



Aviation Investigation Final Report

Location:	Yakutat, Alaska	Accident Number:	ANC22LA035
Date & Time:	May 24, 2022, 15:10 Local	Registration:	N703TH
Aircraft:	DEHAVILLAND DHC-3	Aircraft Damage:	Substantial
Defining Event:	Loss of control in flight	Injuries:	4 Serious
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The purpose of the flight was to transport three passengers and cargo. The pilot reported that, during takeoff, the airplane's tail came up slightly lowered to the runway when he attempted to raise the tail by applying forward elevator. He stated that he thought this was unusual and attributed it to an aft-loaded airplane. He applied additional nose-down trim and departed without incident.

While en route, the tail of the airplane seemed to move up and down, which the pilot attributed to turbulence. Upon arrival at his destination, the pilot entered a left downwind, reduced the power and extended the flaps to 10° abeam the end of the runway. He turned onto the base leg about ½ mile from the approach end of the runway and slowed the airplane to 80 mph. Turning final, he noticed the airplane seemed to pitch up, so he applied full nose-down pitch trim and extended the flaps an additional 10°.

On short final he applied full flaps, and the airplane abruptly pitched up to about a 45° angle. He stated that he applied full nose-down elevator, verified the pitch trim, and reduced the power to idle. When the airplane was about 300 ft above ground level, the airplane stalled, the left wing dropped slightly, and the airplane entered about a 45° nose-down dive. After allowing the airplane to gain airspeed, the pilot applied full back elevator. The airplane impacted forested terrain near the approach end of runway 23 at an elevation of about 18 ft.

A postaccident examination of the airframe and engine revealed no evidence of preaccident mechanical malfunctions or failures that would have precluded normal operation. Elevator and rudder control continuity was confirmed from the cockpit to the respective control surfaces.

The airplane's estimated gross weight at the time of the accident was about 7,796 lbs and the airplane's estimated center of gravity was about 3.2 to 5.6 inches beyond the approved aft limit. Maximum gross weight for the airplane is 8,000 lbs.

The operator did not comply with their operations specifications and the federal regulations that required them to follow the weight and balance control procedures outlined in the aircraft weight and balance section of the pilot operating handbook and the requirement to maintain an aisle between the crew and passenger compartments.

The low speed, left roll, and pitch down of the airplane is consistent with an aerodynamic stall. The additional nose down trim at takeoff, the instability of the airplane during cruise flight, the full nose down trim during the approach and rapid pitch up after the application of full flaps are all consistent with an aft center of gravity (CG) condition of sufficient magnitude that the elevator pitch down authority was insufficient to overcome the pitching moment generated by the loading and aircraft configuration. The full down (or landing) flaps exacerbated the nose-up pitching moment due to the increased downwash on the tail and aft shift of the center of pressure.

For each flight in multiengine operations, Title 14 *Code of Federal Regulations (CFR)* 135.63(c) requires the preparation of a load manifest that includes, among other items the number of passengers, total weight of the loaded aircraft, the maximum allowable takeoff weight, and the center of gravity location of the loaded aircraft; one copy of the load manifest should be carried in the airplane, and the operator is required to keep the records for at least 30 days. Single-engine operations, such as the accident flight, are excluded from this requirement.

Had the pilot been required to prepare a load manifest that included the number of passengers, total weight of the loaded aircraft, the maximum allowable takeoff weight, and the center of gravity location of the loaded aircraft, he may have been more aware of the airplane's out-of-center-of-gravity condition.

The National Transportation Safety Board (NTSB) previously addressed the exclusion of single-engine operations from the Part 135 weight and balance requirements with the issuance of Safety Recommendations A-89-135, A-99-61, and A-15-29, which asked the Federal Aviation Administration (FAA) to amend the record-keeping requirements of 14 *CFR* 135.63(c) to apply to single-engine as well as multiengine aircraft. The FAA did not take the recommended action, and the NTSB classified Safety Recommendations A-89-135, A-99-61, and A-15-29 "Closed—Unacceptable Action" in 1990, 2014, and 2021, respectively.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's failure to determine the actual weight and balance of the airplane before departure, which resulted in the airplane being operated outside of the aft center of gravity limits and the subsequent aerodynamic stall on final approach. Contributing to the accident was the Federal Aviation Administration's failure to require weight and balance documentation for 14 *Code of Federal Regulations* Part 135 single-engine operations.

