive to our safety recommendation. In the final rule, single-pilot and single-pilot-in-command (PIC) operators, which have the most limited size and scope, were excepted from certain requirements that the FAA determined would be impractical for their operations. In 2022, we recommended that the FAA develop guidance to help operators of limited size and scope implement an appropriately scaled SMS. On May 21, 2024, the FAA issued a revised advisory circular that provided such guidance, which is responsive to our safety recommendation.

We also identified accidents that further support requiring Part 135 operators to establish a flight data monitoring (FDM) program and install recording devices capable of supporting it, as we recommended to the FAA in 2016. FDM programs (which are often incorporated into an SMS) can provide Part 135 operators with objective information regarding how their pilots conduct flights and assist operators in detecting and correcting unsafe deviations from standard operating procedures before an accident occurs.

In addition, when performing our review of accidents for this special investigation report, we found that neither the accident and incident data within our own database nor the flight activity data compiled by the FAA could fully support a comprehensive assessment of the safety of the Part 135 industry, highlighting the need for improved data collection and reporting methods. We believe that accident data and flight activity data for Part 135 operations that identify accidents and activity for different segments of the industry based on certificate type, operating authority, and scope are necessary to determine the accident rate for each segment, support

evaluations of the suitability of the varied regulatory standards and levels of oversight applied to each segment, and develop targeted safety initiatives, as needed.

What We Recommended

We issued three recommendations to the FAA. We recommended that the FAA require all Part 135 operators, except single-pilot and single-PIC operators, to use certificated dispatchers who hold joint responsibility with the PIC for the safety and operational control of flights and whose responsibilities include preflight planning; flight dispatch, release, and cancellation decisions; and flight monitoring; consistent with the requirements for Part 121 domestic and flag operations.

We recommended that the FAA expand the applicability of the load manifest and recordkeeping requirements of 14 *CFR* 135.63(c) to include Part 135 single-engine aircraft operations.

We also recommended that the FAA develop, validate, and implement a single, unbiased method for generating activity data for all Part 135 certificate holders to include the identification of activity by certificate type (air carrier or operating), operating authority (on-demand or commuter), and scope (standard, basic, single-pilot, or single-PIC).

We also reiterated the following safety recommendations made previously to the FAA:

> Require all Part 135 operators to install flight data recording devices capable of supporting an FDM program. (A-16-34)
>
> After the action in Safety Recommendation A-16-34 is completed, require all Part 135 operators to establish a structured FDM program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues. (A-16-35)

We also classified the following safety recommendations made previously to the FAA as Closed—Acceptable Action:

> Require all Part 135 operators to establish SMS programs. (A-16-36)
>
> Develop guidance for small operators for scaling an SMS that includes methods and techniques for implementation and specific examples applicable to several operational sectors, including air tours. (A-22-15)

1. Introduction

Title 14 *Code of Federal Regulations* (*CFR*) Part 135 applies to a wide variety of commercial aviation operations of all sizes providing diverse types of services for hire. These range from single-pilot operators that conduct limited operations using one single-engine airplane, to small fleet air tour operators, to larger and more complex operations, such as commuter air carriers, air ambulance services, jet charters, and essential passenger, cargo, and mail-carrying operations for remote areas that lack the infrastructure to support scheduled service by air carriers operated under 14 *CFR* Part 121. Industrywide, in 2024, about 1,850 Part 135 certificate holders operated about 11,760 aircraft to provide these types of services (FAA 2024b and 2024c, 33096).

Generally, for most Part 135 certificate holders, different levels of regulatory requirements and oversight apply based on certificate type (air carrier or operating), operating authority (commuter, sometimes referred to as "scheduled," or on-demand, sometimes referred to as "nonscheduled"), and scope (standard, basic, single-pilot, or single-pilot-in-command [PIC]). About 550 Part 135 certificate holders (about 30%) are single-pilot or single-PIC operators, which have the most limited scope, inherently fly only limited hours annually (using only one authorized PIC), and are subject to the lowest levels of regulatory requirements and oversight compared to other Part 135 operations (FAA 2024c, 33096) (see figure 1).

In December 2022, the National Transportation Safety Board (NTSB) initiated this special investigation of Part 135 operations after our investigations of several accidents in recent years highlighted similar deficiencies, suggesting a need for a more comprehensive review of the industry. This special investigation reviewed the investigation reports for the 116 fatal accidents and 460 nonfatal accidents involving flights operated under Part 135 that occurred from 2010 to 2022 to identify any trends or similarities in the types of deficiencies that led to the accidents.[1] Historically, accident rates for Part 135 operations have fluctuated from year to year but have remained higher than the accident rates for Part 121 commercial airline operations, which are subject to the Federal Aviation Administration's (FAA's) highest level of regulation and oversight (see figure 2).

[1] (a) These totals reflect all accidents involving flights operated under Part 135 during these years. Flights operated under Part 91 by Part 135 certificate holders were not included. At the time of this report, the investigations for seven accidents (two fatal and five nonfatal) were not yet completed. Thus, only preliminary information for these accidents was available for review. Further, six accidents (two fatal and four nonfatal) occurred in other countries, and the investigations were performed by their respective authorities. (b) Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case DCA23SR001). Use the CAROL Query to search investigations and safety recommendations.

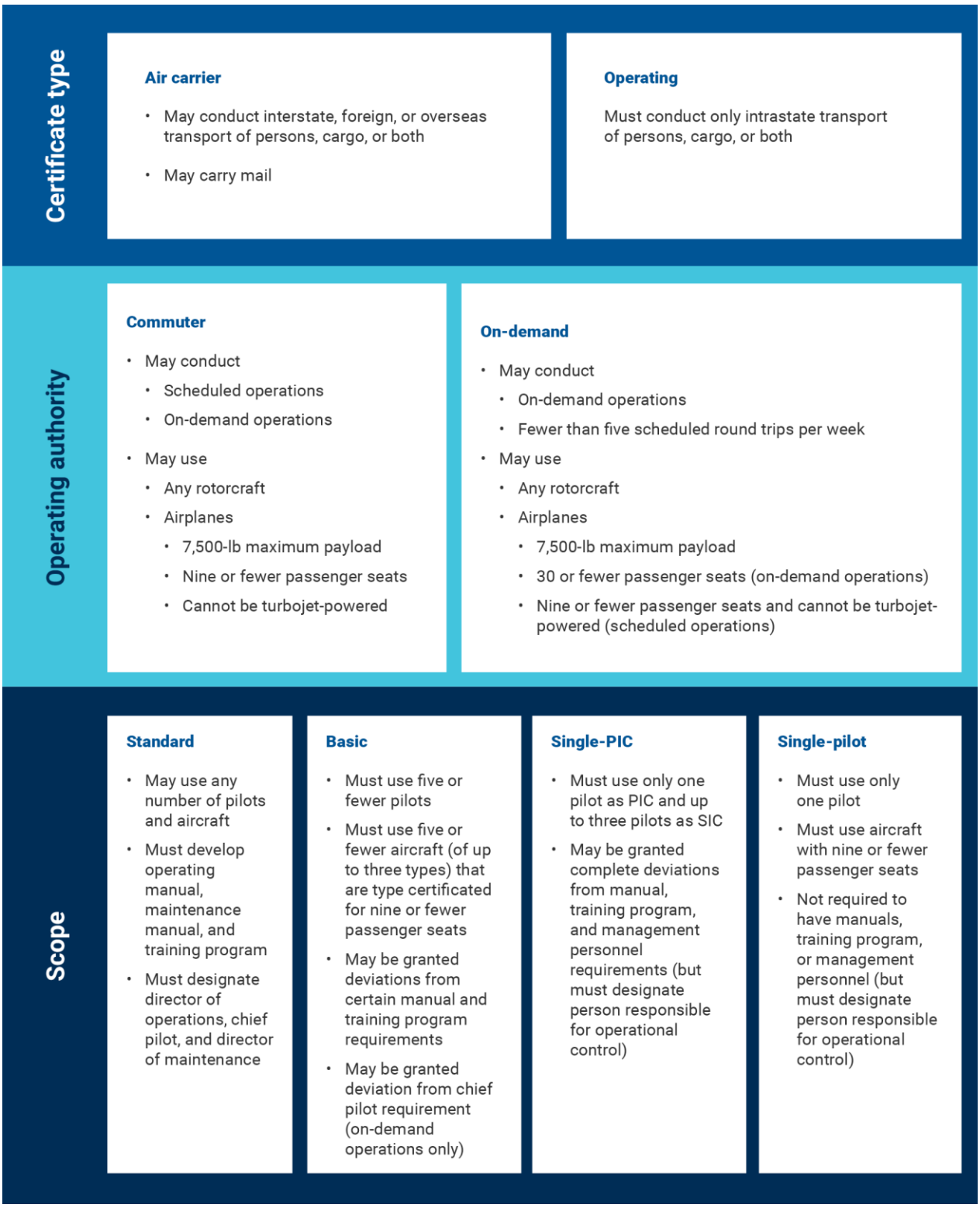

Figure 1. General characteristics and limitations of most Part 135 operations based on certificate type, operating authority, and scope (FAA 2023e and 2023g, 1–4).

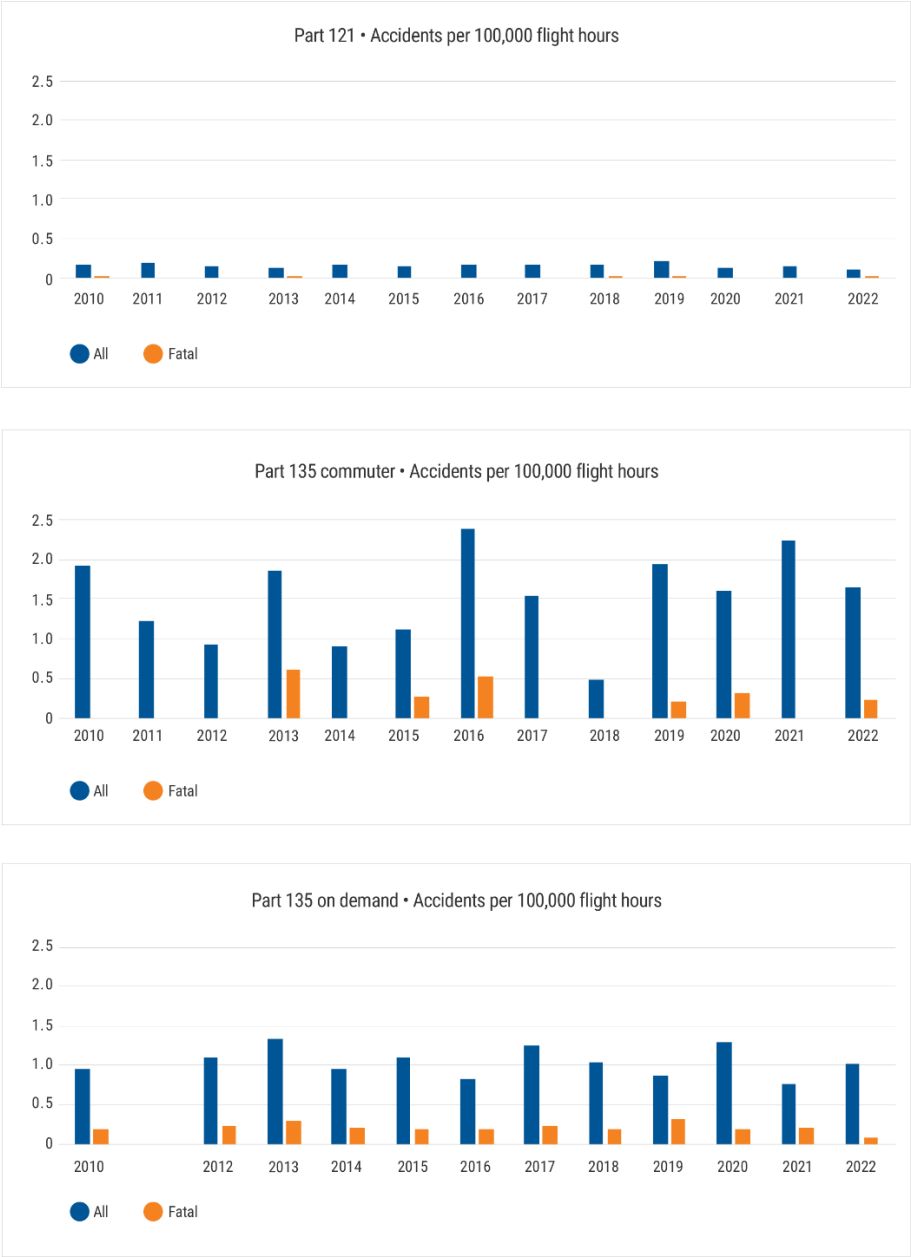

Figure 2. Accident rate comparison for Part 121, Part 135 commuter, and Part 135 on-demand operations for years 2010 through 2022.[2]

[2] The NTSB computed these accident rates using annual flight activity estimates provided by the FAA. No data for Part 135 on-demand operations were available for calendar year 2011 (NTSB 2023). The FAA does not provide flight hour estimates for Part 135 operations by scope. Accident rates per 100,000 flight hours are calculated by dividing the number of accidents (the numerator) by the number of hours flown (the denominator) and multiplying the result by 100,000.

Although the NTSB has long believed that the traveling public deserves one level of safety across all parts of commercial aviation, we also recognize that the diverse mission demands of some segments of the Part 135 industry may inherently involve unique risks that typically do not exist for Part 121 operations. For example, emergency medical services operators provide time-critical, life-saving transport for patients or donor organs, and such services may be requested at any time of day or night and during all types of weather conditions. Further, helicopter air ambulance (HAA) operations may be exposed to additional risks when providing services for destinations that may be remote, unfamiliar, or unimproved.[3]

Also, many passenger, cargo, and mail-carrying operations in Alaska operate in areas of challenging weather and terrain and serve remote areas that lack the communications, weather-reporting, and other infrastructure needed to support instrument flight rules (IFR) operations.[4] Closing the safety gap for these and other segments of Part 135 must involve targeted solutions that effectively mitigate the unique risks without hindering operators' ability to provide their services.

Our review of completed investigation reports identified 12 accidents that support the need for improving operational control and flight-locating procedures. Summaries of these accidents and our history of related safety recommendations are discussed in section 2. We also identified four accidents characterized by aircraft weight and balance issues that support expanding the load manifest and recordkeeping requirements (which already apply for multiengine aircraft operations)

[3] In 2006, the NTSB issued Safety Recommendations A-06-12 through A-06-15 to the FAA that sought to improve protections for passengers, pilots, and other personnel on board without burdening emergency medical services operators with undue requirements (NTSB 2006, vii). In 2014, the FAA implemented rulemaking for HAA operations that was mostly responsive to our recommendations (FAA 2014b). As a result, we classified Safety Recommendations A-06-12, A-06-13, and A-06-15 Closed—Acceptable Action and Safety Recommendation A-06-14 Closed—Acceptable Alternate Action on September 11, 2014. See appendix B for more information.

[4] In 2018, the NTSB issued Safety Recommendations A-18-16 and A-18-17 to ask the FAA to install communications equipment and weather-reporting capabilities to allow increased IFR operations for Part 135 operators in Alaska (NTSB 2018). These recommendations, which resulted from our investigation of a 2016 fatal accident involving a Part 135 commuter operation in Togiak, Alaska, are classified Open—Acceptable Response. The NTSB also performed Alaska-specific safety studies in 1980 and 1995, hosted a roundtable discussion with Alaska Part 135 operators and other industry stakeholders in 2019, and issued an Alaska air tour-specific safety recommendation report in 2022, as part of our longstanding interest in addressing the unique safety challenges faced by aviation operations in Alaska (NTSB 1980, 1995, 2019, and 2022c).

to include single-engine aircraft operations; these accidents and our history of safety recommendations on this topic are discussed in section 3.[5]

Also, some of the safety tools and strategies that have proven effective over time at enhancing the safety of Part 121 operations are adaptable and appropriate for Part 135 operations. These include requirements for implementing proactive, organizational risk management strategies, such as a safety management system (SMS), which has been required for Part 121 operators since 2018, and a flight data monitoring (FDM) program, which can be incorporated into and support an SMS. In 2016, we issued one recommendation to the FAA to require SMS and two recommendations for FDM equipment and program requirements for Part 135 operators. Further, in 2022, we issued one recommendation to the FAA to develop guidance for small operators for scaling an SMS. On April 26, 2024, the FAA issued a final rule to require SMS for all Part 135 operators, and, on May 21, 2024, it issued a revised advisory circular (AC) containing SMS scalabilty guidance; these actions are responsive to two safety recommendations. However, the FAAhas not yet completed acceptable action regarding FDM equipment and programs. Section 4 discusses our safety recommendations concerning SMS and FDM programs and how these processes may be used to help Part 135 operators formalize and scale organizational risk management strategies to prevent accidents.

When performing our review of accidents for this special investigation, we sought to categorize each accident based on Part 135 certificate type, operating authority, and scope; evaluate the circumstances of each accident in the context of applicable regulations and potential mitigations that could prevent similar accidents; and assess any trends in the historic accident rates for each industry segment. However, we found that neither the accident and incident data within our own database nor the flight activity data compiled by the FAA could fully support such an assessment, highlighting the need for improved data collection and reporting methods. Section 5 discusses measures for addressing these accident data collection and flight activity data needs.

[5] Although our accident review for this report extended back to 2010, all four accidents that support the load manifest requirements occurred since 2015, after we issued our last safety recommendation on the subject.

2. Operational Control and Flight-Locating Issues

All Part 135 operators are required to maintain operational control, which is defined (per 14 *CFR* 1.1) as the "authority over initiating, conducting, or terminating a flight." This requirement includes specifying who is authorized to exercise operational control and the conditions under which a flight may be operated (for example, certain weather minimums and fuel requirements). Operators are also required to have procedures for ensuring that, "when safety conditions specified for a flight cannot be met, the flight is canceled, delayed, rerouted or diverted," as well as flight-locating procedures that provide for the timely notification of an FAA or search and rescue facility if an aircraft is overdue or missing (FAA 2016c, 7–9).[6]

Generally, for Part 135 operations of standard scope, a company manager, such as the director of operations, the chief pilot, or both, exercises the first tier of operational control, which includes assigning flight crewmembers and aircraft. For most Part 135 operators, the authority for second-tier operational control, which involves decisions related to the day-to-day conduct of operations and is more tactical than the first tier, is held by the PIC. Depending on company policy, the PIC may exercise that authority either alone or jointly with other designated and trained company personnel, such as those who provide preflight planning support or perform required flight-locating duties (FAA 2016c, 13).

