National Transportation Safety Board
Aviation Accident Factual Report

Location:	Soldotna, Alaska	**Accident Number:**	ANC20LA074
Date & Time:	July 31, 2020, 08:27 Local	**Registration:**	N4982U (A1); N2587M (A2)
Aircraft:	De Havilland DHC-2 (A1); Piper PA 12 (A2)	**Aircraft Damage:**	Substantial (A1); Substantial (A2)
Defining Event:	Midair collision	**Injuries:**	6 Fatal (A1); 1 Fatal (A2)
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled (A1); Part 91: General aviation - Personal (A2)		

On July 31, 2020, about 0827 Alaska daylight time, a de Havilland DHC-2 (Beaver) airplane, N4982U, and a Piper PA-12 airplane, N2587M, sustained substantial damage when they were involved in an accident near Soldotna, Alaska. The pilot of the PA-12 and the pilot and the five passengers on the DHC-2 were fatally injured. The DHC-2 was operated as a Title 14 *Code of Federal Regulations* (*CFR*) Part 135 on-demand charter flight. The PA-12 was operated as a Title 14 *CFR* Part 91 personal flight.

The float-equipped DHC-2, operated by High Adventure Charter, departed Longmere Lake, near Soldotna, about 0824 bound for a remote lake on the west side of Cook Inlet. The purpose of the flight was to transport the passengers to a remote fishing location. The PA-12, operated by a private individual, departed Soldotna Airport, Soldotna, Alaska, (PASX) about 0824 bound for Fairbanks, Alaska.

Flight track data revealed that the DHC-2 was traveling northwest about 78 knots (kts) groundspeed and gradually climbing through about 1,175 ft mean sea level (msl) when it crossed the Sterling Highway. The PA-12 was traveling northeast about 1,175 ft msl and about 71 kts north of, and parallel to, the Sterling Highway. The airplanes collided about 2.5 miles northeast of the Soldotna airport at an altitude of about 1,175 ft msl. See figure 1 for the airplanes' flight tracks.

Figure 1 - Flight track. ADS-B data (N2587M) and ENA/ANX radar data (4982U).

A witness located near the accident site observed the DHC-2 traveling in a westerly direction and the PA-12 traveling in a northerly direction. He stated that the PA-12 impacted the DHC-2 on the left side of the fuselage toward the back of the airplane. After the collision, he observed what he believed to be the DHC-2's left wing separate, and the airplane entered an uncontrolled, descending counterclockwise spiral before it disappeared from view. He did not observe the PA-12 following the collision.

Pilot Information (A1)

Certificate:	Commercial	**Age:**	57,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	June 12, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 12, 2019
Flight Time:	19530 hours (Total, all aircraft), 13480 hours (Total, this make and model), 19030 hours (Pilot In Command, all aircraft), 130 hours (Last 90 days, all aircraft), 91 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Pilot Information (A2)

Certificate:	Commercial	**Age:**	63,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	1600 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information (A1)

Aircraft Make:	De Havilland	**Registration:**	N4982U
Model/Series:	DHC-2	**Aircraft Category:**	Airplane
Year of Manufacture:	1956	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	904
Landing Gear Type:	Float	**Seats:**	8
Date/Type of Last Inspection:	June 1, 2020 Annual	**Certified Max Gross Wt.:**	5090 lbs
Time Since Last Inspection:		**Engines:**	Reciprocating
Airframe Total Time:	23595 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney
ELT:	C126 installed	**Engine Model/Series:**	R-985 AN-14B
Registered Owner:		**Rated Power:**	450 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)

Aircraft and Owner/Operator Information (A2)

Aircraft Make:	Piper	**Registration:**	N2587M
Model/Series:	PA 12	**Aircraft Category:**	Airplane
Year of Manufacture:	1946	**Amateur Built:**	
Airworthiness Certificate:	Unknown	**Serial Number:**	12-952
Landing Gear Type:	Tailwheel	**Seats:**	
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Lycoming
ELT:	C126 installed	**Engine Model/Series:**	O-360A4A
Registered Owner:		**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