Findings

Aircraft	Pitch control - Attain/maintain not possible
Aircraft	(general) - Incorrect use/operation
Personnel issues	Weight/balance calculations - Not specified
Aircraft	Pitch control - Capability exceeded
Aircraft	CG/weight distribution - Incorrect use/operation
Organizational issues	Oversight of reg compliance - FAA/Regulator

Factual Information

History of Flight

Approach-VFR pattern final Loss of control in flight (Defining event)

On May 24, 2022, about 1510 Alaska daylight time, a de Havilland DHC-3 Turbine Otter airplane, N703TH, sustained substantial damage when it was involved in an accident near Yakutat, Alaska. The pilot and three passengers were seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 135 on demand charter flight.

The flight, operated by Yakutat Coastal Airlines, had departed from Yakutat Airport (PAYA), Yakutat, Alaska, destined for Dry Bay Airport (3AK), Yakutat, Alaska. The pilot reported that during takeoff from PAYA, the tail came up slightly and then fell back to the runway when he attempted to raise the tail of the airplane by applying forward elevator. He thought this was unusual and attributed it to an aft-loaded airplane. The pilot applied additional nose-down trim and departed without incident. He stated that, while en route, the tail of the airplane seemed to move up and down, which he attributed to turbulence.

Upon arrival at 3AK, he entered a left downwind for runway 23. At an altitude of about 600 ft, he reduced the power and extended the flaps to 10° abeam the end of the runway. He turned onto the base leg about ½ mile from the approach end of the runway and slowed the airplane to 80 mph. Turning final, he noticed the airplane seemed to pitch up, so he applied full nose-down pitch trim and extended the flaps an additional 10°. On short final, he applied full flaps, and the airplane abruptly pitched up to about a 45° angle. He stated that he applied full nose-down elevator, verified the pitch trim, and reduced the power to idle. When the airplane was about 300 ft above ground level, the airplane stalled, the left wing dropped slightly, and the airplane entered about a 45° nose-down dive. After allowing the airplane to gain airspeed, he applied full back elevator. The airplane impacted forested terrain near the approach end of runway 23 at an elevation of about 18 ft, which resulted in substantial damage to the fuselage, wings, and tail.

A Garmin aera 796 was recovered from the accident site. GPS data logs for the day of the accident revealed that the airplane departed at about 1446 and after the initial climb continued southeast for about 18 minutes at GPS altitudes between 492 and 1,280 ft, with a groundspeed between 111 and 127 knots. About 2 minutes before the accident, the airplane initiated a gradual left turn to the east and entered the traffic pattern for the 3AK. For the remainder of the flight the groundspeed varied from 10 knots to 255 knots. The last fully recorded in-flight data point was at 1509, when the airplane was at a GPS altitude of 335 ft with a groundspeed of 13 kts and on a track of 56° (see figure 1).