According to the FAA, due to the diversity of Part 135 operations, the methods by which operators perform their operational control functions are not defined by regulation; the intent is to allow each operator the flexibility to develop a system that fits its particular operation. FAA guidance for its inspectors has noted that PIC operational control authority is typically adequate for general-purpose, on-demand operations but may be inappropriate for "commuter operations, air ambulance services, jet transport operations, operations conducted beyond the contiguous states, extended overwater operations, and complex operations requiring extensive planning or coordination" (FAA 2016c, 1).

The FAA has recognized that certain operators with operational control systems that require joint concurrence between the pilot and other authorized personnel for flight release decisions have significantly better safety records than

[6] Part 135 operators are required to list company personnel authorized to exercise operational control and to have flight-locating procedures for flights not operating on a flight plan filed with the FAA (per 14 *CFR* 135.77 and 135.79, respectively). Flight-locating procedures must provide the operator with the location, date, and estimated time for reestablishing communications if the flight will operate in an area where communications cannot be maintained.

comparable operators without such systems (FAA 2016c, 1).[7] Although FAA guidance states that principal operations inspectors "should strongly recommend" such systems for the Part 135 operators they oversee, the FAA does not require them, except for the operations control center requirement for HAA operators with a fleet of 10 or more helicopters (FAA 2016c, 1 and 18).[8] For Part 135 operators that electively incorporate joint operational control support, the regulations do not specify any training or qualification standards for the personnel who perform these tasks (other than what applies for pilots and certain managers); each operator determines the level of training, knowledge, and skills that the company considers appropriate for these individuals.

In contrast, Part 121 domestic and flag operators meet their operational control and flight-locating requirements using certificated dispatchers.[9] Dispatcher certification requires the completion of an approved training course (or documentation of acceptable experience) and passing scores on knowledge and practical tests.[10] Certificated dispatchers required for Part 121 operations hold joint

[7] Specifically, the FAA cited data for law enforcement and air ambulance service operators that had such systems versus those that did not.

[8] Title 14 *CFR* 135.619 established the operations control center requirement, effective April 22, 2016, for HAA operators with 10 or more helicopters. The regulation includes initial and recurrent training requirements for operations control center personnel and specifies training topics, including aviation weather and flight monitoring, that must be covered during their training. We note that, although the FAA implemented these requirements in response to our Safety Recommendation A-06-14, the regulation did not apply to all emergency medical services operators, as we had recommended, and the FAA did not include certification requirements for the operations control center personnel, as we had intended (NTSB 2011, 4). We classified Safety Recommendation A-06-14 Closed—Acceptable Alternate Action on September 11, 2014. See section 2.2 and appendix B for more information.

[9] Domestic and flag operations involve scheduled operations, with domestic operations conducted (generally) between points within the United States, whereas flag operations may include one or more points outside the United States. Another subset of Part 121, supplemental operations, is not subject to the certificated dispatcher requirement but must have a flight-following system, per 14 *CFR* 121.125. Flight followers used in Part 121 supplemental operations may have certain operational control authority (as delegated by the director of operations), and the operator must define their qualifications, guidance, and procedures in its manuals (FAA 2016c, 11–12 and Appendix 4, 1). Supplemental operations are not scheduled and involve flights for which the departure time, departure location, and arrival location are specifically negotiated with the customer; all-cargo operations; or certain public charter operations, as specified in 14 *CFR* 110.2.

[10] An approved dispatcher course (per 14 *CFR* 65.61 and Part 65, appendix A) involves a minimum of 200 hours of training on regulations, meteorology, navigation, aircraft, communications, air traffic control, emergency and abnormal procedures, and practical dispatch applications. Alternatively, acceptable experience (per 14 *CFR* 65.57[a]) includes having worked at least 2 years (in the preceding 3 years) as a military pilot, flight navigator, or meteorologist; a Part 121 pilot, flight engineer, meteorologist, or assistant dispatcher; an air traffic controller or a flight service specialist; or

responsibility with the PIC for the safety and operational control of flights, including preflight planning, flight delays, and flight dispatch releases. Dispatchers' responsibilities include monitoring the progress of each flight, issuing necessary information for the safety of the flight (such as meteorological information to identify potential hazards and the most desirable route of flight), and canceling or redispatching the flight if either the dispatcher or the PIC determines that the flight cannot be operated safely as planned or released.[11]

Certificated dispatchers in Part 121 operations are part of an operational control system in which operational control responsibilities, authority, and procedures for flight planning, aircraft dispatch and release, flight monitoring, and other functions must be defined in company manuals for not only the dispatchers but also others within the system (FAA 2016c). Further, certificated dispatchers required for Part 121 operations are subject to initial and recurrent training requirements and competency checks, and they have inherent accountability for their performance, as their certificate can be suspended or revoked if they perform in an unsafe manner.[12]

However, unlike the standardized requirements and procedures for dispatchers used in Part 121 operations, the operational control and flight-locating methods used by Part 135 operators, as well as the training and qualifications of the personnel who perform such tasks, can vary widely. Although Part 135 operators may commonly use terms like "dispatcher," "flight follower," "flight monitor," "flight coordinator," "operational control agent," "flight locator," or "specialist" to refer to various personnel who perform various flight support duties, such personnel are not required to hold a dispatcher certificate, and their duties are not defined by regulation for Part 135 operations (except for the flight-locating requirement specified in 14 *CFR* 135.79).[13]

2.1 Related Accidents

We identified 12 accidents involving Part 135 operators that highlighted operational control or flight-locating deficiencies and resulted in 45 fatalities and

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while performing other duties that the FAA considers equivalent. The knowledge and skill requirements covered by the computer-based knowledge test and the evaluator-administered practical test are described in 14 *CFR* 65.55 and 65.59, respectively.

[11] These responsibilities are specified in 14 *CFR* 121.533 and 121.535.

[12] The training and competency check requirements are specified in 14 *CFR* 121.415, 121.422, 121.427, and 121.463).

[13] These personnel may or may not have delegated operational control authority; if they do, such authority must be defined in the company's general operations manual or operations specifications.

13 serious injuries. (None of these accidents involved single-pilot or single-PIC operators, which are discussed further in section 4.1.) The following sections discuss these accidents in order of complexity of the operators' operational control methods, which ranged from allowing the PIC authority over the flight (with little or no support from other company personnel) to using joint authority between the PIC and other personnel or operations control center specialists. Accidents involving flight-locating deficiencies are discussed last.

Our investigations found that, for each Part 135 operator, essential operational control functions, such as preflight weather and fuel planning, flight release, flight monitoring, or flight locating, were performed without adequate company procedures or by individuals who lacked the training, knowledge, or experience to effectively perform such critical safety duties.

2.1.1 Pilot-in-Command Authority

Three accidents involved Part 135 operators whose procedures were such that the PIC conducted the flight under their own authority with little or no preflight risk management or tactical decision-making support.

One accident occurred on November 28, 2011, when an airplane operated under IFR as an emergency medical services flight lost engine power due to fuel exhaustion and crashed near Riverwoods, Illinois.[14] The pilot and two passengers were fatally injured, the pilot-rated passenger sustained serious injuries, and the medical crewmember sustained minor injuries. Our investigation found that the director of operations (who was responsible for first-tier operational control) was also responsible for monitoring all flights and approving all departures (typically second-tier personnel duties) for the company, which operated four airplanes from bases in in Wisconsin, Illinois, and South Carolina and employed three pilots and one mechanic. Although the company had a fuel log, the director of operations (who was also the company president) did not review it or designate anyone to do so. Further, the accident pilot's time on duty exceeded the regulatory 14-hour maximum; thus, he should not have been assigned to the accident flight.[15]

Another accident involved an on-demand charter airplane that was operated under visual flight rules (VFR) but encountered poor visibility conditions and crashed into mountainous terrain near Angoon, Alaska, on April 8, 2016. The pilot and two passengers were fatally injured, and one passenger was seriously injured.[16] The

[14] See NTSB case CEN12FA086 in appendix A for more information.

[15] Assigning flight crews is a first-tier operational control function.

[16] See NTSB case ANC16FA017 in appendix A for more information.

accident pilot and the director of operations were partners in the company and its only employees.

Flight-tracking data for the airplane showed that the pilot made several turns in various locations where the investigation determined the mountain peaks were obscured by clouds, and the last turn ended near the accident site. The director of operations had been flying at the time that the accident pilot contacted him (while en route) via radio to report his plans to divert over lower terrain due to poor visibility. Thus, the director of operations did not see the actual routing of the accident flight (using the company's flight-tracking system) until after he completed his own flight. Our investigation determined that, at the time of the accident, the pilot likely mistakenly believed that he chose alternate routing over lower terrain when, actually, he had flown into a different valley surrounded by much higher terrain and was unsuccessful in his attempt to clear it.

Another accident occurred on August 4, 2018, when an airplane operated as an air tour flight under VFR likely encountered reduced visibility weather conditions before it struck steep, snow-covered terrain near Talkeetna, Alaska.[17] The pilot and the four passengers were fatally injured. The company operated 23 airplanes and employed about 30 pilots and 5 flight followers. The director of operations, chief pilot, and 12 airplanes were based in Anchorage, Alaska, and a base chief pilot and 11 airplanes were based in Talkeetna. Our investigation found that, although the flight followers' duties could include discussing weather conditions with the pilots, the company had no formal, written, preflight risk assessment process by which pilots or flight followers assessed actual risk associated with a particular flight route and weather conditions. Also, the company had no standard tour routes, and its pilots were able to change the routes at their discretion based on their in-flight assessment of the weather conditions.

2.1.2 Joint Authority: Pilot-in-Command and Other Support Personnel

Three accidents involved Part 135 operators whose pilots shared operational control (that is, the authority over initiating, conducting, or terminating a flight) with other support personnel. These accidents involved an air tour flight and two commuter flights.

On June 25, 2015, an airplane operated as an air tour under VFR encountered instrument meteorological conditions (IMC) and crashed into mountainous terrain

[17] See NTSB case ANC18FA063 in appendix A for more information.

near Ketchikan, Alaska, fatally injuring the pilot and the eight passengers.[18] The company employed about 30 to 40 people and operated 11 airplanes, with 9 airplanes based in Alaska and 2 in Florida. Employees included management personnel, nine seasonal pilots, and a few flight schedulers. Flight schedulers' duties (as defined in the company's general operating manual) included monitoring, assessing, and reassessing weather conditions and jointly agreeing with the pilot that the flight can be conducted safely.

However, on the day of the accident, the flight scheduler on duty and the accident pilot did not discuss the weather conditions or an agreement about the safety of the flight. As a result, the decision to initiate the accident flight rested solely with the accident pilot, who had less than 2 months' experience flying air tours in southeast Alaska and had previously demonstrated difficulty calibrating his own risk tolerance for conducting tour flights in weather that was marginal or below minimums.

Our investigation found that the company had not provided sufficient training and supervision to ensure that the flight scheduler was qualified per 14 *CFR* 119.69 and able to work effectively with the pilots to make safe and appropriate operational control decisions. We concluded that a flight scheduler with more in-depth operational control training might have played a more influential role in ensuring that flights conducted on the morning of the accident were safe for pilots to initiate and complete (NTSB 2017, 57).[19]

On November 29, 2013, an airplane operated as a commuter flight under VFR encountered IMC at night and struck terrain about 1 mile from the destination airport in Saint Mary's, Alaska.[20] The pilot and three passengers were fatally injured, and six passengers were seriously injured. The company operated 56 airplanes and had 12 bases throughout Alaska. Company employees included management personnel, about 130 pilots, and about 80 flight coordinators.

Our investigation found that the company's procedures for operational control and flight release and its training and oversight of operational control personnel were inadequate and contributed to the accident. For example, on the day of the accident, neither of the flight coordinators assigned to the accident flight discussed the flight

[18] See NTSB case ANC15MA041 (Report No. AAR-17/02) in appendix A for more information.

[19] As a result of our investigation, we issued nine recommendations to the FAA, including Safety Recommendation A-17-39, which recommended that the FAA establish minimum initial and recurrent training requirements for personnel authorized to exercise operational control. Safety Recommendation A-17-39 is classified Open—Unacceptable Response. See appendix B for more information.

[20] See NTSB case ANC14MA008 in appendix A for more information.

risks with the accident pilot (as required by company procedures), and neither had received any company training on the risk assessment program. Further, a review of FAA surveillance records for the company revealed that FAA inspectors had repeatedly noted deficiencies with the company's training, risk management, and operational control procedures (similar to the deficiencies identified in the NTSB's accident investigation) but did not hold the operator sufficiently accountable for correcting them.

Another airplane operated as a commuter flight under VFR encountered IMC and crashed near Juneau, Alaska, on July 17, 2015.[21] The pilot was fatally injured, and the four passengers were seriously injured. The company operated 21 airplanes and had bases in Alaska, Oregon, Tennessee, and California. Company employees included management personnel, about 80 pilots, and about 7 flight coordinators.

Our investigation found that, although company procedures required pilots and flight coordinators (whose duties and operational control authority were defined in the general operations manual) to jointly perform preflight planning and flight release, the company's flight risk assessment form was not completed for the accident flight. Also, neither the accident pilot nor the flight coordinator checked the weather for the accident flight route, and the accident flight departed into weather conditions that were below VFR and would not enable the flight to be operated at an altitude in compliance with the Part 135 power-off glide distance requirements (for the part of the flight conducted over open water). Further, the company lacked a method for determining and documenting how its flight coordinators met the qualification requirements specified by 14 *CFR* 119.69.[22]

2.1.3 Joint Authority: Pilot-in-Command and Operations Control Center

Four accidents involved Part 135 operators that had operations control centers staffed with personnel authorized to exercise operational control. Three involved HAA flights, and one involved a commuter flight.[23] None of the personnel who

[21] See NTSB case ANC15FA049 in appendix A for more information.

[22] Title 14 *CFR* 119.69(d) states that anyone in a position to exercise control over Part 135 operations must be "qualified through training, experience, and expertise" and have a full understanding of applicable aviation safety standards, safe operating practices, company operations specifications, specified aircraft maintenance and airworthiness requirements, and company policies and procedures, as contained in the manual required by 14 *CFR* 135.21.

[23] Two of these accidents occurred before the HAA operations control center requirements took effect on April 22, 2016, and one occurred after.

engaged in operational control decisions for any of the accident flights were certificated dispatchers.

On August 26, 2011, a helicopter operated as an HAA lost engine power due to fuel exhaustion and crashed near Mosby, Missouri, fatally injuring the pilot, the flight nurse, the flight paramedic, and the patient.[24] The company had about 4,000 employees and operated 404 helicopters and 20 airplanes from 310 bases serving 48 states. Flight support personnel included communication specialists based in Nebraska, and operations control center personnel (who were experienced emergency medical services pilots) based in Colorado.[25]

Our investigation found that the pilot departed knowing that the helicopter did not have the required 20-minute fuel reserve on board. Although the pilot informed the communication specialist before takeoff that he did not have enough fuel to reach the hospital and requested help locating a nearby fueling location, company communications specialists were not qualified for or tasked with providing such operational guidance. Further, neither the communication specialist nor the accident pilot contacted a company manager or the operations control center (which met company qualifications for providing operational guidance) for guidance about the fuel situation (NTSB 2013).

Our investigation determined that, if an operationally qualified individual had been involved in the predeparture decision-making process, such an individual would likely have asked the accident pilot how much fuel was aboard the helicopter, understood that there was insufficient fuel aboard to meet minimum fuel requirements, and proposed delaying or canceling the mission and having fuel brought to the helicopter. However, even if this had occurred, operations control center personnel did not share responsibility for "go/no go" decisions, which were solely the responsibility of the PIC.[26]

Another HAA accident occurred on March 26, 2016, when the flight, which was operated under VFR, encountered night IMC and struck trees and terrain shortly after picking up a patient at a motor vehicle accident site near Enterprise, Alabama.[27] The

[24] See NTSB case CEN11FA599 (Report No. AAR-13/02) in appendix A for more information.

[25] Communication specialists were tasked with notifying pilots of patient transport requests, entering flight plans, and coordinating patient transfers with the requesting agency and the receiving hospital. Operations control center staff received flight plan notifications, monitored aircraft position as flights progressed, and provided ongoing risk assessment, including weather advisories, as needed.

[26] As a result of our investigation, we reiterated Safety Recommendation A-06-14, which, at the time, was classified Open—Acceptable Response. See section 2.2 and appendix B for more information.

[27] See NTSB case ERA16FA140 in appendix A for more information.

pilot, the flight nurse, and the patient were fatally injured. The company operated more than 130 helicopters out of 98 bases serving 18 states and had an operations control center in Louisiana. Operations control center personnel were responsible for confirming whether flights could be conducted safely, which included verifying that flights were conducted in accordance with the applicable VFR weather minimums.

Before the flight departed to pick up the patient, the company's operations control center personnel used a computer program to provide weather information to the pilot but failed to notice that the location coordinates for the destination were entered in an incorrect format. As a result, the system provided the weather information for an erroneous destination, showing visual meteorological conditions for that location when the weather at the actual destination was IMC. The flight would not have been cleared to depart if the correct weather information had been used.

Although operations control center personnel became aware of the error after the helicopter departed, they did not alert the pilot about the IMC at the destination. Despite the adverse weather, the pilot successfully landed the helicopter at the destination and boarded the patient. However, because the weather conditions were below the company's VFR minimums, the pilot should have canceled the return flight or at least contacted the operations control center personnel for updated weather information and guidance. Instead, the pilot chose to depart, and the helicopter crashed about 1 minute later. Our investigation found that the lack of flight monitoring by the operations control center personnel and overreliance on mission-support software and other automated aids resulted in a loss of operational control.

A third HAA accident occurred on January 29, 2019, when the flight, which was operated under VFR, encountered IMC and crashed near Zaleski, Ohio, fatally injuring the pilot and the two medical personnel.[28] The company employed 70 pilots and operated 16 helicopters and 1 airplane from 15 bases in 6 states and had an operations control center staffed by 12 operations control specialists at company headquarters in Arkansas. The duties of an operations control specialist included analyzing weather information to determine marginal and hazardous conditions for each flight and ensuring that the pilot completed the company's risk assessment worksheet.