A registration card located inside the PA-12 identified the airplane as a Piper PA-12 with a registration number of N2587M. The Federal Aviation Administration's (FAA) registration database revealed that N2587M was a valid registration for a Piper PA-12 assigned to the pilot. However, the PA-12's exterior registration number identified the airplane as N1904T; in addition, the word "EXPERIMENTAL" was applied to the inside of the lower clam shell door. A search of the FAA registration database revealed that the registration number had been reserved by the pilot but was not a valid registration.

The DHC-2 was being operated as a Part 135 on-demand charter flight, and the PA-12 was operating as a Part 91 personal flight. The DHC-2 had no traffic awareness equipment installed, but ADS-B Out and In were installed on the PA-12.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PASX,113 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:		**Direction from Accident Site:**	200°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 8500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	15°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Soldotna, AK (A1); Soldotna, AK (A2)	**Type of Flight Plan Filed:**	Company VFR (A1); None (A2)
Destination:	Tyonek, AK (A1); Fairbanks, AK (A2)	**Type of Clearance:**	None (A1); None (A2)
Departure Time:		**Type of Airspace:**	Class E (A1); Class E (A2)

Weather observations, cameras, and airborne images taken by passengers on the Beaver within a minute and less than a mile before the collision showed a thin ceiling characterized by high broken-scattered clouds resulting in a mix of direct sun and shaded conditions in the general vicinity both airplanes were operating in.

The sun was about 84° azimuth and its elevation was about 18° above the horizon, within 20° of the Piper's track.

Wreckage and Impact Information (A1)

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	5 Fatal	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	6 Fatal	**Latitude, Longitude:**	60.495555,-151.01693

Wreckage and Impact Information (A2)

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	60.495555,-151.01693

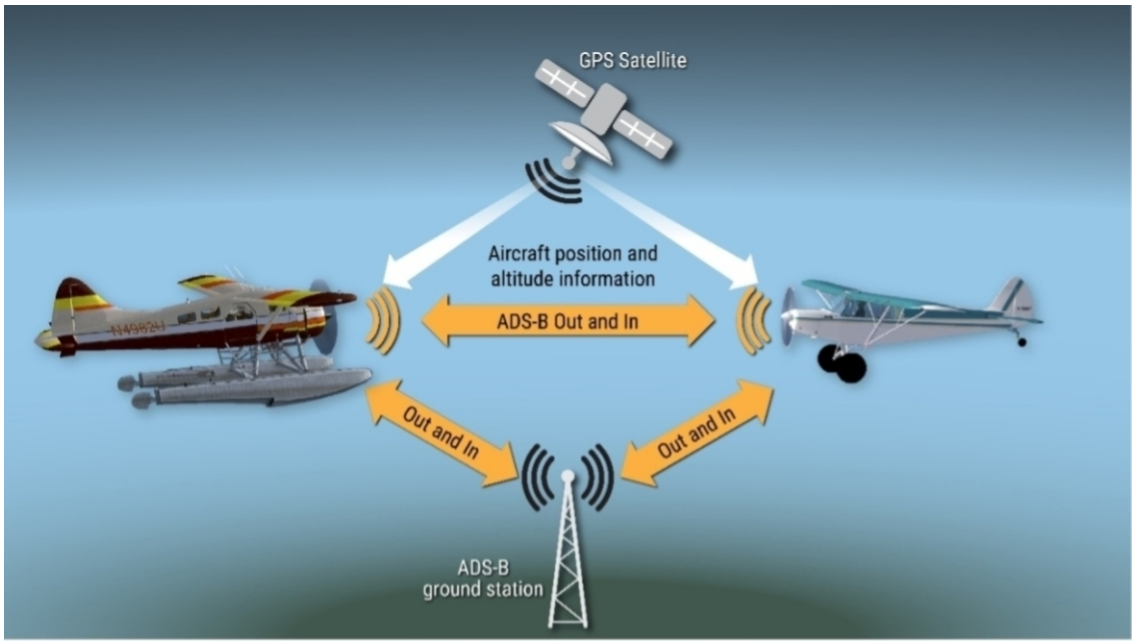
The DHC-2 main wreckage was heavily fragmented and located in a wooded residential area; the fuselage was oriented on a heading of about 270° at an elevation of about 240 ft. A debris field about 300 ft long and oriented on about a 327° heading included the engine, fuselage, wings, vertical stabilizer, and portions of the floats. Dark green paint transfers consistent with the PA-12 were observed on the aft fuselage of the DHC-2.