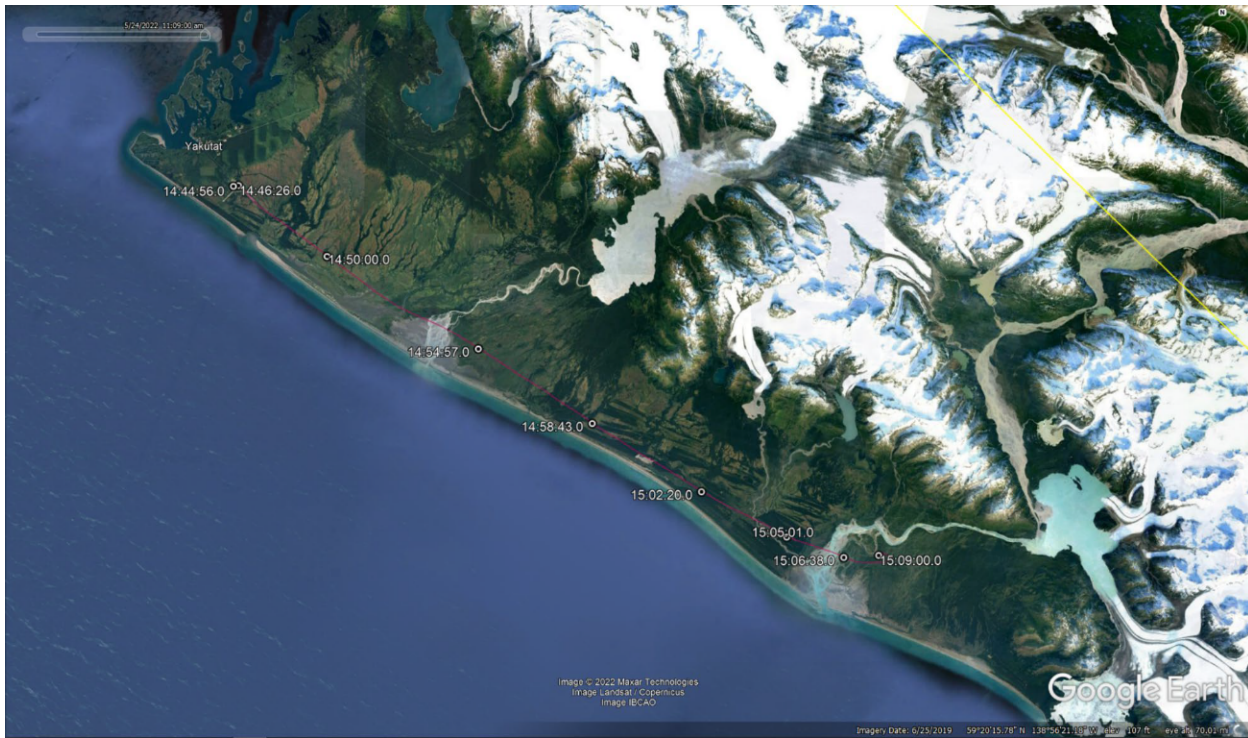


Figure 1 - Accident airplane's flight track.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	51, Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	Toxicology Performed:	
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	May 14, 2022
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	June 21, 2021
Flight Time:	24000 hours (Total, all aircraft), 6100 hours (Total, this make and model), 23700 hours (Pilot In Command, all aircraft), 100 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft), 5.5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	DEHAVILLAND	Registration:	N703TH
Model/Series:	DHC-3	Aircraft Category:	Airplane
Year of Manufacture:	1966	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	456
Landing Gear Type:	Tailwheel	Seats:	11
Date/Type of Last Inspection:		Certified Max Gross Wt.:	8000 lbs
Time Since Last Inspection:		Engines:	1 Turbo prop
Airframe Total Time:		Engine Manufacturer:	WALTER
ELT:		Engine Model/Series:	M601E-11
Registered Owner:	MUNICH HANS W DBA	Rated Power:	751 Horsepower
Operator:	Yakutat Coastal Airlines	Operating Certificate(s) Held:	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	PAYA,41 ft msl	Distance from Accident Site:	42 Nautical Miles
Observation Time:	15:04 Local	Direction from Accident Site:	300°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	Overcast / 1300 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	3 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	60°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.02 inches Hg	Temperature/Dew Point:	8°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Yakutat , AK	Type of Flight Plan Filed:	Company VFR
Destination:	Yakutat , AK	Type of Clearance:	None
Departure Time:		Type of Airspace:	Class G

Airport Information

Airport:	Dry Bay Airport 3AK	Runway Surface Type:	Gravel
Airport Elevation:	33 ft msl	Runway Surface Condition:	
Runway Used:	5/23	IFR Approach:	None
Runway Length/Width:	3600 ft / 170 ft	VFR Approach/Landing:	Full stop

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:	3 Serious	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	4 Serious	Latitude, Longitude:	59.164333,-138.4888

The cargo was removed from the airplane following the accident without the knowledge or consent of the National Transportation Safety Board (NTSB).

A postaccident examination of the airframe and engine, which included an Electronics International MVP-50T engine monitor revealed no pre-accident mechanical malfunctions or failures with the airplane, that would have precluded normal operation. Elevator control continuity was established from the control column in the control cables to the quadrant in the rear of the fuselage at fuselage station (FS) 427 to the elevator control rod to the elevators. Rudder control continuity was established from the rudder pedals to the quadrant at FS 427 to the control rod and to the rudder. .