Our investigation found that the company's risk assessment form did not include such elements as en route weather risks or refusal of previous requests for a flight (known as weather turndowns) and that company personnel routinely failed to complete the assessment before flights. In addition, the operations control specialist who handled the accident flight understood some aspects of aviation weather

[28] See NTSB case CEN19FA072 (Report No. AAR-20/01) in appendix A for more information.

planning but did not fully use the weather tool available for preflight and in-flight planning. Also, the company pilot who accepted the flight for the accident pilot spent only about 28 seconds reviewing the weather information.

As a result, crucial meteorological risks for the accident flight, including the potential for snow, icing, and reduced visibility along the accident flight route, were not identified before the flight departed (NTSB 2020b, 32, 36, 47, and 49). Further, although the company had an operations control center (as required by 14 *CFR* 135.619 for an HAA fleet of its size), the operations control specialists were not (and were not required to be) certificated dispatchers, did not share operational control authority with the pilots, and could not override a pilot's decision to take a flight, even if hazards were identified.

In another accident, an airplane operated as a commuter flight under VFR encountered IMC and crashed into mountainous terrain near Togiak, Alaska, on October 2, 2016.[29] The two pilots and the passenger were fatally injured. The company operated 56 airplanes and employed about 120 pilots based at various airports throughout Alaska. The company had more than 6,000 flight routes and released about 55,000 flights (with an average of 2.5 destinations per flight) each year. More than two thirds of the company's destinations did not have the infrastructure to support IFR operations.

Our investigation determined that the operational control agent (who was jointly responsible with the PIC for preflight planning) performed the preflight risk assessment for the flight and initially recommended that the PIC conduct the flight on an IFR flight plan due to rain and clouds along the planned route. However, the agent subsequently agreed with the pilot that the flight could depart under VFR; as a result, the routing and altitudes of the VFR accident flight could be changed at the pilot's discretion. The PIC chose a routing in which the flight encountered an area of deteriorating visibility while at altitudes below the elevation of the adjacent mountain peaks, and the airplane crashed in a manner consistent with controlled flight into terrain (NTSB 2018). If the flight had been operated under IFR, as the operational control agent originally suggested, the prescribed route altitudes would have provided adequate clearance above the terrain.[30]

[29] See NTSB case ANC17MA001 (Report No. AAR-18/02) in appendix A for more information.

[30] Our investigation also determined that, although the accident flight's departure under VFR was consistent with regulations and company policy, the conservative approach that the operational control agent used when initially recommending an IFR flight should be encouraged. We concluded that incorporating the operational control agents into crew resource management training for flight crews would better facilitate teamwork during the risk assessment process and other communications with flight crews. We issued Safety Recommendation A-18-20 to recommend that the operator

2.1.4 Flight Locating

Two accidents involved flight-locating deficiencies such that each operator was unaware that its aircraft was missing until hours after the accident or upon notification by another entity. In one case, these deficiencies resulted in search and rescue delays that prolonged the survivor's exposure to adverse environmental conditions.

In the first accident, the operator of a charter flight helicopter involved in a March 27, 2021, accident near Palmer, Alaska, was unaware that the helicopter was missing until nearly 2 hours after it had crashed.[31] The pilot and four passengers sustained fatal injuries, and the surviving passenger sustained severe frostbite injuries due to the prolonged exposure to subfreezing temperatures while waiting almost 6 hours for help to arrive. The company operated 17 helicopters and employed management personnel and about 20 pilots, some of whom were seasonal.

The operator had delegated responsibility for flight locating to a lodge that had contracted the flight for heli-ski passenger operations; however, this delegation was not documented in the operator's operations specifications or general operating manual as required by Part 135. Further, lodge personnel who were monitoring the flight's progress did not comply with their own emergency response plan after losing communication with the helicopter. Our investigation determined that the delayed notification of search and rescue organizations contributed to the severity of the surviving passenger's injuries.

The second accident involved an airplane cargo flight that crashed shortly after takeoff near Sioux Falls, South Dakota, on June 7, 2020, fatally injuring the pilot. The company, which had headquarters in Arkansas, operated 8 airplanes, and employed management personnel (including the director of operations, who was the accident pilot), about 12 to 14 pilots, and 3 flight followers.

The accident occurred before dawn, and the flight follower who handled the accident flight was asleep at the time of the accident and unaware that the airplane had crashed until about 1 hour later when she received a phone call from the airport personnel who found the wreckage.[32] Our investigation found that, during weekends, the company flight follower performed the task as a 24-hour "on call" duty from home

implement such training; however, we classified this recommendation Closed—No Longer Applicable on August 23, 2022, after the company ceased operations.

[31] See NTSB case WPR21FA143 in appendix A for more information.

[32] See the Operations/Human Performance Specialist's Report in the docket for NTSB case CEN20LA215 for more information. The flight follower had also been asleep during the pilot's previous flight leg and had been unaware that the pilot had diverted to Sioux Falls until awakened by a call from someone at the original destination inquiring about the flight.

and was often asleep while the night flights were airborne. The flight follower would either set an alarm or wait for pilots to call her when their aircraft were inbound. The flight follower had received initial training for that position about 25 years before the accident with no recurrent training thereafter.

2.2 Safety Recommendation History

Since 2011, the NTSB has issued several safety recommendations related to improving the training and procedures for operational control personnel in various segments of Part 135. However, the FAA has repeatedly expressed reluctance to impose any such requirements.

For example, in response to NTSB Safety Recommendation A-11-41, which recommended (in part) standardized training and procedures for Part 135 personnel involved in certain flight-following or dispatch-related functions, the FAA stated on September 22, 2011, that it did not plan to require Part 135 operators to have an FAA-approved dispatcher program or flight-following system.[33] On September 14, 2015, the FAA also expressed concerns about the cost of such a program to the operators, noting that some Part 135 certificate holders operate only one aircraft.

Also, as a result of our investigation of the 2015 accident in Ketchikan, we issued Safety Recommendation A-17-39, which asked the FAA to establish minimum initial and recurrent training requirements for personnel authorized to exercise operational control; however, on March 8, 2022, the FAA informed us that it was not planning to introduce rulemaking to establish training requirements for operational control personnel.[34] Later that year, the FAA provided a similar response to Safety Recommendation A-22-14, which recommended that air tour operators (operating

[33] Safety Recommendation A-11-41 asked the FAA to improve pilot, dispatcher, and flight-follower training and procedures to address the dangers of flight operations in freezing precipitation for all Part 121, Part 135, and Part 91 subpart K operators. We classified this recommendation Closed—Unacceptable Action on December 8, 2015. See appendix B for more information.

[34] We classified Safety Recommendation A-17-39 Closed—Unacceptable Action on May 23, 2024. In addition, Safety Recommendation A-17-40, which asked the FAA to publish guidance for operational control best practices, is classified Open—Unacceptable Response. Also, we classified Safety Recommendation A-17-41, which asked the FAA to develop guidance for FAA inspector oversight of operational control training program subject areas, including, but not limited to, the criteria for a qualification module, Closed—Unacceptable Action on May 23, 2024. See appendix B for more information.

under either Part 135 or Part 91) be required to have flight support personnel who are trained to exercise operational control authority.[35]

Further, although the FAA issued a final rule in 2014 that established the operations control center requirement for HAA operators with 10 or more helicopters (effective April 22, 2016), the requirement did not fully address Safety Recommendation A-06-14, as we had intended.[36] We had previously informed the FAA in 2011 (after it issued a notice of proposed rulemaking [NPRM]) that HAA operators with a fleet size fewer than 10, if omitted from the final rule, would transport about 100,000 patients or more per year without the benefit of an operations control center (NTSB 2011, 3).[37] We also informed the FAA that, given the level of responsibility assigned to operational control personnel, we believed that each operations control specialist "should be required to earn FAA certification" because "an FAA certificate will ensure that the FAA has oversight over training, testing, and certification, which is key, from the NTSB's perspective, to ensuring quality control" (NTSB 2011, 4).

However, as reflected in the final rule, the FAA chose to keep the fleet size criteria at 10 or more helicopters and did not include certification requirements for operations control specialists. Although the HAA operations control center requirements and guidance that the FAA implemented represented a marked safety improvement for mitigating hazards and preventing accidents, the HAA accident in Zaleski, Ohio (which occurred after those actions were taken), highlighted the continued deficiencies that can persist when operations control specialists are not required to be certificated dispatchers.[38] We continue to believe that the safety of all

[35] Safety Recommendation A-22-14, which we issued as a result of our investigation of 2019 accident involving an air tour helicopter in Hawaii, is classified Open-Unacceptable Response. See appendix B for more information.

[36] We classified Safety Recommendation A-06-14 Closed—Acceptable Alternate Action on September 11, 2014. See appendix B for more information.

[37] We provided this estimate in our January 10, 2011, comments on the FAA's October 12, 2010, NPRM, "Air Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments" (FAA 2010b). Our estimate was based on HAA fleet data provided by the FAA and 2007 HAA activity data provided in testimony during our 2009 hearing on HAA safety. According to FAA data, as of February 2009, most HAA operators had fewer than 10 helicopters in their fleet (50 of the 74 operators) and operated 30% of the helicopters dedicated to HAA at that time (264 of 884 helicopters). In our comments on the NPRM, we noted that testimony from our hearing indicated that, in 2007, each HAA flew annually, on average, 580 hours and transported 420 patients (NTSB 2011, 3).

[38] Improvements introduced in the final rule included requirements for operations control center specialists to receive initial and recurrent training on specified topics and to perform defined minimum duties, per 14 *CFR* 135.619.

HAA operations, regardless of operator fleet size, would be enhanced through the use of certificated dispatchers.

The operational control deficiencies identified in the accident investigations discussed in section 2.1 of this report (related to Part 135 operators' preflight weather, route, and fuel planning; training for operational control personnel; or flight-locating procedures that either contributed to the circumstances of the accident or delayed the initiation of search and rescue operations) could all be addressed using certificated dispatchers.

We note that most of the described accidents involved pilots' improper decision-making concerning weather-related hazards and that the requirements for dispatcher certification include knowledge testing on a variety of meteorology topics that are more extensive than those specified for airline transport pilot and commercial pilot certification.[39] We believe that the defined operational control responsibilities and the standardized certification criteria, initial and recurrent training, and competency checks required of certificated dispatchers can help ensure that dispatchers, as part of their joint responsibility for the safety of the flight, effectively support pilots with their preflight and in-flight decision-making, including recognizing and avoiding high-risk situations.

Although we believe that a requirement for certificated dispatchers would enhance the safety of all Part 135 operations, we recognize that requiring certificated dispatchers for operators of the most limited size and scope, such as the holders of single-pilot and single-PIC operator certificates, may not be feasible or practical. For these operators, implementing an SMS scaled to their operations may be a practical approach for reducing risks associated with initiating, conducting, or terminating a flight. (See section 4.1 for more information.)

The NTSB concludes that the safety of Part 135 operations would be enhanced by the required use of certificated dispatchers, which would allow for improved quality control over the functions such as preflight weather, fuel, and route planning; active monitoring of in-flight aircraft position and conditions along the route of flight; and timely notification of emergency response organizations if an aircraft becomes overdue. The NTSB further concludes that requiring joint operational control responsibility between a certificated dispatcher and a PIC can minimize the likelihood of a single-point failure that could affect the safety of Part 135 operations.

[39] The training, knowledge, and skills requirements for dispatchers specified in 14 *CFR* 65.55, 65.59, and 65.61 include testing on all meteorology topics listed in Part 65, appendix A. The meteorology topics specified for airline transport and commercial pilots in 14 *CFR* 61.156 and 61.125, respectively, are much more general.

Therefore, the NTSB recommends that the FAA require all Part 135 operators, except single-pilot and single-PIC operators, to use certificated dispatchers who hold joint responsibility with the PIC for the safety and operational control of flights and whose responsibilities include preflight planning; flight dispatch, release, and cancellation decisions; and flight monitoring, consistent with the requirements for 14 *CFR* Part 121 domestic and flag operations.

3. Aircraft Weight and Balance Issues

Title 14 *CFR* 135.63(c) requires Part 135 operators of multiengine aircraft to prepare a load manifest for each flight, which includes computing an accurate weight and balance for the aircraft and preserving the documentation onboard the aircraft during the flight and for at least 30 days after. Although the NTSB previously issued three safety recommendations to the FAA (beginning in 1989) to require manifests and recordkeeping for single-engine aircraft operated under Part 135, the FAA has repeatedly declined to take the recommended action. (These recommendations and the FAA's responses are discussed in section 3.2.)

Since issuing our most recent recommendation on this topic in 2015, we have investigated four additional single-engine airplane accidents involving Part 135 operators that highlighted aircraft weight and balance concerns.[40] These accidents, which collectively exposed 21 persons to unsafe conditions, resulted in 1 fatality and 6 serious injuries. Although the identified weight and balance issues were not causal or contributing in all the accidents, we are concerned that these repeated examples suggest persistent, systemic operational pressures or deficiencies that neither the operators nor the FAA have adequately identified and mitigated for the operation of single-engine aircraft carrying persons and cargo for hire.

3.1 Related Accidents

One accident occurred on July 18, 2018, near Willow, Alaska, when a single-engine, float-equipped airplane operated as an on-demand flight entered an aerodynamic stall and crashed shortly after takeoff from a lake; the pilot sustained fatal injuries, and the two passengers (an adult and child) sustained serious injuries.[41]

Before the pilot departed from the company base to pick up the passengers and cargo, the director of operations reviewed the route and fuel load with the pilot, and the company vice president told the pilot that the passenger said the cargo weight would be 600 lbs. However, after the pilot arrived at the lake to pick up the passengers and load the cargo, the actual cargo consisted of 800 lbs of masonry mortar bags, three totes full of food and stores, two propane tanks, a utility sink, and miscellaneous bags and supplies. Postaccident weight and balance calculations

[40] Although the accident that supported our 2015 safety recommendation occurred within the date range of accidents reviewed for this special investigation report, we discuss this accident separately in section 3.2 in the context of our safety recommendation history.

[41] See NTSB case ANC18FA055 in appendix A for more information.

estimated that the airplane was loaded about 76 lbs over the maximum gross takeoff weight with a center of gravity (CG) aft of the rear limit.

Two witnesses who helped push the airplane off the shore after loading reported that the airplane appeared very aft-heavy and that the pilot told them he would offload some of the cargo if he could not take off. A review of witnesses' videos and statements revealed that the pilot's first takeoff attempt was unsuccessful and that, when he taxied the airplane back across the lake, the floats' aft ends were deep under the water; however, the pilot did not offload any cargo. During the pilot's second takeoff attempt, the airplane slowly lifted off, attained a nose-high attitude, and cleared the trees at the end of the lake before it turned left, rolled left, and crashed. Our investigation determined that, although the airplane was able to lift off, its out-of-limit weight-and-balance condition increased its stall speed and degraded its climb performance, stability, and slow-flight characteristics.

Another accident occurred on May 24, 2022, when a single-engine, turbine-powered airplane operated as an on-demand flight entered an aerodynamic stall and crashed while on final approach to an airport near Yakutat, Alaska; the pilot and the three passengers sustained serious injuries.[42] According to the pilot, during the takeoff roll, he noticed that he had to apply an unusual amount of forward elevator control input to raise the airplane's tail; the pilot also applied additional nose-down trim and departed without incident. En route, the pilot noticed that the tail of the airplane seemed to move up and down, and he attributed this to turbulence. Later, while the pilot was slowing and configuring the airplane during the approach at the destination airport, the airplane exhibited nose-up pitch behavior such that the pilot first applied full nose-down trim and eventually full nose-down elevator control input to try to counter it.

Our investigation determined that the airplane's loading exceeded its aft CG limit such that the airplane's elevator control authority was insufficient to overcome the nose-up pitching moment generated by the loading and the aircraft configuration, and the airplane entered an aerodynamic stall. Further, although the company's operations specifications contained aircraft loading procedures that addressed determining weight and balance for its single-engine aircraft, the accident flight was not conducted in compliance with these procedures.

A third accident occurred on August 16, 2021, when a single-engine, turbine-powered airplane operated as a commuter flight sustained substantial damage following an in-flight loss of control due to an accumulation of airframe icing

[42] See NTSB case ANC22LA035 in appendix A for more information.

near Fairbanks, Alaska; the pilot and the eight passengers were not injured.[43] Our investigation determined that, among several factors that contributed to the accident, the airplane's loading exceeded the maximum weight limit by about 300 lbs and the maximum weight limit for flight in known icing conditions by about 800 lbs. The company's operations specifications did not require pilots of its single-engine aircraft to document any weight and balance calculations. We believe that, had the pilot been required to record such calculations, she may have been more aware of the airplane's limitations and its overweight condition.

Another accident occurred August 5, 2020, when the pilot of a single-engine airplane operated as an on-demand flight lost directional control of the airplane during landing in Kenai, Alaska, resulting in a ground loop.[44] The pilot and the four passengers—one of whom occupied the rear baggage compartment with multiple bags and without a seat—were not injured. Our investigation determined that the airplane was loaded with an aft CG, which increased its directional instability during the landing roll and adversely affected the pilot's ability to maintain directional control.

3.2 Safety Recommendation History

Since 1989, the NTSB has issued three safety recommendations to the FAA to expand the recordkeeping requirements of 14 *CFR* 135.63(c) (which applies only to multiengine aircraft) to include single-engine aircraft. These recommendations, which were issued in 1989, 1999, and 2015, were based on our investigations of fatal accidents relevant to this safety issue area; however, the FAA repeatedly declined to take responsive action.[45]

The FAA's April 5, 1990, response to our first recommendation (Safety Recommendation A-89-135) disagreed with our belief that manifest and recordkeeping requirements would provide an incentive for operators to conduct accurate weight and balance calculations and enable more effective FAA surveillance of single-engine aircraft loading operations.[46] The FAA noted that all operators were already required to determine before takeoff that the aircraft is within its specified

[43] See NTSB case ANC21LA073 in appendix A for more information.

[44] See NTSB case ANC20LA077 in appendix A for more information.