The PA-12 main wreckage was located about 600 ft east of the DHC-2. The airplane impacted in a near vertical attitude and came to rest at an elevation of about 258 ft. The horizontal stabilizer and one elevator from the DHC-2 were found intertwined in the wreckage of the PA-12.

Additional Information

Advance Dependent Surveillance-Broadcast (ADS-B)

ADS-B uses global navigation satellite system position reports from appropriately equipped aircraft to track aircraft movements. ADS-B Out-equipped aircraft broadcast aircraft position (latitude, longitude, and altitude) and velocity to ADS-B In-equipped aircraft and to ADS-B ground stations once per second. ADS-B ground stations record and re-broadcast this data along with additional traffic data collected using legacy radar technology (see figure 2). ADS-B In-equipped aircraft can receive this information, process it through onboard transceivers, and display it on a cockpit display of traffic information (CDTI) screen.



Depending on the configuration of the transceiver and the CDTI, ADS-B In avionics enable aircraft surveillance applications to display traffic and produce visual and aural alerts of predicted collision threats. One example of these applications is the ADS-B traffic advisory system (ATAS). The ATAS application, previously known as traffic situation awareness with alerts, monitors potential traffic conflicts by combining ADS-B tracking data with proximity-prediction algorithms. When it detects a traffic conflict, ATAS sounds an audio alert or "traffic callout." Conflicting aircraft are also highlighted on cockpit displays when such displays are available in an aircraft. ATAS was designed to operate without excessive nuisance alerts and is the only ADS-B application with an aural-only implementation. Additionally, ATAS was designed to meet FAA Technical Standard Order (TSO) C195b and RTCA Document (DO) No. 317B, Minimum Operational Performance Standards (MOPS) for Aircraft Surveillance Applications System (dated June 17, 2014).

Since January 1, 2020, installation of ADS-B Out equipment is required on all aircraft in the National Airspace System (NAS) operating above 10,000 ft msl and within or above class B and C airspace with certain exceptions. ADS-B Out equipment is not required in the Soldotna area because the airspace is class E and class G. According to 14 *CFR* 91.225, each person operating an aircraft equipped with ADS-B Out must use transmit mode at all times. ADS-B In is currently not required by the FAA.

An NTSB performance study concluded that if both airplanes had been equipped with ADS-B Out and In, and with CDTI displays capable of ATAS alerts conforming to DO-317B standards, it is possible that both pilots could have been made aware of the presence of the other airplane at least as soon as they were within line-of-sight of each other (say, by the time the Beaver climbed to 500 ft. msl), or by 08:25:01 (about a minute and a half before the collision). Additionally, the PA-12 pilot would have received an alert 26 seconds before the collision and another alert 9 seconds before the collision. The DHC-2 pilot would have received an alert 26 seconds before the collision and another alert 19 seconds before the collision.

FAA Advisory Circular AC 90-48D indicates that the minimum time for a pilot to detect another aircraft, judge a collision course, and take evasive action is about 12.5 seconds. Therefore, it is likely the pilots of both aircraft could have maneuvered to avoid the collision if their aircraft were equipped with ATAS-capable devices conforming to DO-371B standards, and these devices were operational.