Additional Information

WEIGHT AND BALANCE INFORMATION

As a single-engine operation, the flight was not required to have a load manifest on the airplane. The pilot stated that he had computed a weight and balance for the accident flight and recorded it on a piece of paper; however, it could not be located following the accident. At the request of the NTSB, the pilot provided documents indicating the weight of the cargo and passengers and their locations in the airplane. The first set of documents was provided on May 28, 2022, and the values and locations were not consistent with witness statements. A

second set of documents was provided on June 10, 2022, that is believed to have more accurately reflected the loading of the accident flight.

One passenger reported that the freight had been weighed on pallets and he assisted the pilot by handing him freight that was then loaded on the airplane. He stated there was a pallet of garbage cans that was placed near the front of the airplane, in addition to a pallet of ATV tires, wheels, and a portable sawmill head. Another passenger stated that the airplane was partially loaded when he arrived at the operator's facility. He was not asked his weight, his bags were not weighed, and he did not see a scale. He stated that he was seated in the back of the airplane with a saw at his feet.

According to the weight and balance information for the airplane dated March 15, 2017, the basic empty weight of the airplane was 4,425 lbs with a center of gravity of 141.1 inches. At the airplane's maximum takeoff gross weight of 8,000 lbs, the center of gravity range was 135.8 inches to 152.2 inches.

The airplane's weight and balance at the time of the accident was estimated using the documentation provided by the pilot on June 10, 2022. The pilot stated that the airplane departed with about 618.8 lbs of fuel and 1,996 lbs of cargo. Assuming an average fuel burn of about 360 lbs/hr, and about 23 minutes of flight time before the accident, fuel onboard at the time of the accident was about 480.8 lbs. The gross weight of the airplane at the time of the accident, was about 7,796.8 lbs. A CG range of about 155.4 - 157.8 inches aft of datum was computed based on the two possible fuel loading extremes.

The accident flight was operated under the provisions of Part 135 as an on-demand charter and was subject to the regulation's applicable rules and the requirements set forth in the company's operations specifications (OpSpecs). Per §135.399, the operator was not allowed to operate the accident airplane without complying with "the takeoff weight limitations in the Approved Flight Manual or equivalent." The requirements of § 135.87 state, in part, that no person may carry cargo (including carry-on baggage) in an aircraft unless it is not located in a position that obstructs the access to, or the use of the aisle between the crew and the passenger compartment (see figure 2).



Figure 2 - Accident airplane being loaded for the accident flight. (Source: A passenger on the accident flight)

Neither Part 135 for single-engine operations nor the operator's OpSpecs require that the aircraft weight and balance be physically documented for any flight. However, according to OpSpec Paragraph A096, when determining aircraft weight and balance, the operator was authorized to use either the actual measured weights for all passengers, baggage, and cargo or the solicited weights for passengers plus 10 lbs and actual measured weights for baggage and cargo. In addition, for routine operations, the operator was required to follow the weight and balance control procedures outlined in the aircraft weight and balance section of the pilot operating handbook.

Although neither Part 135 nor Yakutat Coastal Airlines' OpSpec requires the operator to physically document the weight and balance for any flights conducted in the company's single-engine airplanes, §135.63 requires that operators using multiengine aircraft are "responsible for the preparation and accuracy of a load manifest in duplicate containing information concerning the loading of the aircraft." This load manifest must be prepared before each flight and include, among other items, the number of passengers, total weight of the loaded aircraft, the maximum allowable takeoff weight, and the center of gravity location of the loaded aircraft. Further, one copy of the load manifest is to be carried in the airplane, and the operator is required to keep the records for at least 30 days.

The NTSB attempted to address this single-engine exclusion with the issuance of Safety Recommendations A-89-135, A-99-61, and A-15-29, which asked the Federal Aviation Administration (FAA) to amend the record-keeping requirements of 14 CFR 135.63(c) to apply

to single-engine as well as multiengine aircraft. The FAA did not take the recommended action in the above recommendations, and the NTSB classified them "Closed—Unacceptable Action" in 1990, 2014, and 2021, respectively.

Administrative Information

Investigator In Charge (IIC):	Banning, David		
Additional Participating Persons:	Frederick Adams; Federal Aviation Administration ; Juneau, AK		
Original Publish Date:	October 5, 2023	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=105132		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).