[45] We classified Safety Recommendations A-89-135, A-99-61, and A-15-29 Closed—Unacceptable Action on July 2, 1990; September 11, 2014; and May 18, 2021; respectively. See appendix B for more information.

[46] Our December 7, 1989, recommendation letter referenced 43 accidents since 1967 that involved Part 135 operations of single-engine aircraft for which our investigations determined that the weight and balance condition of the aircraft was causal or a contributing factor.

weight and balance limitations (as required by 14 *CFR* 91.9[a]); all pilots received required training on the principles and methods for determining aircraft weight and balance; and (then-current) AC 120-27B, "Aircraft Weight and Balance Control," included additional guidance for Part 135 operators.[47] The FAA concluded that single-engine aircraft manifest and recordkeeping requirements were not "warranted based on safety considerations" and "would not enhance the effectiveness or the efficiency of Part 135 weight and balance programs."

However, the FAA's view of the potential safety benefits changed after we issued our second recommendation (Safety Recommendation A-99-61). In its initial responses in 2000 and 2003, the FAA stated that it agreed with the intent of the recommendation and intended to consider rulemaking. As part of our rationale for again recommending manifest and recordkeeping requirements, we informed the FAA on February 8, 2000, that, since 14 *CFR* 135.63(c) became effective in 1978, "the weight and loading characteristics of single-engine aircraft have changed to include a turbine-powered fleet with larger cabin volume and cargo load zones." We noted, for example, that the single-engine airplane model involved in the fatal accident referenced in our recommendation letter could "exceed its certificated gross weight and cg limit with full fuel tanks and either a full complement of passengers or cargo load zones filled to the maximum capacity."[48]

In its October 12, 2010, NPRM, the FAA proposed revising the requirements of 14 *CFR* 135.63(c) to apply to all aircraft operated under Part 135 and to allow for the electronic transmission of manifest copies (FAA 2010b, 62660). The FAA stated that:

> In the past, multiengine airplanes were the predominant means of transportation under Part 135. Recently, single-engine passenger carrying aircraft have increased in size and capacity and, therefore their use in on-demand operations has increased…. The FAA finds that all operators carrying passengers for hire must generate a manifest, regardless of the type of aircraft operated…. In addition, the FAA is proposing to eliminate the requirement that the load manifest be prepared in duplicate for certificate holders who elect to electronically

[47] Advisory Circular 120-27F (the current version of the advisory circular, issued in 2019) includes guidance for developing a loading schedule, which "is used to document compliance with the certificated [weight and balance] limitations" contained in the applicable airplane or rotorcraft flight manual. The advisory circular states that a loading schedule "can provide more loading flexibility by requiring more detailed inputs, or it can be made easier to us by adjusting the operational limits to account for the uncertainty caused by the less detailed inputs…. Several types of loading schedules are commonly used, including computer programs as well as 'paper' schedules" (FAA 2019a, 2-4 and 2-5).

[48] See NTSB case DCA98MA002 in appendix A for more information.

transmit the information…to their operations base before takeoff (FAA 2010b, 62660-1).

In the NPRM, the FAA stated that "the safety of commercial air operations could be enhanced by requiring a load manifest for all Part 135 operations and [that it] is proposing to amend its rules accordingly." However, when the FAA issued the final rule on February 21, 2014, it did not include the proposed load manifest and recordkeeping requirements.

In the FAA's regulatory evaluation for the final rule, the FAA stated that it withdrew the proposed requirement based on its additional review of the NPRM and comments from industry stakeholders that expressed concerns about the cost, justification, and operational impact of the proposed requirement (FAA 2014a, 51–52). When the FAA prepared the NPRM, its cost estimates were based on the value of 5 minutes of a pilot's time per flight to prepare the proposed manifest, and the benefits were based on the statistical value of fatalities, injuries, and aircraft hull losses that may be averted by the implementation of the proposed rule. We note that, generally, the FAA determined that the then-present value of the 10-year costs associated with the requirement were about quadruple the value of the benefits.[49] The FAA's final regulatory evaluation determined that the proposed requirement did not have sufficient benefits to be included in the final rule (FAA 2014a, 85).[50]

The following year, as a result of our investigation of yet another fatal accident that was caused by a Part 135 operator's improper loading and operation of a single-engine airplane, we issued our third recommendation (Safety Recommendation A-15-29); in this accident, 10 people lost their lives.[51] In the FAA's October 30, 2015, initial response to us, it repeated its cost-benefit concerns and its

[49] According to the FAA's regulatory evaluation for the NPRM, the costs represented the value of 5 minutes of a pilot's time per takeoff to prepare the proposed manifest (using a presumed value for a single-engine pilot's salary) and assumed an average of three takeoffs daily for a commercial single-engine fleet total of 3,860 aircraft. The FAA calculated that the total cost over 10 years would be $134 million, or $82 million present value (year 2009). The FAA's benefits estimate represented the statistical value of fatalities and injuries that may be averted by implementation of the proposed rule and included the application of an assumed effectiveness value. The FAA's benefits estimate was based on seven weight and balance-related accidents that occurred from 1997 through 2009 and resulted in 11 fatalities and 10 minor injuries. The FAA calculated that the present value (year 2009) benefits over 10 years would be about $20 million (FAA 2010a, 30–32; FAA 2010b, 62660).

[50] The FAA's regulatory evaluation for the final rule did not provide an updated cost-benefit analysis for the load manifest provision.

[51] See NTSB case DCA13MA121 in appendix A for more information.

belief in the adequacy of existing regulations, pilot training, and pilot testing.[52] However, the FAA also indicated that it would review its safety assurance system (SAS) data collection tools to determine whether the tools adequately assess Part 135 operators' single-engine weight and balance procedures, training, and checking.[53]

In 2020, the FAA completed its review, identified no systemic issues with Part 135 operators' single-engine weight and balance procedures, and planned no regulatory action. On October 7, 2020, the FAA informed us that the applicable SAS tools required FAA inspectors to conduct comprehensive assessments of operators' weight and balance calculations, policies, procedures, controls, monitoring, evaluating, and correcting of deficiencies and that these assessments allowed inspectors to recognize areas of risk and provided operators the opportunity to mitigate those risks. The FAA stated that it believed these assessments presented an equal, more immediate, and positive impact on safety than a load manifest and recordkeeping requirement for single-engine aircraft operations.

We recognize the value of the FAA's system safety approach to oversight of operators' weight and balance practices; however, we believe its effectiveness in detecting and correcting deficiencies—for both operators and inspectors—would be enhanced by the availability of current and past load manifests. Currently, although 14 *CFR* 91.9(a) requires all operators to comply with an aircraft's weight and balance limitations, they are not required to document the input data (such as passenger and cargo weights and locations) and resulting weight and CG indicating that the aircraft was loaded in compliance with the limitations. We believe that requirements for such documentation would not only help pilots detect unsafe loading conditions and correct them before takeoff but also provide operators and inspectors the information needed to support proactive, comprehensive assessments to identify any related operational risk areas—including factors that may influence intentional misloading—and mitigate them before an accident occurs.

Further, we reviewed the public comments the FAA received on the 2010 NPRM and found that, at the time, many commenters who objected to the proposed rule "as written" indicated that they were not opposed to requiring single-engine

[52] Specifically, the FAA referenced 14 *CFR* 135.23(b), which requires operators to have procedures for ensuring compliance with aircraft weight and balance limitations, and 14 *CFR* 135.293, which requires initial and recurrent pilot testing on determining compliance with aircraft weight and balance limitations for each type of aircraft the pilot flies.

[53] SAS is the FAA's oversight tool that includes the policy, processes, and software for performing certification, surveillance, and continued operational safety. SAS was developed to support the evolution of a system safety approach to a single oversight system; build connections between policy content and purpose; allow for the use of consistent, risk-based, and data-supported approaches; provide tools for collecting recording, and analyzing data; and allow inspectors to be more effective in their role by focusing their work on the highest area of risk (FAA 2023i).

aircraft operators to calculate weight and balance before each flight. Most commenters who objected to the proposed requirement cited two primary concerns: 1) the perception that the manifests would require them to include the passengers' names, and 2) the operational feasibility of electronically transmitting manifests from remote locations with no cellular or satellite coverage.[54]

However, we note that the manifest provisions of 14 *CFR* 135.63(c) do not require passenger names and that the NPRM stated that "the proposal would not change the required content of the load manifest" (FAA 2010b, 62661). We note that, beyond the information that operators would already use when determining compliance with an aircraft's weight and balance limitations in accordance with 14 *CFR* 91.9(a), the load manifest requirement would add only origin, destination, and crew name and position information.

The NTSB also notes that, in the 14 years since the NPRM was issued, simple, web-based weight and balance applications for use on personal electronic devices have become common; these applications can collect, compute, and store such information then send it as soon as connectivity is available, making the preparation, submission, and 30-day retention of manifests more feasible today than when the FAA first considered the requirement.[55] The FAA has acknowledged that the safety of commercial air operations could be enhanced by requiring a load manifest for all aircraft operated under Part 135 operations. We believe that excluding single-engine aircraft operations from this requirement unjustifiably applies a different level of safety to these operations.

Thus, the NTSB concludes that manifest and recordkeeping requirements for all aircraft that are operated under Part 135 would not only help pilots detect and correct unsafe loading conditions but also provide operators and inspectors the

[54] The NPRM included a statement that, "in the event of an emergency, the operator must be able to account for aircraft occupants and, in the case of a fatal or serious accident, contact next of kin" (FAA 2010b, 62660). The public docket for the NPRM contained concerns from many commenters who interpreted this statement to mean that the proposed rule would require passenger names on the manifests. Most of these commenters worked for HAA operators and noted that, during emergency transports, they often did not know the name of a patient, and, even if they did, federal patient privacy regulations would preclude transmitting it through discoverable means. Several other commenters worked for a commercial operator that provided passenger service in remote locations and noted that their customers were in a hurry and did not want to stand around in harsh weather conditions waiting for them to fill out paperwork; these commenters stated that preparing a load manifest would need to be kept simple and manageable by a single-pilot crew.

[55] Customizable, aircraft-specific weight and balance calculation profiles are provided with some popular web-based, flight-planning software and related mobile applications for personal electronic devices. For pilots that use only paper forms, the features of even the most basic personal electronic devices have improved such that most can capture a scan or image of a completed form and send it when connectivity is available.

information needed to support proactive, comprehensive assessments to identify any related operational risk areas that may influence improper aircraft loading and mitigate them before an accident occurs. Therefore, the NTSB recommends that the FAA expand the applicability of the load manifest and recordkeeping requirements of 14 *CFR* 135.63(c) to include Part 135 single-engine aircraft operations.

4. Organizational Risk Management Strategies

The NTSB has long believed that the safety of commercial aviation can be improved using strategies that enable operators to proactively address in a nonpunitive way underlying organizational issues before they result in accidents. One such process is an SMS, which is the formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls.[56] SMS incorporates proactive safety methods for operators to identify hazards, mitigate risk, and monitor the extent to which they are meeting their objectives.

Further, the effectiveness of the safety assurance component of SMS can be enhanced through safety performance monitoring and measurement tools, such as an FDM program. FDM involves the recording and analysis of flight-related data to provide vital information regarding trends in operational deviations that may adversely affect safety during flights. These objective data can help operators develop mitigations, such as improvements in training and procedures, to address such deviations before they lead to an accident.[57]

SMS for Part 121 operations has been required since 2018, following a long history of both international and domestic support, including a 2007 NTSB safety recommendation.[58] In 2016, we issued three recommendations to the FAA regarding requiring SMS and FDM equipment and programs for Part 135, and, in 2022, we

[56] The goal of an SMS is to identify safety hazards, ensure necessary remedial action is implemented to maintain an acceptable level of safety, provide continuous monitoring and regular assessment of the safety level achieved, and continuously improve an organization's overall level of safety. The four main components of an SMS are 1) safety policy, which establishes senior management's commitment to continually improve safety; 2) safety risk management, which determines the need for new or revised risk controls; 3) safety assurance, which evaluates the effectiveness of implemented risk control strategies; and 4) safety promotion, which includes training, communications, and other actions to create a positive safety culture (FAA 2015b).

[57] An FDM program typically involves the use of an onboard device that can record various flight parameters installed on each aircraft in an operator's fleet. Periodic review of the recorded data enables an operator to identify operational exceedances, deviations from company procedures, and other potential safety issues and then explore—in a nonpunitive way—the reasons why these events occurred and what can be done to avoid them in the future.

[58] In 2006, the International Civil Aviation Organization established a standard for mandatory implementation of SMS, requesting member compliance by 2009. In 2007, the NTSB issued Safety Recommendation A-07-10, which asked the FAA to require SMS for Part 121, and, in 2010, Congress directed the FAA to issued proposed rulemaking (NTSB 2007, 65; FAA 2015a, 1308). When the FAA issued its final rule in 2015 to require SMS for Part 121 (allowing operators until March 9, 2018, to develop and implement their programs), it established a uniform standard that could be extended to apply to Part 135 certificate holders, but it did not require SMS for Part 135 (FAA 2015a, 1313). We classified Safety Recommendation A-07-10 Closed—Acceptable Action on December 1, 2015. See appendix B for more information.

issued one recommendation to the FAA to develop guidance for small operators for scaling an SMS. The following sections discuss these open safety recommendations to the FAA.

4.1 Safety Management System

The NTSB has long advocated that the FAA require various Part 135 operations to implement an SMS, having issued the first associated safety recommendation, which applied to HAA operators, in 2009.[59] Subsequently, as a result of our investigation into the 2015 crash of a Part 135 on-demand charter flight in which all nine persons on board sustained fatal injuries, we recommended that the FAA expand the applicability of SMS requirements, as follows:

> Require all 14 *Code of Federal Regulations* Part 135 operators to establish safety management system programs. (A-16-36)[60]

In the 7 years since we issued this recommendation, we reiterated it in the final reports of seven fatal accidents involving Part 135 operators that resulted in 39 fatalities and 9 serious injuries.[61] Most of these accidents were also on the FAA's list of 35 serious- and fatal-injury accidents involving Part 135 operators from 2015 to 2019 that the FAA determined could have been mitigated through the implementation of SMS (FAA 2023a, 1936).[62]

In addition to engaging in ongoing discussions with the FAA regarding the importance of an SMS requirement for Part 135 operations, the NTSB conducted outreach to increase industrywide awareness. On March 2, 2020, we hosted a panel

[59] Although the FAA published a final rule in 2014 that required HAA operators to implement tools and procedures that the FAA believed contained elements of an effective SMS, the rule did not require the complete SMS that we recommended. We classified Safety Recommendation A-09-89 Closed—Unacceptable Action on September 11, 2014. See appendix B for more information.

[60] See NTSB case CEN16MA036 in appendix A. We classified Safety Recommendation A-16-36 Open—Acceptable Response on October 2, 2023. See appendix B for more information.

[61] See NTSB cases ANC15MA041, ANC17MA001, CEN17MA183, CEN19FA072, DCA20MA059, CEN19MA141, and ANC20MA010 in appendix A for more information.

[62] The FAA's regulatory impact assessment for the proposed rule provided its evaluation of how SMS would have mitigated each accident, which included 23 fatal accidents (NTSB cases ANC15FA049, CEN16MA036, ANC15MA041, ANC16FA017, ANC17MA001, ANC18FA055, ANC18FA063, CEN18FA215, CEN19FA072, DCA17FA109, CEN15FA171, WPR16FA037, ERA17FA066, ERA16FA215, CEN18FA033, ANC17FA039, ERA17FA195, ANC17FA021, CEN17FA168, CEN17FA100, ERA18FA264, CEN18FA386, ANC18FA045, ANC18LA027) and 11 nonfatal accidents (NTSB cases CEN15LA288, WPR15LA198, ANC15LA033, WPR16LA189, CEN16LA386, CEN16FA372, ANC16LA012, ANC17TA015, ANC18FA053, CEN18FA259, and ANC18LA046) (FAA 2022c, 47 and 54-62). Select cases from this list are summarized in appendix A.

of representatives from various-sized Part 135 operators to discuss improving the safety of the industry, and panel participants shared their perspectives on SMS.[63] On May 11, 2023, we hosted a webinar that included a roundtable discussion with several small and midsized operators to explore how they implemented an SMS, the challenges they overcame, and the safety and economic benefits they were seeing (NTSB 2023b).

On January 11, 2023, the FAA issued an NPRM proposing to require an SMS for all Part 135 certificate holders (FAA 2023a, 1932). In our March 10, 2023, comments on the NPRM, we stated that we strongly supported the proposed expansion of SMS requirements to include Part 135 operations and noted that our investigations have consistently shown the need for aviation service providers to implement an SMS to ensure its benefits to the industry and the public are realized (NTSB 2023a, 3–4).

On April 26, 2024, the FAA issued its final rule to require all Part 135 operators to have an SMS, which is responsive to our recommendation. Thus, the NTSB concludes that the FAA's SMS final rule, which requires all Part 135 operators to incorporate formal system safety methods into their internal oversight programs, will help these operators proactively identify and mitigate risks to prevent accidents. Therefore, the NTSB classifies Safety Recommendation A-16-36 Closed—Acceptable Action in this report.

The FAA has noted that, by design, SMS is scalable to allow the integration of safety management practices into a unique business model for operators of any size (FAA 2015b, 21–46). However, during our investigation of the 2019 accident involving the air tour helicopter that encountered IMC and crashed in Kekaha, Hawaii, fatally injuring seven people, we found that the operator's president (who was also the director of operations) mistakenly believed that the operation was too small to maintain an SMS (NTSB 2022a, 73). As a result of our investigation and to help ensure that small operators can successfully implement SMS, we recommended that the FAA do the following:

> Develop guidance for small operators for scaling a safety management system that includes methods and techniques for implementation and

[63] The discussions included participant experiences with gaining organization-wide employee engagement in and ownership of the program, continuously improving safety reporting and risk management processes, and cultivating a just safety culture (NTSB 2020a).

specific examples applicable to several operational sectors, including air tours. (A-22-15)[64]

In its 2023 NPRM, the FAA acknowledged that smaller operators (because they have fewer people) have fewer opportunities for checks and balances on decisions that can affect safety and that SMS can help mitigate this by creating a structure for proactively monitoring decision-making processes and addressing deficiencies.[65] The FAA stated that, with SMS, "a one-person operator would have a system for documenting their own hazard information, actions, mitigations, safety performance, etc., for future reference" (FAA 2023a, 1940).