The FAA recognized the differences between Part 91, Part 121, and Part 135 operations from the perspective of a passenger in the agency's notice of proposed rulemaking (NPRM) for fractional aircraft ownership. In the NPRM, the FAA stated that aircraft owners flying aboard aircraft that they own or lease "exercise full control over and bear full responsibility for the airworthiness and operation of their aircraft." In contrast, the FAA stated that passengers who are transported under Parts 121 and 135 "exercise no control over and bear no responsibility for the airworthiness or operation of the aircraft aboard which they are flown" (NARA 2001). As a result, the FAA concluded that the "appropriate level of public safety is provided by…very stringent regulations and oversight under Part 121 and Part 135."

However, the NTSB believes the lack of a requirement for ADS-B In-based traffic awareness displays for all aircraft conducting Part 135 operations fails to take advantage of the demonstrated benefit of this technology in mitigating the midair collision hazard. In addition, aircraft without ADS-B do not demonstrate the "appropriate level of safety" for passenger-carrying operations conducted under Part 135 regulations. Therefore, the NTSB issued Safety Recommendation A-21-17 to the FAA to require the installation of ADS-B Out- and In-supported airborne traffic advisory systems that include aural and visual alerting functions in all aircraft conducting operations under 14 *CFR* Part 135. (Source: NTSB Aircraft Accident Brief, NTSB/AAR-21/04, "Midair Collision over George Inlet de Havilland DHC-2, N952DB, and de Havilland DHC-3, N959PA, Ketchikan, Alaska, May 13, 2019.")

Medical and Pathological Information

According to information on file with the FAA, the pilot of the PA-12 was denied medical certification in June 2012 due to open-angle glaucoma with visual field loss in both eyes. Following the denial, the PA-12 pilot requested reconsideration, but the FAA sustained the denial in July 2012. The NTSB reviewed personal medical records from the PA-12 pilot, which showed that his glaucoma was severe and had caused irreversible optic nerve damage and visual field defects in both eyes.

Tests and Research

The NTSB completed an aircraft performance and cockpit visibility study to determine the position and orientation of each airplane in the minutes before the collision using ADS-B data for the PA-12, three-dimensional laser scans of the cockpits of exemplars for both airplanes, passenger photos, radar data for the DHC-2 and wreckage and impact information. This information was then used to estimate the approximate location of each airplane in the other airplane pilot's field of view and to recreate CDTI data that could have been presented to the pilots.

The study determined that, at the time of the collision, for the DHC-2 pilot, the sun would have been behind the DHC-2 pilot's head and out of view. For the PA-12 pilot, both the sun and the DHC-2 would have appeared to the east of the PA-12, and the trajectory of the sun in the PA-12 pilot's field of view is parallel to, and about 20° degrees of elevation above, the trajectory of the DHC-2. Consequently, to spot the DHC-2, the PA-12 pilot would have to be looking towards the sun.

The cockpit visibility study revealed that for the 53-second period before the collision, the Piper would have been unobscured and visible from the DHC-2 pilot through the DHC-2 left windshield.