The FAA has also acknowledged that implementing an SMS could help single-pilot and single-PIC operators identify and mitigate such issues as operational control deficiencies (FAA 2023a, 1953–4; FAA 2016b, 3). We believe this is an important observation because, as described in section 1, nearly one-third of Part 135 certificate holders are single-pilot or single-PIC operators. Further, as discussed in section 2.2, although we believe that a certificated dispatcher could enhance the safety of all Part 135 operations, we are aware that hiring additional personnel may not be practical for single-pilot and single-PIC operators due to their limited size and scope. Thus, the NTSB concludes that, for Part 135 operators of limited size and scope for which the hiring of a certificated dispatcher may not be practical (such as single-pilot and single-PIC operators), implementation of an appropriately scaled SMS that includes planning tools to analyze and assess the inherent risks in operations can help in the development of effective operational control strategies, including methods for ensuring adequate preflight weather, route, and fuel planning.

In the NPRM, the FAA stated that it was revising AC 120-92, "Safety Management Systems for Aviation Service Providers," to include guidance and numerous examples for small operators on how to scale an SMS (FAA 2015b; FAA 2023a, 1953-4). However, in our comments on the NPRM, we noted that the FAA's proposed revisions in the draft AC were too general.

In the SMS final rule, the FAA excepted "certain single-pilot operators" from requirements that would be impractical for their operations, such as certain recordkeeping, communication, and disciplinary action requirements that would not

[64] We classified Safety Recommendation A-22-15 Open—Unacceptable Response on October 2, 2023. See appendix B for more information.

[65] In addition, during our May 11, 2023, roundtable webinar, the FAA's SMS program office manager provided insight on the scalability of SMS and right-sizing sustainable processes to an organization, including adapting existing practices in ways that can meet the intent of the proposed rule. The SMS program office manager noted that, even for a single-pilot operator, adding structure to their system will yield more reliable outcomes (NTSB 2023b, 14:30).

be applicable in organizations of their size (FAA 2024c, 33076). The FAA's final rule stated that guidance (including ACs) to help single-pilot organizations navigate the exceptions would be available about 30 days after publication of the final rule in the *Federal Register* (FAA 2024c, 33075).

We note that, in section 308 of the FAA Reauthorization Act of 2024, which was signed into law on May 16, 2024, Congress directed the FAA to consider the scalability of SMS in any regulation requiring SMS implementation, regardless of the size or complexity of the operation. On May 21, 2024, the FAA issued revised AC 120-92D, which included an appendix that provided potential methods that smaller aviation organizations, including single-pilot and single-PIC operators, could use when developing an SMS scaled to the size and complexity of their organization. The appendix included a table that discussed various SMS implementation strategies and provided examples of how practices such as performance monitoring and documenting and managing hazards can be scaled and applied by smaller operators (FAA 2024d). The NTSB believes that the inventory of methods and techniques contained in this guidance will help operators of all sizes implement an effective SMS. Therefore, the NTSB classifies Safety Recommendation A-22-15 Closed—Acceptable Action in this report.

4.2 Flight Data Monitoring

The NTSB has long recognized the value of an FDM program for various Part 135 operations. In 2009, we recommended that the FAA require HAA operators to establish a structured FDM program and install recording devices capable of supporting it.[66] Subsequently, as a result of our investigation of a 2015 fatal accident involving a jet airplane (operated as a Part 135 on-demand charter flight) that crashed while on an approach to an airport in Akron, Ohio, we expanded the recommended action to apply to all Part 135 operations and asked the FAA to do the following:

> Require all 14 *Code of Federal Regulations* Part 135 operators to install flight data recording devices capable of supporting a flight data monitoring program. (A-16-34)
>
> After the action in Safety Recommendation A-16-34 is completed, require all 14 *Code of Federal Regulations* Part 135 operators to establish a structured flight data monitoring program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues. (A-16-35)

[66] We classified Safety Recommendation A-09-90 Closed—Unacceptable Action on January 25, 2018. See appendix B for more information.

In response to these recommendations, the FAA informed us that, although it agreed with the benefits that additional flight data can provide, it encountered challenges in achieving a favorable cost-benefit analysis. On April 6, 2017, we replied that we disagreed with the FAA's previous determination that a mandate for FDM equipment and programs would provide no quantifiable benefits, and we cited seven accidents that occurred from 2000 through 2015 that were relevant to this safety issue.[67] These accidents, which involved Part 135 operators, resulted in fatal injuries to 53 people and serious injuries to 4 people (NTSB 2022a, 74–75).

In the 7 years since we issued these recommendations, we reiterated them four and five times, respectively, based on the findings from our investigations of other fatal accidents involving Part 135 operators relevant to this issue area.[68] The FAA identified monitoring-related mitigations for 12 of the 35 accidents it cited in its evaluation to support SMS rulemaking for Part 135 (as discussed in section 4.1).[69] We believe that implementation of an FDM program is one method by which operators can acquire and analyze the data necessary to support the safety assurance monitoring requirements of an SMS.

For example, one of the fatal accidents cited by the FAA involved a Part 135 cargo flight that crashed in Charleston, West Virginia, during an unstable instrument approach in IMC in 2017.[70] Our investigation of that accident found evidence that, during the 3 months before the accident, the accident flight crew routinely performed visual approaches in a manner inconsistent with the operator's standard operating procedures.[71] The operator, which employed 38 pilots and operated 18 airplanes

[67] When the FAA told us in 2017 that it would conduct a review to determine the feasibility of requiring all Part 135 certificate holders to install FDM recording devices, it referenced the cost-benefit analysis it performed in 2014 when considering such a mandate for HAA operators. The FAA's regulatory evaluation for the proposed HAA rule showed costs of about $20.4 million and a benefit of $0 for a 10-year period. As discussed in section 3.2, typically, benefits estimates represent the statistical value of fatalities and injuries that may be averted by implementation of a proposed rule.

[68] We reiterated Safety Recommendations A-16-34 and A-16-35 four and five times, respectively; both recommendations are classified Open—Unacceptable Response. See appendix A for more information about NTSB reports AAR-18/02, AAR-19/02, AAR-21/01, and AIR-22/05 (which supported the reiterations of both recommendations) and NTSB report AAR-20/01 (which supported the reiteration of A-16-35).

[69] The FAA's evaluation of accidents cited the safety assurance monitoring aspect of 14 *CFR* 5.71 for NTSB cases ANC18LA027, CEN18FA215, ANC18FA045, ANC17FA021, DCA17FA109, ANC16FA017, ERA16FA215, CEN16LA386, ANC17MA001, ANC15MA041, CEN16MA036, and WPR16FA037 (FAA 2022c, 54–62).

[70] See NTSB case DCA17FA109 in appendix A for more information.

[71] The accident airplane was not equipped with a recording device capable of supporting an FDM program. During our investigation, we reviewed archived air traffic control data and airport

from 12 crew bases in the United States and Puerto Rico, had no formal safety and oversight program to assess compliance with procedures or monitor pilots with previous performance issues. An effective FDM program with appropriately equipped aircraft (ideally implemented as part of an SMS) can enable an operator to proactively identify and mitigate these types of deviations in a nonpunitive way before an accident occurs.

While the NTSB has continued to engage in discussions with the FAA regarding the importance of an FDM requirement for Part 135 operations, we have also included this topic in our industry outreach. During our 2020 panel for improving the safety of Part 135 (referenced in section 4.1), we asked participants to share their perspectives on the benefits and challenges of implementing FDM.

Participants discussed such experiences as proactively identifying and managing hazards and reducing maintenance and fuel costs by identifying and correcting nonstandard operations (such as flap overspeed events and sloppy approaches) and improving the efficiency of operations. One participant described the value of external sources of data, such as online flight tracking software and air traffic control communications recordings, to obtain objective data about how crews are conducting flights. However, representatives from some smaller operators on the panel discussed challenges, including the costs of equipping smaller aircraft in their fleet or how to equip aircraft that they manage but do not own (NTSB 2020a).

To help address such concerns and other perceived impediments to FDM adoption, on October 20, 2022, the NTSB hosted a roundtable focused on practical FDM solutions for smaller operators.[72] Participants from the NTSB, FAA, small operators, and other relevant stakeholders discussed FDM equipment solutions and other sources of data and provided best-practices examples of how an FDM program has benefitted the safety of their operations, improved pilots' performance, and reduced maintenance and operations costs.

Further, we note that lightweight flight recording systems are increasingly becoming standard equipment or available as retrofit options for new production general aviation and business aircraft. According to a General Aviation Manufacturers Association representative, about 70% to 80% of new production turbine-powered business airplanes were equipped with a lightweight flight data recording system,

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security camera videos to determine that the flight crew repeatedly executed nonstandard approaches.

[72] Participants included representatives from the NTSB, FAA, the General Aviation Manufacturers Association, the National Business Aviation Association, the Air Charter Safety Foundation, and small operators of Part 135 charter, Part 91 corporate, and Part 141 training flights (NTSB 2022b).

and about 10% to 20% had at least some data recording and download capability, such as through the avionics or other systems. The representative stated that standard and retrofit recorder equipment options for new production piston-powered airplanes have increased, driven, in part, by demand from customers wanting to participate in an FDM program (NTSB 2022b).

The NTSB continues to believe that an effective FDM program can help all Part 135 operators identify and correct in a nonpunitive way issues with pilot performance and support mitigations that can prevent future accidents, particularly when incorporated into an SMS. Further, although the FAA has not yet pursued rulemaking to address Safety Recommendations A-16-34 and A-16-35, we are encouraged that, in the FAA Reauthorization Act of 2024, Congress directed the FAA to task an aviation rulemaking committee to review and assess the need for changes to the safety requirements related to FDM for certain aircraft and operations and, in doing so, consider any applicable NTSB safety recommendations and the recommendations of previous aviation rulemaking committees that reviewed FDM requirements for Part 135 operators.[73] We continue to believe the need for the recommended action is well justified based on the findings of our investigations.

Thus, the NTSB concludes that operational FDM programs can provide Part 135 operators with objective information regarding the manner in which their pilots conduct flights, and a periodic review of such information could assist operators in detecting and correcting unsafe deviations from standard operating procedures. Therefore, the NTSB reiterates Safety Recommendations A-16-34 and A-16-35.

[73] Specifically, section 333 of the Act directed the FAA to task a rulemaking advisory committee to review and assess FDM requirements for certain helicopters, and section 363 addressed FDM for commercial air tour operations.

5. Accident and Flight Activity Data Needs

The NTSB maintains an aviation accident database that contains the probable cause statements and other data for all civil aviation accidents occurring in the United States and its territories, accidents occurring in foreign states involving a US-based operator or aircraft of US registry or manufacture, public aircraft operations, and certain other accidents, incidents, and events relevant to US aviation safety. In 2020, upgrades to both our internal investigations management system, System for Analysis of Federal Transportation Investigations (SAFTI), and our publicly available database query tool, Case Analysis and Reporting Online (CAROL), enabled us to streamline our reporting processes and improve the way we share the data we collect (NTSB 2020c).[74]

We use the accident and injury data from our database and flight activity data from the FAA to develop and publish annual statistical reviews of accident and injury data for various segments of commercial aviation, including accident rates for Part 135 commuter and on-demand operations. Congress, other federal agencies, and industry stakeholders often use our statistical reviews when assessing the safety of US civil aviation operations.

Searchable accident data and valid flight activity data for different segments of Part 135 are essential for enabling comparisons of accident rates for different types of operations and tracking industry growth. These data can help support evaluations of the appropriateness of the different regulatory standards that apply to different segments of commercial aviation, estimates of the costs and benefits associated with proposed rulemaking, and the development of targeted safety initiatives, as needed, as segments of the industry grow and change.[75]

When we initiated our review of accidents for this special investigation report, we were interested in categorizing each accident based on the operator's Part 135 certificate type (air carrier or operating), operating authority (commuter or

[74] These improvements to our data collection processes and data query tool resulted from a mandate and funding from Congress in the NTSB's reauthorization, where Congress charged the NTSB to develop and maintain a multimodal accident database management system to improve the quality of accident data we make available to the public. CAROL enables users to conduct queries for all transportation modes we investigate, as well as all of the safety recommendations we have issued since our inception in 1967 (NTSB 2020c).

[75] For example, the FAA cited industry growth when considering whether a regulatory change may be appropriate for managing the level of safety for 14 *CFR* Part 380 public charter operations that, per a historic regulatory exception, are allowed to be conducted under Part 135 on-demand rules. The FAA noted that that the size, scope, frequency, and complexity of these operations "has grown significantly over the past 10 years" such that, were it not for the exception, the operations would otherwise be subject to the provisions of Part 121 (FAA 2023f, 59480).

on-demand), and scope (standard, basic, single-pilot, or single-PIC) and assessing any trends in the historic accident rates for each of these industry segments. However, we found that neither the accident and incident data within our own database nor the flight activity data compiled by the FAA could fully support such assessments, highlighting the need for improved data collection and reporting methods.

5.1 NTSB Data Collection Improvements

Currently, the NTSB's internal accident database contains fields to capture parameters such as the certificate holder's name, address, and unique certificate designator; operating authority (commuter or on-demand); regulation under which the flight was conducted (such as Part 91 or Part 135); whether the flight was scheduled or nonscheduled; and the type of service (such as passenger, cargo, or mail). Available search parameters for the NTSB's accident database can enable both internal and external uses to readily produce lists of fatal and nonfatal accidents involving Part 135 certificate holders and sort them based on such criteria as operating authority (commuter or on-demand) aircraft category, and type of operation (including air medical, commercial sightseeing, passenger, cargo, or passenger/cargo).[76]

However, our database does not contain searchable data fields that capture operating certificate type (air carrier or operating) or scope information (standard, basic, single-pilot, or single-PIC) in a way that would enable us (or other industry stakeholders) to easily search and group accidents based on certificate type or scope. For example, when attempting to identify for this report which accidents involved Part 135 flights operated by certificate holders of single-pilot and single-PIC scope, we had to manually review the contents of each investigation's docket, including the pilot- or operator-reported certificate information, interviews, operations specifications excerpts, and other documents and apply deductive reasoning to determine the operators' certificate scope.[77]

[76] Searches can be refined to include a specified date range, aircraft type, injury severity, or other parameters; CAROL will produce a list of accidents (with hyperlinks to the investigation reports and dockets) that meet the user-selected criteria. Although our database enables searches to be conducted based on "scheduled" (currently known as commuter) or "nonscheduled" (currently known as on-demand) criteria, these criteria reflect the operation of the accident flight and not necessarily the operating authority of the certificate holder. For example, as described in section 1, certificate holders with commuter operating authority may also conduct on-demand operations, and certificate holders with on-demand operating authority may conduct limited scheduled operations.

[77] For each accident, the certificate holder's name, certificate designator, and address were recorded in the data fields, but no fields existed for recording certificate type or scope.

Further, we determined that any historical accidents for which we had documentation for operator training programs, a director of operations, chief pilot, director of maintenance, or multiple PICs likely did not involve single-pilot or single-PIC operators.[78] However, we were unable to categorize all of the accidents based on all of the desired criteria with certainty.

The NTSB concludes that our collection of operating certificate type, operating authority, and scope parameters when investigating accidents, incidents, and other reportable events involving Part 135 certificate holders and the updated searchability of our aviation accident database based on these parameters will enhance the database's usefulness for government and industry stakeholders when assessing the safety of the industry, such as the suitability of the varied regulatory standards applied to different segments of commercial aviation, and developing targeted safety initiatives to prevent future accidents. To accomplish this, we implemented immediate measures and initiated ongoing plans for improving our aviation accident database, investigative processes, and investigator training to ensure that we consistently capture the data needed to effectively support such assessments.

For example, in May 2023, the NTSB's Office of Aviation Safety updated its internal guidance for investigators to standardize the collection of certain certificate and operational information when investigating accidents or incidents involving Part 135 certificate holders. The updated guidance states that, when investigating an accident or incident involving a Part 135 operation, investigators should enter the certificate holder's scope of operations into a notes field in SAFTI. We implemented this guidance as an interim measure while we pursued an update to our database that could provide separate fields for capturing these data. We completed this update in June 2024, effectively allowing us to search our database based on operating certificate type, operating authority, and scope parameters.

The revised guidance for investigators also includes procedures for ensuring we capture relevant information from the operations specifications and other details, as appropriate for the circumstances of the accident or incident. We implemented this guidance as an interim process while we develop the final revisions to our standard operating procedures for conducting investigations involving Part 135 operations to ensure we capture sufficient details to further support data-driven analyses of the safety of the industry and targeted safety interventions.

[78] We used this process to determine that none of the operational control- and flight-locating-related accidents discussed in section 2 involved single-pilot or single-PIC operators.

5.2 Flight Activity Data Needs

More than 50 years ago, the NTSB conducted a study of what was then called the "air taxi" industry and determined that the available flight activity data for the various on-demand and commuter operations did not provide for "a meaningful comparison of the relative safety levels" between different segments of the industry or between the industry and other operations, such as Part 121 (NTSB 1972, 12–13).[79] Based on that study and others, we issued several safety recommendations between 1972 and 2003 seeking mandatory flight activity reporting; however, the recommended mandates were not fully implemented.[80]

During our ongoing correspondence with the FAA to advocate for our recommendations for mandatory reporting, the FAA stated that it needed to discuss the subject both internally with other stakeholders (including the Bureau of Transportation Statistics and an aviation rulemaking committee), gain insight into the relative costs and benefits from the industry's viewpoint, and understand the options for collecting and processing the data. However, the FAA never provided us with any information about the outcomes of any such discussions. By 2011, the FAA had neither taken the recommended action nor indicated any intention to do so.[81] As a result, few Part 135 operators today are subject to mandatory flight activity reporting, and some of the general data problems we identified half a century ago have persisted.

In a recent report to Congress, the FAA acknowledged that "no single source of integrated data on Part 135 operations exists" (FAA 2023d, 5). As a result, when attempting to develop a profile of the Part 135 industry, the FAA (and other

[79] We noted that the data collection methods differed depending on the type of operation and included a mix of mandatory reports (from commuter operators) and FAA estimates derived from a voluntary reporting system (from subset of on-demand operators). Further, the collected data did not identify and separate flight hours for certain industry segments to enable the determination of accident rates for those segments (NTSB 1972, 4–5).