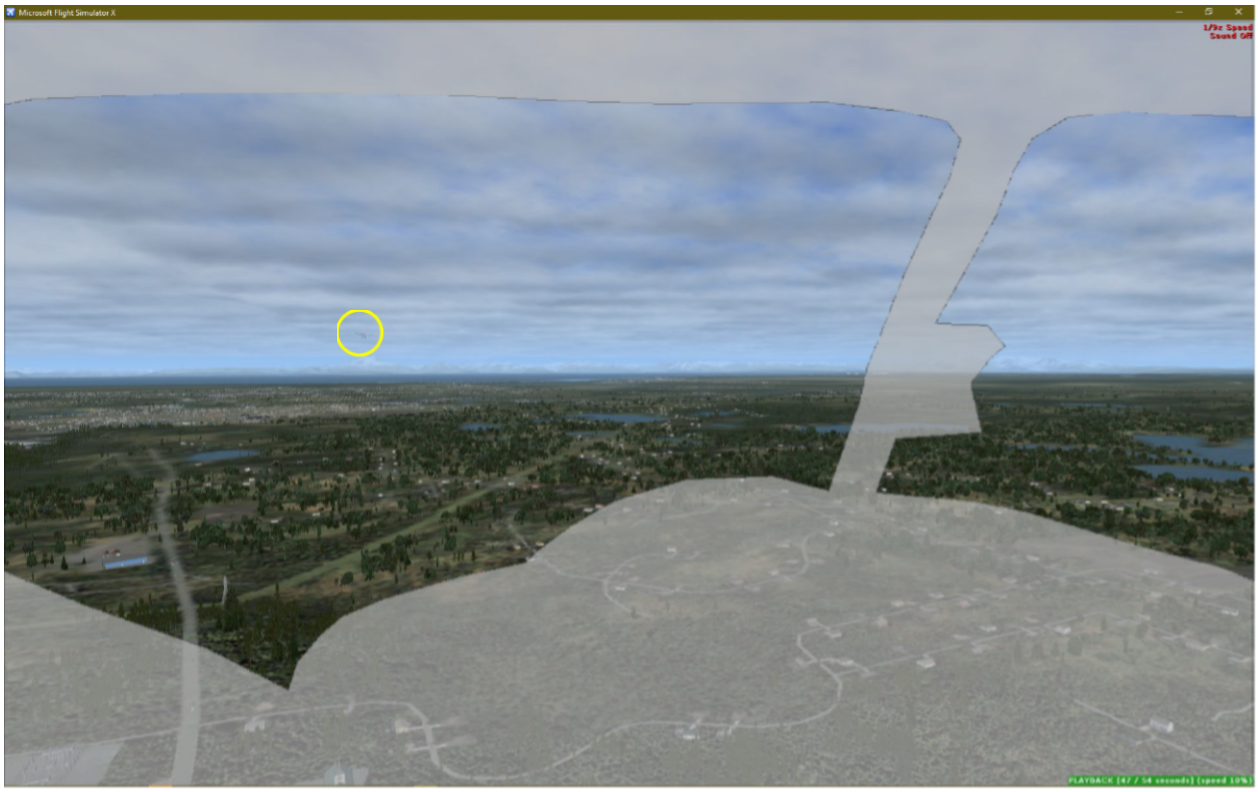


Figure 2 - Recreation of the view from the DHC-2 cockpit at 0826:27 (5.3 seconds before the collision). The location of the PA-12 is indicated by the yellow circle.

Regarding whether the PA-12 pilot could have seen the DHC-2, between 0825:39 to just before 0825:51 (12 seconds) the DHC-2 would have been unobscured and visible through the PA-12

right window. The DHC-2 would have then been obscured behind the PA-12 right wing root until about 0825:58. The DHC-2 would then have appeared on the right edge of, or been obscured by, a structural support tube inside the cockpit from about 0825:58 to about 0826:04 (6 seconds). From 08:26:04 to the collision at 08:26:32.3 (28.3 seconds), the DHC-2 would have been unobscured and visible in the PA-12 windshield, just to the left of the support tube.