[80] Safety Recommendations A-72-191 and A-72-192, which were addressed to the Civil Aeronautics Board, asked for (in part) mandatory flight activity data reporting for operations generally equivalent to today's Part 135 operations. We classified Safety Recommendations A-72-191 and A-72-192 Closed—No Longer Applicable on September 16, 1976. Safety Recommendation A-03-37 asked the FAA to require (in part) flight activity data reporting for Part 135 on-demand operators. We classified Safety Recommendation A-03-37 Closed—Unacceptable Action on March 29, 2011. See appendix B for more information.

[81] In our March 29, 2011, correspondence with the FAA regarding Safety Recommendation A-03-37, we informed the FAA that a mandatory reporting requirement would not be burdensome for Part 135 on-demand operators because the operational and recordkeeping requirements that already exist for these operators allow for more comprehensive activity reporting than the methods the FAA used to survey the activity of these operations.

stakeholders) must compile information from a variety of databases, some of which have differences in reporting and other conventions (FAA 2023d, 5–7). These types of differences continue to present challenges for identifying and comparing accident rates for various industry segments.

For example, most Part 135 certificate holders (93% in 2012) conduct on-demand passenger or passenger and cargo operations, with only a small percentage conducting commuter (scheduled) operations or on-demand all-cargo operations (2% and 3%, respectively) (FAA 2016a, 1–6). The FAA estimates flight activity data for Part 135 on-demand operations based on the voluntary responses to its annual General Aviation and Part 135 Activity Survey.

In contrast, Part 135 commuter operators are subject to mandatory reporting of flight activity and other information to the Bureau of Transportation Statistics per 14 *CFR* 298.60, an economic regulation. However, the bureau aggregates these data with the data from the mandatory reports it collects for Part 121 scheduled operations, such that the FAA must apply some methodology when using these data as the basis for developing its annual flight activity report for Part 135 commuter operations.[82] In addition, in 2012, Congress mandated flight activity reporting for HAA operations (a segment of Part 135 on-demand operations), and the FAA began collecting and reporting these data in 2015, independent of its annual survey-based estimates of HAA flight activity (discussed further below).[83]

During the past few decades, the NTSB has worked with the FAA and industry stakeholders to improve the flight activity estimates derived from the FAA's voluntary survey.[84] Some of the implemented improvements to the survey and data validation were responsive to safety recommendations we issued in 2001 and 2005.[85] When the

[82] The bureau also collects mandatory flight activity reports for Part 121 nonscheduled operations, per economic regulation 14 *CFR* Part 241 (NTSB 2003, 1).

[83] As part of the FAA Modernization and Reform Act of 2012, Congress mandated that HAA operators report annual activity data to the FAA. The FAA began collecting these data in April 2015 and has since provided Congress with data reports for calendar years 2016 through 2022 (FAA 2017, 2; FAA 2018, 2019b, 2020a, 2020b, 2022a, 2022b, and 2023h).

[84] In 2000, the then-General Aviation Joint Steering Committee (now known as the General Aviation Joint Safety Committee) formed the General Aviation Data Improvement Team, which was jointly chaired by the FAA, NTSB, and industry representatives and sought to recommend ways to improve estimates of flight activity for Part 135 on-demand operations (GADIT 2001, 18).

[85] Safety Recommendations A-01-74, A-01-77, and A-05-11 addressed methods for improving the survey and the accuracy of flight activity estimates, and the FAA took responsive action. We classified Safety Recommendation A-01-74 Closed—Acceptable Action on July 16, 2013, and classified Safety Recommendations A-01-77 and A-05-11 Closed—Acceptable Action on March 29, 2011. See appendix B for more information.

survey was introduced in 1978, it relied exclusively on the FAA's civil aircraft registry, selecting the survey sample from the population of aircraft owners.

Since 2004, survey methods have included the option of using a "large fleet" summary form to simplify reporting for owners or operators of multiple aircraft (cross-referencing the FAA's Operations Safety System database to identify which aircraft are operated under a Part 135 certificate) and sampling 100% of all aircraft used in Part 135 on-demand operations (FAA 2023b, A-4, A-6, and A-15). Other improvements included strategies to reduce survey nonresponse, minimize measurement and coding errors, and improve the weighting of the data from completed surveys to better reflect population characteristics (FAA 2023b, A-10 through A-12).

However, we note that the survey does not identify the scope of the certificate for which activity data are collected, precluding the determination of accident rates for such Part 135 on-demand operations as single-pilot and single-PIC, which comprise about 30% of certificate holders. Although our review of accidents for this report identified five accidents that likely involved single-pilot or single-PIC operators, without flight activity data for these industry segments, it is not possible to determine the accident rates to support an assessment of the relative safety of these operations.[86]

Further, although the FAA continues to provide estimated flight activity for HAA operations based on survey responses, differences between these estimates and mandatory flight activity data that the FAA reports to Congress can affect the calculated accident rate for this part of the industry, depending on which data are referenced. For example, the FAA-reported annual flight activity data collected from HAA operators' mandatory reports have been lower than the FAA's survey-based activity estimates, and, in some cases, the differences are substantial. For calendar year 2022, the FAA's report to Congress indicated that HAA operators reported 518,251 hours flown and had 11 accidents, resulting in an accident rate of 2.1 per 100,000 flight hours; however, the FAA's published survey-based activity estimate for the same year was 679,997 hours flown, which results in an accident rate of 1.6 per 100,000 flight hours (FAA 2023h, 3; and FAA 2024a).[87] The differences between survey-derived flight activity estimates and the data collected from mandatory

[86] See NTSB cases CEN14FA122, ERA15FA313, WPR17FA035, CEN18FA215, and ANC20LA046 in appendix A for more information.

[87] Also, for calendar year 2021, the FAA's report to Congress indicated 500,691 hours flown and an accident rate of 1.0 per 100,000 flight hours (based on five accidents), but its survey-based activity estimate was 703,464 hours flown, which results in an accident rate of 0.7 per 100,000 flight hours (FAA 2022b, 3; and FAA 2023c).

reporting operations suggest potential problems, either with the survey-based estimates, the mandatory reporting, or both.

As stated in section 5.1, we believe that the measures we have implemented and the ongoing changes we have planned for improving the NTSB's accident and incident data collection for Part 135 operations will be useful for both government and industry stakeholders by including the certificate type (air carrier certificate or operating certificate), operating authority (on-demand or commuter operations), and scope of the operation (standard, basic, single-pilot, or single-PIC) and enabling users to easily search our database on those parameters. However, without corresponding—and accurate—activity data for the same parameters, the accident rates for these operations cannot be determined.

As we indicated in our previous discussions with the FAA, we continue to believe that mandatory reporting is the best way to ensure that valid activity data are available for all Part 135 operations, and we believe that such a requirement would not be burdensome to these operators due to existing operational and recordkeeping requirements. However, because the FAA never fully explained the rationale for its previous refusal to require mandatory reporting, we have no insight as to whether any perceived constraints that may have precluded responsive action years ago still exist today. We recognize that, should any such constraints still exist, other solutions, such as expansion of or enhancements to voluntary surveys and data collection methods, may be able to produce flight activity data of sufficient quality and detail to effectively support safety assessments for various industry segments.

Thus, the NTSB concludes that the collection and validation of flight activity data for Part 135 operations that identify activity for different segments of the industry are fundamental to determine the accident rate for each segment, support evaluations of the suitability of the varied regulatory standards and levels of oversight applied to each segment, and develop targeted safety initiatives, as needed. Therefore, the NTSB recommends that the FAA develop, validate, and implement a single, unbiased method for generating activity data for all Part 135 certificate holders, either through mandatory reporting or some other means, to include the identification of activity by certificate type (air carrier or operating), operating authority (on-demand or commuter), and scope (standard, basic, single-pilot, or single-PIC).

6. Conclusions

6.1 Findings

1. The safety of Title 14 Code of Federal Regulations Part 135 operations would be enhanced by the required use of certificated dispatchers, which would allow for improved quality control over the functions such as preflight weather, fuel, and route planning; active monitoring of in-flight aircraft position and conditions along the route of flight; and timely notification of emergency response organizations if an aircraft becomes overdue.

2. Requiring joint operational control responsibility between a certificated dispatcher and a pilot-in-command can minimize the likelihood of a single-point failure that could affect the safety of Title *14 Code of Federal Regulations* Part 135 operations.

3. Manifest and recordkeeping requirements for all aircraft that are operated under Title 14 *Code of Federal Regulations* Part 135 would not only help pilots detect and correct unsafe loading conditions but also provide operators and inspectors the information needed to support proactive, comprehensive assessments to identify any related operational risk areas that may influence improper aircraft loading and mitigate them before an accident occurs.

4. The Federal Aviation Administration's safety management system final rule, which requires all Title 14 *Code of Federal Regulations* Part 135 operators to incorporate formal system safety methods into their internal oversight programs, will help these operators proactively identify and mitigate risks to prevent accidents.

5. For Title 14 *Code of Federal Regulations* Part 135 operators of limited size and scope for which the hiring of a certificated dispatcher may not be practical (such as single-pilot and single-pilot-in-command operators), implementation of an appropriately scaled safety management system that includes planning tools to analyze and assess the inherent risks in operations can help in the development of effective operational control strategies, including methods for ensuring adequate preflight weather, route, and fuel planning.

6. Operational flight data monitoring programs could provide Title 14 *Code of Federal Regulations* Part 135 operators with objective information regarding the manner in which their pilots conduct flights, and a periodic review of such information could assist operators in detecting and correcting unsafe deviations from company standard operating procedures.

7. The National Transportation Board's (NTSB) collection of operating certificate type, operating authority, and scope parameters when investigating accidents, incidents, and other reportable events involving Title 14 *Code of Federal Regulations* Part 135 certificate holders and the updated searchability of the NTSB's aviation accident database based on these parameters will enhance the database's usefulness for government and industry stakeholders when assessing the safety of the industry, such as the suitability of the varied regulatory standards applied to different segments of commercial aviation, and developing targeted safety initiatives to prevent future accidents.

8. The collection and validation of flight activity data for Title 14 *Code of Federal Regulations* Part 135 operations that identify activity for different segments of the industry are fundamental to determine the accident rate for each segment, support evaluations of the suitability of the varied regulatory standards and levels of oversight applied to each segment, and develop targeted safety initiatives, as needed.

7. Recommendations

7.1 New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations.

To the Federal Aviation Administration:

Require all Title 14 *Code of Federal Regulations* (*CFR*) Part 135 operators, except single-pilot and single-pilot-in-command (PIC) operators, to use certificated dispatchers who hold joint responsibility with the PIC for the safety and operational control of flights and whose responsibilities include preflight planning; flight dispatch, release, and cancellation decisions; and flight monitoring, consistent with the requirements for 14 *CFR* Part 121 domestic and flag operations. (A-24-17)

Expand the applicability of the load manifest and recordkeeping requirements of Title 14 *Code of Federal Regulations* (*CFR*) 135.63(c) to include 14 *CFR* Part 135 single-engine aircraft operations. (A-24-18)

Develop, validate, and implement a single, unbiased method for generating activity data for all Title 14 *Code of Federal Regulations* Part 135 certificate holders, either through mandatory reporting or some other means, to include the identification of activity by certificate type (air carrier or operating), operating authority (on-demand or commuter) and scope (standard, basic, single-pilot, or single-pilot-in-command). (A-24-19)

7.2 Previously Issued Recommendations Reiterated in This Report

The National Transportation Safety Board reiterates the following safety recommendations.

To Federal Aviation Administration

Require all 14 *Code of Federal Regulations* Part 135 operators to install flight data recording devices capable of supporting a flight data monitoring program. (A-16-34)

After the action in Safety Recommendation A-16-34 is completed, require all 14 *Code of Federal Regulations* Part 135 operators to

establish a structured flight data monitoring program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues. (A-16-35)

7.3 Previously Issued Recommendations Classified in This Report

The National Transportation Safety Board classifies the following safety recommendations.

To the Federal Aviation Administration:

Require all 14 *Code of Federal Regulations* Part 135 operators to establish safety management system programs. (A-16-36)

Develop guidance for small operators for scaling a safety management system that includes methods and techniques for implementation and specific examples applicable to several operational sectors, including air tours. (A-22-15)

Safety Recommendations A-16-36 and A-22-15 are classified Closed—Acceptable Action in section 4.1 of this report.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JENNIFER HOMENDY
Chair

MICHAEL GRAHAM
Member

ALVIN BROWN
Member

J. TODD INMAN
Member

Report Date: July 24, 2024

Appendixes

Appendix A: Referenced Accidents

Operational Control and Flight-Locating Issues

Table A1. Accidents involving operational control and flight-locating issues referenced in this report.[1]

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
Pilot-in-command authority	CEN12FA086	11/28/2011	Riverwoods, Illinois	Emergency medical services airplane (multiengine) operated under instrument flight rules (IFR) crashed following loss of engine power due to fuel exhaustion	3 fatal, 1 serious, 1 minor	• Director of operations was also responsible for monitoring all flights and approving all departures for the company's three pilots, who operated four airplanes from bases in three states. • Company's fuel log was not reviewed by management. • Pilot flew with less than the 45-minute fuel reserve required for the IFR flight. • Pilot should not have been assigned to the flight because his time on duty exceeded the regulatory 14-hour maximum.
	ANC18FA063	8/4/2018	Talkeetna, Alaska	Air tour airplane (single-engine) operated under visual flight rules (VFR) crashed into steep, snow-covered terrain, likely in	5 fatal	• Tour routes were subject to change at pilot's discretion. • Company had no formal, written preflight risk assessment process by which the pilot or flight follower assessed actual risk associated with flight route and weather.

[1] Visit ntsb.gov to find additional information in the public docket for each NTSB accident investigation. Use the CAROL Query to search safety recommendations and investigations.

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
				reduced-visibility conditions		
	ANC16FA017	4/8/2016	Angoon, Alaska	On-demand flight (single-engine airplane) operated under VFR crashed into mountainous terrain while maneuvering	3 fatal, 1 serious	• Pilot likely chose alternate route over higher-than-expected terrain by mistake when diverting to avoid poor visibilty conditions. • Director of operations was flying in a different airplane at the time the pilot contacted him via radio to report that the airplane was diverting. • Director of operations did not see the accident flight's actual routing (using the company's flight-tracking system) until after completing his own flight.
	ANC20MA010 (AIR-22-05)[2]	12/26/2019	Kekaha, Hawaii	Air tour helicopter (turbine-powered, single-engine) operated under VFR encountered instrument meteorological conditions (IMC) and crashed	7 fatal	• Company had inadequate safety assurance processes to assess whether company strategies to reduce pilots' risk of inadvertent encounters with IMC were effective. • Air tour operators were not required to have flight support personnel trained to exercise operational control authority, participate in preflight risk analysis, provide pilots with weather briefings, monitor the progress of flights, and participate in two-way communications with pilots to alert them of weather hazards. • Hawaii lacked the necessary infrastructure to enable (1) continuous radio

[2] This accident is not included among the 12 accidents that support our new recommendation to the Federal Aviation Administration (FAA) to require certificated dispatchers for all Part 135 operators except single-pilot and single-pilot-in-command operators. The accident is referenced because it resulted in the issuance of Safety Recommendation A-22-15 to the FAA, which is classified in this report. (See appendix B for more information.)

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
						communications between low-flying tour flights and ground support personnel and (2) real-time flight tracking along entire tour routes. • FAA's weather camera system was not yet fully implemented in Hawaii.
Joint authority: Pilot-in-command and other support personnel	ANC14MA008	11/29/2013	Saint Marys, Alaska	Commuter flight (turbine-powered, single-engine airplane) operated under special VFR crashed during approach in IMC at night	4 fatal, 6 serious	• Flight coordinators performed a risk assessment for the flight but did not discuss with the pilot the risks identified. • Flight coordinators had not received any company training on the risk assessment program.
	ANC15MA041 (AAR-17/02)	6/25/2015	Ketchikan, Alaska	Air tour airplane (turbine-powered, single-engine) operated under VFR crashed in mountainous terrain in IMC	9 fatal	• Training and supervision that the company provided to the flight scheduler was insufficient to ensure that she was qualified per 14 *Code of Federal Regulations (CFR)* 119.69 and that she fully understood and could perform her responsibilities to work jointly with pilots to make safe and appropriate operational control decisions.
	ANC15FA049	7/17/2015	Juneau, Alaska	Commuter flight (single-engine airplane) operated under VFR crashed in IMC	1 fatal, 4 serious	• Company required pilots to complete flight risk assessments, but they routinely did not do so, and the accident pilot did not complete one for the accident flight • Neither the pilot nor the flight coordinator checked the weather for the flight route before the accident flight departed. • Weather conditions at the time of departure were below VFR and did not allow for the flight to be operated in compliance with Part 135 power-off glide distance requirements. • Company lacked a method for determining and documenting how its

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
						flight coordinators met the qualification requirements of 14 *CFR* 119.69.
Joint authority: Pilot-in-command and operations control center personnel	CEN11FA599 (AAR-13/02)	8/26/2011	Mosby, Missouri	Helicopter air ambulance (HAA) (turbine-powered, single-engine) crashed following loss of engine power due to fuel exhaustion	4 fatal	• Pilot knew before depature that the helicopter had insufficient fuel and notified communications specialist. • Communication specialists who provided dispatch services to pilots were not qualified to provide operational guidance. • Operations control center was staffed at all times with at least one specialist with relevant operational experience, but these personnel did not share responsibility for "go/no go" decisions. • Company risk assessment used by pilots did not include a risk threshold for mandatory consultation with operations control center personnel.
	ERA16FA140	3/26/2016	Enterprise, Alabama	HAA (turbine-powered, single-engine) operated under VFR crashed in dark night IMC	3 fatal	• Data input error resulted in computer system providing weather information for erroneous destination location, showing visual meteorological conditions when the weather at the actual destination was IMC. • Operations control center personnel became aware of the error after the 3 fatal helicopter departed, but center personnel did not alert the pilot. • Pilot successfully landed the helicopter at the destination, boarded the patient, and decided to depart despite weather conditions below the company's VFR minimums. • Pilot should have canceled the flight or at least contacted the operations control center personnel for updated weather information and guidance.

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
	ANC17MA001 (AAR-18/02)	10/2/2016	Togiak, Alaska	Commuter flight (turbine-powered, single-engine airplane) operated under VFR crashed into steep terrain, likely in IMC	3 fatal	• Operational control agents were jointly responsible with pilots for preflight planning and formal risk assessment. • Joint agreement required on risk level determined for flight. • Operational control agent initally recommended IFR flight plan but later. agreed flight could operate under VFR • VFR flight routes chosen at pilot's discretion.
	CEN19FA072 (AAR-20/01)	1/29/2019	Zaleski, Ohio	HAA (turbine-powered, single-engine) operated under VFR crashed in night IMC	3 fatal	• Company risk assessment form did not include such elements as en route weather risks or refusal of previous requests for a flight (known as weather turndowns). • Company personnel routinely failed to complete risk assessment before flights. • Operations control specialists did not share operational control authority with the pilots and could not override pilots' decisions to take a flight, even if hazards were identified. • Operations control specialist who handled the accident flight did not fully use the weather tool available for preflight and in-flight planning. • Company pilot who accepted the flight for the accident pilot spent about 28 seconds reviewing the weather information. • Crucial meteorological risks for the accident flight were not identified before the flight departed.
Flight Locating	WPR21FA143	3/27/2021	Palmer, Alaska	Charter flight (turbine-powered, single-engine helicopter) struck snow-covered ridge	5 fatal, 1 serious	• Operator was unaware the on-demand, remote operations flight (contracted to a lodge to conduct heli-ski flights) was missing until nearly 2 hours after it crashed.

Operational control method or flight locating	NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
						• Operator's delegation of flight locating to a lodge was not documented in the operations specifications or general operating manual. • Lodge personnel did not comply with emergency response plan after losing communication with the flight. • Delayed notification of search and rescue contributed to the severity of the surviving passenger's injuries.
	CEN20LA215	6/7/2020	Sioux Falls, South Dakota	Cargo flight (turbine-powered, multiengine airplane) crashed shortly after takeoff in dark night conditions	1 fatal	• Operator had satellite flight-tracking software that enabled it to check the location of its aircraft, but flight follower was "on call" at home on weekends and asleep while night flights were airborne. • Flight follower was asleep and unaware that the accident pilot had diverted until called and awakened by someone at the original destination. • Flight follower was asleep and unaware that the airplane had crashed until called and awakened by airport personnel about 1 hour after the accident.

Aircraft Weight and Balance Issues

Table A2. Accidents involving weight and balance issues referenced in this report.

NTSB case	Date	Location	Aircraft and operation	Injuries	Related findings
ANC22LA035	5/24/2022	Yakutat, Alaska	Single-engine airplane, on-demand cargo and passenger flight	4 serious	• Airplane was loaded with aft center of gravity (CG) and entered aerodynamic stall during final approach.
ANC21LA073	8/16/2021	Fairbanks, Alaska	Single-engine airplane, commuter flight	9 uninjured	• Unexpected encounter with supercooled liquid droplets resultd in a loss of airplane control due to ice accumulation. • At time of accident, airplane's weight exceeded the maximum limit by about 294 lbs and exceeded limit for operations in known icing conditions by 806 lbs.
ANC20LA077	8/5/2020	Kenai, Alaska	Single-engine airplane, on-demand air taxi flight	5 uninjured	• Airplane loaded with aft CG due to pilot's improper decision to place one passenger in the rear baggage compartment (which was not equipped with a seat) with baggage. • Aft CG increased airplane's directional instability during landing roll and adversely affected pilot's ability to maintain directional control, resulting in a ground loop.
ANC18FA055	7/18/2018	Willow, Alaska	Single-engine airplane, on-demand air taxi flight	1 fatal 2 serious	• Airplane was loaded with aft CG and weight that exceeded maximum limit.
DCA13MA121	7/7/2013	Soldotna, Alaska	Single-engine airplane, on-demand cargo and passenger flight	10 fatal	• Pilot did not (and was not required to) document any weight and balance calculations. • After takeoff, airplane crashed less than 1/2 mile from depature end of runway. • Investigation determined the airplane's CG was considerably exceeded the aft limit, resulting in uncontrollable nose-up pitch and aerodynamic stall.

NTSB case	Date	Location	Aircraft and operation	Injuries	Related findings
DCA98MA002	10/8/1997	Montrose, Colorado	Single-engine airplane, on-demand charter	9 fatal	• Pilot lost control of airplane during VFR flight while maneuvering in or near IMC. • Pilot did not use oxygen as required for fligh altitude • Airplane was loaded near the the maximum gross weight and aft center of gravity limit. • Investigation highlighted concern that this model of airplane (and others in the growing single-engine, turbine-powered fleet) had larger cabin volume and cargo load zones such that, when fully fueled, would exceed the maximum weight and CG limits with either a full complement of passengers or cargo load zones filled to the maximum capacity.

Need for Organizational Risk Management Strategies

Table A3. Accidents with circumstances supporting the need for an operator safety management system (SMS), scalable SMS, and/or flight data monitoring (FDM) program.

NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
CEN16MA036 (AAR-16/03)	11/10/2015	Akron, Ohio	Airplane (jet-powered, multiengine) on-demand charter flight operated under IFR crashed during approach in IMC	9 fatal	• Crew mismanaged the approach in IMC, which led to an unstabilized approach and aerodynamic stall. • Crew deviated from multiple standard operating procedures. • Operator lacked SMS and FDM, had casual attitude toward procedural compliance, and had inadequate hiring, training, and operational oversight of the crew. • Inadequate FAA oversight of operator.
ANC15MA041 (AAR-17/02)	6/25/2015	Ketchikan, Alaska	Air tour airplane (turbine-powered, single-engine) operated under VFR crashed in mountainous terrain in IMC	9 fatal	• Operator's company culture tacitly endorsed flying in hazardous weather and failed to manage the risks associated with the competitive pressures affecting local air tour operators. • Local tour operators had no mechanism to review and discuss objective data from tour flights to identify operatational strategies and collaborate on mitigation strategies.

NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
					• Lack of conservative weather minimums for local tour operators such that operators willing to take the most weather-related risks were able to fly more revenue passengers. • Local tour operators that fly tours as cruise line shore excursions may face schedule pressures to return passengers to the ship on time. • Operator lacked SMS.
ANC17MA001 (AAR-18/02)	10/2/2016	Togiak, Alaska	Airplane (turbine-powered, single-engine) commuter flight operated under VFR crashed into steep, mountainous terrain in IMC	3 fatal	• Crew decided to continue VFR flight into deteriorating visibility and did not perform immediate escape maneuver after entry into IMC, resulting in controlled fligh into terrain. • Operator allowed crews to routinely inhibit the terrain awareness and warning system (TAWS) alerts. • Operator lacked SMS and FDM.
DCA17FA109	5/5/2017	Charleston, West Virginia	Airplane (turbine-powered, multiengine) on-demand cargo flight operated under IFR crashed during approach in IMC	2 fatal	• Unstabilized instrument approach resulting in inadvertent, uncontrolled contact with the ground. • Flight crew did not comply with multiple standard operating procedures. • Evidence of flight crew intentional procedural noncompliance during previous approaches. • Captain had history of poor performance during instrument flight. • First officer may have been reluctant to speak up and call for missed approach due to authority gradient. • Operator lacked formal safety and oversight program to assess hazards and compliance with standard operating procedures and to monitor pilots with previous performance issues.
CEN17MA183 (AAR-19/02)	5/17/2017	Teterboro, New Jersey	Airplane (jet-powered, multiengine) Part 91 positioning flight for Part 135 operator in visual conditions	2 fatal	• Unstabilized visual approach resulting in aerodynamic stall. • Procedural deviations and errors resulted in crew's loss of situational awareness. • Operator lacked SMS and FDM.
CEN19FA072 (AAR-20/01)	1/29/2019	Zaleski, Ohio	HAA (turbine-powered, single-engine) operated under VFR crashed at night	3 fatal	• Flight request had been turned down by two other operators due to poor weather conditions.

NTSB case (report)	Date	Location	Accident circumstances	Injuries	Related findings
			in area with snow showers and IMC while en route to pick up patient		• Pilot who accepted flight passed it off to other pilot who was just starting duty shift; there was no record that the accident pilot received a weather briefing or performed a preflight risk assessment. • Operator installed FDM equipment on fleet helicopters but did not have FDM program. • Operator had poor safety culture and lacked SMS.
DCA20MA059 (AAR-21/01)	1/26/2020	Calabasas, California	Helicopter (turbine-powered, multiengine) on-demand chater flight operated under VFR encountered IMC and crashed	9 fatal	• Pilot decided to continue VFR flight into IMC, due to likely self-induced pressure and plan continuation bias. • IMC encounter resulted in pilot's spatial disorientation and loss of control of the helicopter. • Operator lacked FDM and had incomplete implementation of SMS. • Operator's review and oversight of its safety management processes were inadequate.
CEN19MA141 (AAR-21/04)	5/13/2019	Ketchikan, Alaska	Midair collision of two air tour airplanes (each single-engine, one turbine-powered) in visual conditions in area with high concentration of air tour traffic	6 fatal, 9 serious, 1 minor	• Inherent limitations of see-and-avoid concept, which prevented each pilot from seeing the other airplane before the collision. • Absence of visual and aural alerts from each airplane's traffic display system. • Operator lacked SMS.
ANC20MA010 (AIR-22-05)	12/26/2019	Kekaha, Hawaii	Air tour helicopter (turbine-powered, single-engine) operated under VFR crashed in mountainous terrain in IMC	7 fatal	• Pilot decided to continue VFR flight into IMC. • Operator lacked SMS and FDM. • FAA delayed implementing Hawaii avation weather cameras, lacked leadership in developing cue-based weather training program, and provided ineffective monitoring and oversight of Hawaii air tour operators' weather-related operating practices.

Single-Pilot or Single-Pilot-in-Command Operators

Table A4. Accidents likely involing single-pilot or single-pilot-in-command (PIC) operators.[3]

NTSB case	Date	Location	Accident circumstances	Injuries	Related findings
CEN14FA122	1/27/2014	Silt, Colorado	Helicopter (turbine-powered, single-engine) struck power line during on-demand power line inspection flight in visual conditions	3 fatal	• Pilot's inadequate preflight planning resulted in lack of awareness of a power line that crossed the planned route of flight. • Sun position likely increased difficulty for pilot to see the line.
ERA15FA313	8/16/2015	Hicksville, New York	Single-engine airplane operated under VFR as on-demand passenger flight lost engine power in visual conditions, struck obstacle durig forced landing on railroad tracks	1 fatal, 1 serious	• Pilot's improper decision to delay turning toward a suitable runway following an engine failure (crankshaft failure due to bearing shift) resulted in a forced landing on unsuitable terrain. • Air traffic controller provided erroneous emergency divert airport information to pilot due to the FAA's lack of a requirement review and validate radar video maps. • Pilot's impairment due to amphetamine abuse and underlying medical condition(s) contriubuted to the accident.
WPR17FA035	12/12/2016	Moab, Utah	Single-engine airplane operated under VFR as a positioning flight in dark, night visual conditions crashed during climb after takeoff	1 fatal	• Airplane climbed and turned right after takeoff consistent with the established traffic direction for the runway; however, it continued the right turn then entered an increasingly rapid descent and collided with terrain. • Circumstances of the accident were consistent with the known effects of spatial disorientation. • No evidence of pilot impairment or medical incapacitation was identified.

[3] Our database did not contain fields that captured Part 135 certificate type, operating authority, or scope. We manually reviewed the contents of each investigation's docket, including the pilot/operator-reported certificate information, interviews, and other documents and applied deductive reasoning to determine that these accidents likely involved single-pilot or single-PIC operators.

CEN18FA215	6/9/2018	Oshkosh, Wisconsin	Single-engine helicopter operated under VFR as on-demand photography flight struck power lines in visual conditions	1 fatal	• Pilot decided to fly over river at a low altitude (about 100 ft agl) and failed to mainain clearance with power lines.
ANC20LA046	5/14/2020	Nuiqsut, Alaska	Single-engine airplane operated under VFR as on-demand passenger flight to remote locations	1 fatal, 1 serious	• Pilot maneuvered airplane at low altitude and it struck snow-covered terrain in weather conditions that were conducive to flat light conditions.

Appendix B: Previously Issued Safety Recommendations

Operational Control and Flight Locating

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-06-14	Closed–Acceptable Alternate Action	9/11/2014	To the Federal Avation Administration (FAA): Require emergency medical services operators to use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions.
A-11-41	Closed–Unacceptable Action	12/8/2015	To the FAA: Review the approved pilot, dispatcher, and flight follower training programs and procedures for all 14 *Code of Federal Regulations* (*CFR*) Part 121, 135, and 91 subpart K operators and require revisions to the programs and procedures, as necessary, to include standardized training and aircraft-specific information to educate pilots, dispatchers, and flight followers of the dangers of flight operations in freezing precipitation and of the differences between ground deicing considerations and in-flight icing operations.
A-17-39	Closed–Unacceptable Action	5/23/2024	To the FAA: Establish minimum initial and recurrent training requirements for personnel authorized to exercise operational control, including, but not limited to, approved subject knowledge areas, training hours, subject hours, and qualification modules.
A-17-41	Closed–Unacceptable Action	5/23/2024	To the FAA: Revise FAA Order 8900.1 to include guidance for inspector oversight of operational control training program subject areas, including, but not limited to, the criteria for a qualification module.
Open recommendations			
Number	**Classification**	**Date issued**	**Recipient and recommended action**
A-17-40	Open–Uncceptable Response	5/9/2017	To the FAA: Publish an advisory circular that provides guidance on operational control best practices, including, but not limited to, such areas as risk mitigation strategies, joint flight safety responsibilities, prior experience of operational control personnel, and operational control personnel duty time limitations.
A-22-14	Open–Unacceptable Response	5/26/2022	To the FAA: Require air tour operators to have flight support personnel who are trained to exercise operational control authority, participate in preflight risk analysis, provide pilots with weather briefings, monitor the progress of the flights, and participate in two-way communications with pilots to alert them of any weather hazards.

Aircraft Weight and Balance

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-88-41	Closed–Unacceptable Action	4/11/1990	To the FAA: Amend Part 135 to require that commuter air carrier certificate holders maintain, for at least 90 days, copies of the completed load manifest and the weight and balance documentation that support the calculated total weight of the aircraft and its center of gravity location.

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-88-79	Closed–Acceptable Action	6/29/1989	To the FAA: Require that the principal operations inspectors assigned to Part 135 operators of reciprocating-engine aircraft that carry nine or fewer passengers verify that the operator complies with advisory circular 120-27A concerning the use of actual passenger weight.
A-88-80	Closed–Acceptable Action	6/29/1989	To the FAA: Issue an air carrier operations bulletin to principal operations inspectors assigned to Part 135 operators of reciprocating-engine aircraft which carry nine or fewer passengers; the bulletin should stress the importance of informing pilots of these airplanes about ensuring passenger seat assignments in accordance to planned weight and balance data.
A-89-135	Closed–Unacceptable Action	7/2/1990	To the FAA: Amend 14 *CFR* 135.63(c) to require operators of single-engine aircraft to comply with the requirements therein for preparation of a load manifest before each takeoff.
A-99-61	Closed–Unacceptable Action	9/11/2014	To the FAA: Amend the recordkeeping requirements of 14 *CFR* 135.63(c) to apply to single-engine as well as multiengine aircraft.
A-15-29	Closed–Unacceptable Action	5/18/2021	To the FAA: Expand the applicability of the recordkeeping requirements of 14 *CFR* 135.63(c) to all Part 135 operations, including single-engine operations, to require (1) the preparation of an accurate load manifest containing evidence that aircraft are within the approved center of gravity limits for each flight, (2) the inclusion of a copy of the documentation on board aircraft for each flight, and (3) the preservation of a copy of the documentation for at least 30 days after the flight.

Safety Management System and Flight Data Monitoring

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-07-10	Closed–Acceptable Action	12/1/2015	To the FAA: Require that all Part 121 operators establish safety management system (SMS) programs.
A-09-16	Closed–Acceptable Action	9/12/2011	To the FAA: Develop a safety alert for operators encouraging all Part 91 business operators to adopt SMS programs that include sound risk management practices.
A-09-89	Closed–Unacceptable Action	9/11/2014	To the FAA: Require helicopter emergency medical services operators to implement an SMS program that includes sound risk management practices.
A-09-90	Closed–Unacceptable Action	1/25/2018	To the FAA: Require helicopter emergency medical services operators to install flight data recording devices and establish a structured flight data monitoring (FDM) program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues.
A-16-36	Closed–Acceptable Action	7/24/2024	To the FAA: Require all Part 135 operators to establish SMS programs.[1]

[1] Classified in section 4.1 of this report.

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-22-15	Closed–Acceptable Action	7/24/2024	To the FAA: Develop guidance for small operators for scaling an SMS that includes methods and techniques for implementation and specific examples applicable to several operational sectors, including air tours.[2]
Open recommendations			
Number	**Classification**	**Date issued**	**Recipient and recommended action**
A-16-34	Open–Unacceptable Response	11/3/2016	To the FAA: Require all Part 135 operators to install flight data recording devices capable of supporting an FDM program.
A-16-35	Open–Unacceptable Response	11/3/2016	To the FAA: After the action in Safety Recommendation A-16-34 is completed, require all Part 135 operators to establish a structured FDM program that reviews all available data sources to identify deviations from established norms and procedures and other potential safety issues.
A-19-28	Open–Acceptable Response	1/16/2020	To the FAA: Require all commercial air tour operators, regardless of their operating rule, to implement an SMS.