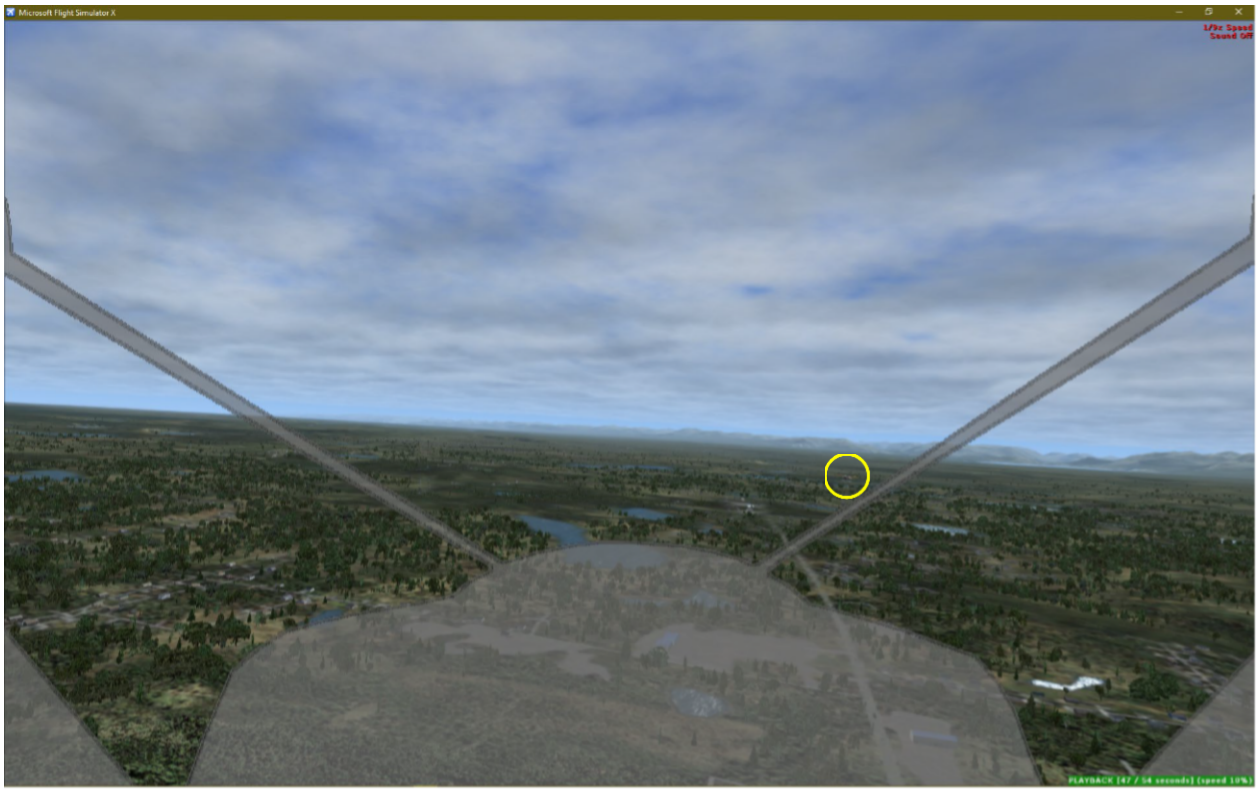


Figure 3 - Recreation of the view from the Piper cockpit at 0826:27 (5.3 seconds before the collision). The location of the DHC-2 is indicated by the yellow circle.

The cockpit visibility study also considered whether the geometry of the "blind spots" created by the window supports, and other structures could shift based on the position of the pilot in the cockpit. To determine how this geometry changes as the pilot's eye position changes (for example, by the pilot leaning in different directions, or by a seat height adjustment), the study considered 27 potential eye positions and evaluated whether the DHC-2 pilot could have seen the PA-12 in any of those positions. The study concluded that the PA-12 would have been unobscured and visible to the DHC-2 pilot for all eye positions considered for the period studied (53 seconds before the collision). The position of the DHC-2 was very sensitive to movements of the PA-12 pilot's eye position relative to the right support tube behind the PA-12 windshield. At some eye positions, the DHC-2 was temporarily obscured by the support tube, but at others, the tube never obscured the DHC-2.

Administrative Information

Investigator In Charge (IIC):	Banning, David
Additional Participating Persons:	Matthew Cary; Federal Aviation Administration; Anchorage, AK Mark Bell; High Adventure Air Charter; Soldotna , AK
Report Date:	August 10, 2022
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101718