Flight Activity and Other Data Collection

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-72-172	Closed–Acceptable Action	7/15/1973	To the FAA: Establish and maintain a separate listing of all current holders of air taxi operator certificates to permit the identification of each operator by type of servce being performed.
A-72-191	Closed–No Longer Applicable	9/16/1976	To the Civil Aeronautics Board: Require all air taxi operators registered with the board and designated as commuter air carrier, to report the hours flown, the miles flown, and the number of departures in scheduled revenue operations.
A-72-192	Closed–No Longer Applicable	9/16/1976	To the Civil Aeronautics Board: Require all air taxi operators classified under Part 298 of the Federal Aviation Act of 1958 to report the number of passengers carried, the hours flown, miles flown, and the number of depatures in revenue operation.
A-74-42	Closed–Uncceptable Action	2/20/1975	To the FAA: Collect and make available, on a calendar year basis, the following data from commercial operators: (a) for all nonrevenue operations–hours flown, miles flown, and departures; (b) for passenger and cargo operations–separately applicable tabulations of hours flown, miles flown, departures, freight ton-miles flown, and freight ton-miles available; and (c) for passenger operations only–seat-miles available and passenger-miles flown.
A-93-12	Closed–Superseded by A-95-57	6/19/1995	To the Department of Transportation: Devise a method for collecting data from air tour operators regarding flight hours, flight segments, and passengers carried that can be included in civil aviation exposure information for industry comparisons.

[2] Classified in section 4.1 of this report.

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-95-57	Closed–Unacceptable Action	7/14/1999	To the Department of Transportation: Establish and maintain a database of all air tour operators that would provide data for use in determining the scope of air tour operations and accident rates that can be used to assess the safety of the air tour industry.
A-01-74	Closed–Acceptable Action	7/16/2013	To the FAA: Identify and implement methods independent of the *General Aviation and Air Taxi Survey* that can be used to check the accuracy of nonairline flight hour estimates.
A-01-75	Closed–Acceptable Action	12/9/2014	To the FAA: Implement a program that will (a) measure and track the currency of aircaft owner contact information in the Civil Aircraft Registry and (b) systematically improve the currency of this information in a measurable way.
A-01-77	Closed–Acceptable Action	3/29/2011	To the FAA: Develop a new reporting matrix on the *General Aviation and Air Taxi Survey* form that separates the administrative purpose of flight (for example, personal, business, corporate, regional, air taxi, air tours, sightseeing, public use, air medical services, search and rescue, and so on) from the actual flying activity performed (for example, transport of passengers, flight instruction, aerial observation, aerial application, external load, and so on). Incorporate these changes in published flight hour estimates.
A-03-37	Closed–Unacceptable Action	3/29/2011	To the FAA: Require nonscheduled Part 135 operators to report activity data on an annual basis to include total hours flown, revenue flight hours, revenue miles flown, and number of departures by category/class of aircraft; to identify for each aircraft the proportion of flight time operations that are involved in sightseeing, air medical transport, passenger transportation, and cargo-only transportation; to report for cargo operations freight ton-miles available and freight ton-miles flown; and to report for passenger service operations seat-miles available and passenger miles flown.
A-03-38	Closed–Superseded by A-05-11	5/12/2005	To the FAA: Develop, validate, and document an unbiased method for generating and revising activity estimates based on nonscheduled Part 135 operator surveys or reporting.
A-05-11	Closed–Acceptable Action	3/29/2011	To the FAA: Develop, validate, and document an unbiased method for generating and revising activity estimates based on nonscheduled 14 *CFR* Part 135 and Part 91, Subpart K, operator surveys or reporting.

Emergency Medical Services Operations

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
A-06-12	Closed–Acceptable Action	9/11/2014	To the FAA: Require emergency medical services operators to comply with Part 135 operations specifications during the conduct of all flights with medical personnel on board.
A-06-13	Closed–Acceptable Action	9/11/2014	To the FAA: Require emergency medical services operators to develop and implement flight risk evaluation programs that include training all employees involved in the operation, procedures that support the systematic evaluation of flight risks, and consultation with others trained in emergency medical services flight operations if the risks reach a predefined level.
A-06-14	Closed–Acceptable	9/11/2014	To the FAA: Require emergency medical services operators to use formalized dispatch and flight-following procedures that include up-

Closed recommendations			
Number	**Classification**	**Date closed**	**Recipient and recommended action**
	Alternate Action		to-date weather information and assistance in flight risk assessment decisions.
A-06-15	Closed–Acceptable Action	9/11/2014	To the FAA: Require emergency medical services operators to install TAWS on their aircraft and to provide adequate training to ensur that flight crews are capable of using the systems to safely conduct emergency medical services operations.

Additional Open Recommendations

Open recommendations			
Number	**Classification**	**Date issued**	**Recipient and recommended action**
A-17-35	Open–Acceptable Response	5/9/2017	To the FAA: Implement ways to provide effective TAWS protections while mitigating nuisance alerts for single-engine airplanes operated under Part 135 that frequently operate at altitudes below their respective TAWS class design alerting threshold.
A-17-38	Open–Unacceptable Response	5/9/2017	To the FAA: Expand the application of FAA Order 8900.1, volume 3, chapter 19, section 6, "Safety Assurance System: Flight Training Curriculum Segments," paragraphs 3-1251(B) and 3-1252, which address controlled flight into terrain-avoidance training programs for 135 helicopter operations, to all Part 135 operations.
A-18-13	Open–Acceptable Response	4/26/2018	To the FAA: Although controlled flight into terrain-avoidance training programs are not required by federal regulation for Part 135 fixed-wing operations, work with Part 135 operators in Alaska to improve any voluntarily implemented training programs aimed at reducing the risk of controlled flight into terrain accidents involving continuation of flight under visual flight rules (VFR) into instrument meteorological conditions, with special attention paid to the human factors issues identified in recent Alaska accident investigations, including, but not limited to, (1) the challenges of flying in mountainous terrain in Alaska and low-altitude VFR flight in an area subject to rapid changes in weather; and (2) limitations of the Alaska infrastructure, particularly weather observations, communications, and navigation aids.
A-18-14	Open–Acceptable Response	4/26/2018	To the FAA: Work with Part 135 certificate holders that operate under VFR in mountainous terrain at altitudes below the required terrain clearance of the aircraft's required TAWS class to (1) ensure that management and pilots are aware of the risks associated with distraction (from continuous nuisance alerts) and complacency (brought about by routine use of the terrain inhibit feature); (2) develop plans for mitigating those risks and minimizing nuisance alerts; and (3) develop procedures that specifically address when pilots should test, inhibit, and uninhibit the TAWS alerts, considering the operator's typical operations and the TAWS manufacturer's guidance.
A-18-16	Open–Acceptable Response	4/26/2018	To the FAA: Install communications equipment throughout Alaska, after determining what would be most effective, to allow increased access to the instrument flight rules system, giving priority to those areas used by Part 135 operators.
A-18-17	Open–Acceptable Response	4/26/2018	To the FAA: Ensure that Alaska airports that are served by Part 135 operators and have instrument approaches are equipped with

Open recommendations			
Number	**Classification**	**Date issued**	**Recipient and recommended action**
			weather-reporting capabilities to enable instrument flight rules operations in accordance with 14 *CFR* 135.225(a).
A-19-8	Open—Unacceptable Response	3/18/2019	To the FAA: Develop guidance for Part 135 operators to help them create and implement effective crew resource management training programs.
A-19-31	Open—Unacceptable Response	1/16/2020	To the FAA: Develop and implement national standards within Part 135, or equivalent regulations, for all air tour operations with powered airplanes and rotorcraft to bring them under one set of standards with operations specifications, and eliminate the exception currently contained in 14 *CFR* 135.1.
A-19-34	Open—Acceptable Response	1/16/2020	To the FAA: Develop guidance on how to identify intoxicated or impaired passengers, and distribute it to operators who carry passengers for hire under Part 91 and Part 135.
A-21-5	Open—Acceptable Response	2/25/2021	To the FAA: Require the use of appropriate simulation devices during initial and recurrent pilot training for Part 135 helicopter operations to provide scenario-based training that addresses the decision-making, skills, and procedures needed to recognize and respond to changing weather conditions in flight, identify and apply mitigation strategies for avoiding adverse weather, practice the transition to the use of flight instruments to reduce the risk of spatial disorientation, and maintain awareness of a variety of influences that can adversely affect pilot decision-making.
A-21-15	Open—Unacceptable Response	5/13/2021	To the FAA: Identify high-traffic air tour areas and require, through a special federal aviation regulation or other means, that Parts 91 and 135 air tour operators that operate within those areas be equipped with an Automatic Dependent Surveillance-Broadcast Out- and In-supported traffic advisory system that 1) includes both visual and aural alerts, 2) is driven by an algorithm designed to minimize nuisance alerts, and 3) is operational during all flight operations.
A-21-17	Open—Unacceptable Response	5/13/2021	To the FAA: Require the installation of Automatic Dependent Surveillance-Broadcast Out- and In-supported airborne traffic advisory systems that include aural and visual alerting functions in all aircraft conducting operations under Part 135.

References

FAA (Federal Aviation Administration). 2010a. "Regulatory Evaluation, Notice of Proposed Rulemaking: Air Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments." April 1, 2010. Washington, DC: FAA APO-310.

—— 2010b. "Notice of Proposed Rulemaking, Air Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments." 75 *Federal Register* 62640, October 12, 2010.

—— 2013. "Agency Information Collection Activities: Requests for Comments; Clearance of a New Approval of Information Collection: Helicopter Air Ambulance Operator Reports; Correction." 78 *Federal Register* 155, August 12, 2013.

—— 2014a. "Regulatory Evaluation, Final Rule: Air Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments." Washington, DC: FAA APO-310. January 31, 2014.

—— 2014b. "Final Rule, Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations." 79 *Federal Register* 35, February, 21, 2014.

—— 2015a. "Final Rule, Safety Management Systems for Domestic, Flag, and Supplemental Operations Certificate Holders." 80 *Federal Register* 5, January 8, 2015.

—— 2015b. "Safety Management Systems for Aviation Services Providers." Advisory Circular 120-92B, Editorial Update. Washington, DC: FAA. January 8, 2015.

—— 2016a. "Study of Operators Regulated Under Part 135: FAA Modernization and Reform Act of 2012, Public Law 112-95, Section 409." Washington, DC: FAA. April 2016.

—— 2016b. "Part 121 Air Carrier Operational Control." Advisory Circular 120-101, Change 1. Washington, DC: FAA. October 17, 2016.

—— 2016c. "Safety Assurance System: Part 135 Flight Locating Systems and Operating Rules." FAA Order 8900.1, CHG 500, Volume 3, Chapter 25, Section 5. Washington, DC: FAA. December 7, 2016.

—— 2017. "Report to Congress, Safety of Air Ambulance Operations [April 1 through December 31, 2015], FAA Modernization and Reform Act of 2012, Public Law 112-95, Section 306." Washington, DC: FAA. May 16, 2017.

—— 2018. "Report to Congress, Safety of Air Ambulance Operations [Calendar Year 2016], FAA Modernization and Reform Act of 2012, Public Law 112-95, Section 306." Washington, DC: FAA. April 4, 2018.

—— 2019a. "Aircraft Weight and Balance Control." Advisory Circular 120-27F. Washington, DC: FAA. May 6, 2019.

—— 2019b. "Annual Report on the Safety of Air Ambulance Operations – 2017." Washington, DC: FAA. August 6, 2019.

—— 2020a. "Report to Congress: Safety of Air Ambulance Operations, Annual Report – Calendar Year 2018." Washington, DC: FAA. September 18, 2020.

—— 2020b. "Report to Congress: Safety of Air Ambulance Operations, Annual Report – Calendar Year 2019." Washington, DC: FAA. October 23, 2020.

—— 2022a. "Report to Congress: Collection of Data on Helicopter Air Ambulance Operations, Annual Report – Calendar Year 2020." Washington, DC: FAA. March 15, 2022.

—— 2022b. "Report to Congress: Collection of Data on Helicopter Air Ambulance Operations, Annual Report – Calendar Year 2021." Washington, DC: FAA. October 18, 2022.

—— 2022c. "Preliminary Regulatory Impact Analysis, Safety Management Systems for Parts 21, 91, 121, and 135, Notice of Proposed Rulemaking." Washington, DC: FAA. December 2022.

—— 2023a. "Notice of Proposed Rulemaking, Safety Management Systems." 88 *Federal Register* 1932, January 11, 2023.

—— 2023b. "Appendix A: Methodology for the 2012 General Aviation and Part 135 Activity Survey." January 20, 2023.

—— 2023c. "General Aviation and Part 135 Activity Surveys – CY 2021, Chapter III: Primary and Actual Use, Table 3.2 – Total Hours Flown by Actual Use by Aircraft Type." Updated March 1, 2023.

—— 2023d. "Updated Study of Operators Regulated Under Part 135: FAA Modernization and Reform Act of 2012, Public Law 112-95, Section 409." March 28, 2023.

—— 2023e. "General Information, Types of 14 *CFR* 135 Operations." Updated May 11, 2023. From faa.gov, https://www.faa.gov/licenses_certificates/airline_certification/135_certification/general_info, accessed November 27, 2023.

—— 2023f. "Notice of Proposed Rulemaking, Revisions to the Regulatory Definitions of 'On-Demand Operation', 'Supplemental Operation', and 'Scheduled Operation'." 88 *Federal Register* 166, August 29, 2023.

—— 2023g. "Safety Assurance System: Single-Pilot, Single Pilot-in-Command, and Basic Part 135 Operations." FAA Order 8900.1, CHG 386, Volume 2, Chapter 4, Section 6. February 24, 2023.

—— 2023h. "Report to Congress: Collection of Data on Helicopter Air Ambulance Operations, Annual Report – Calendar Year 2022." Washington, DC: FAA. September 14, 2023.

—— 2023i. "Safety Assurance System: What is SAS?" Updated December 1, 2023. From faa.gov, www.faa.gov/about/initiatives/sas, accessed April 30, 2024.

—— 2024a. "General Aviation and Part 135 Activity Surveys – CY 2022, Chapter III: Primary and Actual Use, Table 3.2 – Total Hours Flown by Actual Use by Aircraft Type." Updated January 4, 2024.

—— 2024b. "FAA-certificated Aircraft Operators (Legal Part 135 Holders)." Updated April 1, 2024. From faa.gov, www.faa.gov/about/officeorg/headquartersoffices/avs/faa-certificated-aircraft-operators-legal-part-135-holders, accessed April 25, 2024.

—— 2024c. "Final Rule, Safety Management Systems." 89 *Federal Register* 82, April 26, 2024.

—— 2024d. "Safety Management Systems for Aviation Service Providers." Advisory Circular 120-92D. Washington, DC: FAA. May 21, 2024.

Federal Aviation Administration Reauthorization Act of 2024, H.R. 3935, 118th Congress. (2024).

General Aviation Data Improvement Team (GADIT). 2001. *Activity-Data Task Report*. June 15, 2001.

—— 2002. *Activity-Data Task Report*. August 12, 2002.

National Transportation Safety Board (NTSB). 1972. *Air Taxi Safety Study*. AAS-72-9. Washington, DC: NTSB.

—— 1980. *Air Taxi Safety in Alaska*. AAS-80/03. Washington, DC: NTSB.

—— 1995. *Aviation Safety in Alaska*. SS-95/03. Washington, DC: NTSB.

—— 2006. *Special Investigation Report on Emergency Medical Services Operations*. SIR-06/01. Washington, DC: NTSB.

—— 2007. *Crash of Pinnacle Airlines Flight 3701, Bombardier CL-600-2B19, N8396A, Jefferson City, Missouri, October 14, 2004*. AAR-07/01. Washington, DC: NTSB.

—— 2011. "Official Correspondence from the NTSB to the Federal Aviation Administration (FAA) in Response to the FAA's Notice of Proposed Rulemaking, 'Air Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments,' Rules Docket No. FAA-2010-0982; Notice No. 10-13." January 10, 2011.

—— 2013. *Crash Following Loss of Engine Power Due to Fuel Exhaustion, Air Methods Corporation, Eurocopter AS350 B2, N352LN, Near Mosby, Missouri, August 26, 2011*. AAR-13/02. Washington, DC: NTSB.

—— 2017. *Collision with Terrain, Promech Air, Inc., de Havilland DHC-3, N270PA, Ketchikan, Alaska, June 25, 2015*. AAR-17/02. Washington, DC: NTSB.

—— 2018. *Collision with Terrain, Hageland Aviation Services, Inc., dba Ravn Connect Flight 3153, Cessna 208B, N208SD, Togiak, Alaska, October 2, 2016*. AAR-18/02. Washington, DC: NTSB.

—— 2019. "Alaska Part 135 Operations: Charting a Safer Course." Roundtable discussion hosted September 6, 2019, in Anchorage, AK. https://www.youtube.com/watch?v=5mnDetnPgVI

—— 2020a. "Improving the Safety of Part 135 Operations." Panel discussion hosted March 2, 2020, at the NTSB Training Center, Ashburn, VA. https://youtu.be/i45rq6r7IDQ.

—— 2020b. *Helicopter Air Ambulance Collision with Terrain, Survival Flight Inc., Bell 407 Helicopter, N191SF, near Zaleski, Ohio, January 29, 2019*. AAR-20/01. Washington, DC: NTSB.

—— 2020c. "NTSB Moves Forward in Meeting Federal Data Strategy, Requirements for Open Data." October 13, 2020. From ntsb.gov, https://www.ntsb.gov/news/press-releases/Pages/NR20201013.aspx, accessed December 7, 2023.

—— 2022a. *Collision into Terrain, Safari Aviation Inc., Airbus AS350 B2, Kekaha, Hawaii, December 26, 2019*. AIR-22-05. Washington, DC: NTSB.

—— 2022b. "Safeguard Your Flights with Valuable Insights: Practical FDM Solutions for Smaller Operators." Roundtable hosted October 20, 2022, at the National Business Aviation Association Convention & Exhibition in Orlando, FL (with highlights video). https://www.youtube.com/watch?v=QUwONESOn_o (https://www.youtube.com/watch?v=kKRSav55Whg).

—— 2022c. Implement Special Federal Aviation Regulation for Air Tours near Ketchikan, Alaska. AIR-22-09. Washington, DC: NTSB.

—— 2023a. "Comments on Notice of Proposed Rulemaking, 'Safety Management Systems,' 88 *Federal Register* 1932, Docket No. FAA-2021-0419." March 10, 2023.

—— 2023b. "Implementing an SMS in Small to Midsized Aviation Operations." Webinar hosted May 11, 2023, virtually. https://youtu.be/6EqRWXaG2Qs?si=mIgLQma3Nkys7py7.

—— 2023c. "2003-2022 Accident Statistics." Excel file "AviationAccidentStatistics_2003-2022_20231228.xlsx," available from the NTSB's "Statistical Reviews, US Civil Aviation Accident Statistics" web page. Accessed April 19, 2024.

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