NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 4, 2020

Specialist's Report

OPERATIONAL FACTORS

ANC20LA074AB

Table Of Contents

A. ACCIDENT

Location: Soldotna, Alaska
Date: July 31, 2020
Time: 0827 Alaska Daylight Time (ADT)[1]
1627 Coordinated Universal Time (UTC)
Airplanes: DHC2; N4982U and PA-12; N2587M

B. AIR SAFETY INVESTIGATOR

Shawn Etcher
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On July 31, 2020, about 0827 Alaska daylight time, a de Havilland DHC-2 (Beaver) airplane, N4982U, and a Piper PA-12 airplane, N2587M, were involved in an accident near Soldotna, Alaska. The pilots of both airplanes 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.

D. DETAILS OF THE INVESTIGATION

The Operational Factors investigator was assigned to the investigation on July 31, 2020. Documentation and manuals were requested from the Part 135 operator. Pilot information, for both pilots, was requested from the Federal Aviation Administration (FAA).

The FAA Principal Operations Inspector (POI) was interviewed on August 26, 2020.[2] During that interview the POI described the recent observation flight with the DHC-2 pilot, which occurred approximately 2 weeks prior.

The Chief Pilot for High Adventure Air Charter, Guides and Outfitters, the operator of N4982U, was interviewed on September 2, 2020.[3] During that interview he described the operation and the accident pilot's flying history.

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[1] All times in the report will be in Alaska daylight time, also known as local lime, except as noted. At the time of the accident local time was UTC -8 hours.
[2] Source: Attachment 2 - Interview Transcript with Inspector Dahl - FAA
[3] Source: Attachment 3 – Interview Transcript with High Adventure Air Charter, Guides and Outfitters Chief Pilot.

E. FACTUAL INFORMATION

1.0 History of Flight

The crew of each airplane consisted of a single pilot.

1.1 N4982U

On the day of the accident, N4982U was scheduled to operate a charter flight from Longmere Lake, which was the base of operations for the operator, to Big River Lake. Radar data indicated that the flight was approaching the area of the accident from the southeast and was climbing on a west-northwest ground track. Radar data was lost about 0827 with the last radar data altitude reported was about 1,350 ft above mean sea level (msl).

According to a representative for High Adventure Air Charter, Guides and Outfitters, the flight departed Longmere Lake, which was High Adventure Air Charter, Guides and Outfitters' base of operation, about 0824. The flight had one pilot and five passengers. Shortly, after departure the pilot reported to the base, via radio communication, that he was airborne, and that was the last transmission received. The intended route of flight was from Longmere Lake direct to Big River Lake, which was approximately 50 nautical miles on a west-northwest track.

1.2 N2587M

N2587M was on a flight that departed Soldotna Airport (PASX), Soldotna, Alaska about 0825. After departure the aircraft's ground track indicated a climb to the north and then the ground track indicated a track to the east-northeast. Radar track data was lost about 0827 with the last radar data altitude reported of 1,200 ft msl.

N2587M and N4982U collided in flight about two miles to the north-northeast of PASX and approximately three miles to the west of Longmere Lake about 0827.

1.3 Witness Statement[4]

An eyewitness provided that on the day of the accident he was outside and audibly noticed a propeller sound change on one of the airplanes, which he described as a change of sound from a "cruise speed" to an "evasive speed." He then observed a "darker" larger airplane traveling from the east to the west and the "smaller lighter" airplane was traveling from the south to the north. He further stated that there was a "decent amount of aircraft" in the area and he further clarified that he saw about five airplanes in the area around the time of the accident. He further stated that he observed both aircraft just prior to impact. He then observed the "bigger" aircraft lose a wing and began what he described as a "flat spin" in a counterclockwise direction. He estimated that the airplane made about two revolutions prior to him losing sight of it behind some trees in the area. He further stated that he did not observe the other airplane after the midair impact. He stated that he was approximately 200 yards from where the accident occurred and described the accident as similar to a "T-bone" crash. He described the weather as blue skies and that the sun was "pretty bright" and would have been behind the airplane traveling from the south to the north.

[4] Source: Operational Factors Attachment 1 – Record of Conversations Eyewitness Interviews.

Another witness, who was traveling on a nearby highway, did not see the collision; however, she recalled seeing the fuselage and left wing of one of the airplanes, and the airplane appeared to be "disintegrating" in the air. She stated that the airplane was "to low" and thought it may have been landing in a nearby lake. She further provided that the sun was "not super bright" and was behind them as they traveled on the highway, but that there was nothing remarkable about the weather.

2.0 Pilot Information

2.1 Pilot – N4982U

The pilot was 57 years old. The High Adventure Air Charter, Guides and Outfitters Operation Specifications A006 "Management Personnel" indicated at the time of the accident he was the director of operations. In addition, interview transcripts with the chief pilot of the operator also indicated that the accident pilot was the line check airman for the operator. According to the operator, he had approximately 19,530 hours of total flight experience and approximately 13,480 of those hours were in the DHC-2.[5]

A review of the FAA Accident and Incident Data System (AIDS), Enforcement Information System (EIS) and Program Tracking and Reporting Subsystem (PTRS)[6] databases indicated no records or reports of any previous aviation incidents or accidents involving the pilot.

2.1.1 Pilot's Certification Record – N4982U

FAA records of the pilot indicated the following:

Private Pilot – Airplane Single-Engine Land certificate issued August 23, 1980.

Private Pilot – Airplane Single-Engine Land and Sea certificate issued August 26, 1982.

Private Pilot – Airplane Single-Engine Land and Sea; Instrument Airplane certificate issued June 19, 1983.

Commercial Pilot – Airplane Single-Engine Land; Instrument Airplane; Private Privileges – Airplane Single-Engine Sea certificate April 30, 1984.

Commercial Pilot – Airplane Single-Engine Land and Sea; Instrument Airplane certificate June 5, 1984.

Flight Instructor – Airplane Single-Engine certificate issued March 30, 1985. Renewed November 3, 1986, November 22, 1988, November 8, 1990, November 9, 1992, November 6,

[5] Source: Attachment 4 - N4982U Pilot Information and the NTSB 6120.1 Pilot/Operator Aircraft Accident/Incident Report.

[6] The Program Tracking and Reporting Subsystem (PTRS) was a comprehensive information management and analysis system used in many Flight Standards Service (AFS) job functions. It provided the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety Inspectors in the field, the regions, and headquarters. The system provided managers and inspectors with the current data on airmen, air agencies, air operators, and many other facets of the air transportation system. source: FAA

1994, November 10, 1996, November 22, 1998, November 6, 2000, October 17, 2002, November 5, 2004, October 25, 2006, October 30, 2008, November 24, 2010, November 6, 2012, October 29, 2014, October 17, 2016, September 18, 2018.[7]

Commercial Pilot Airplane Single-Engine Land and Sea, Airplane Multiengine Land; Instrument Airplane certificate issued January 6, 1992.

Mechanic – Airframe, Powerplant certificate issued March 29, 2010.

Mechanic – Airframe, Powerplant; Inspection Authorization certificate issued December 1, 2014. Renewed: March 13, 2015, March 7, 2017, and March 6, 2019.

2.1.2 Pilot Certificates and Ratings Held at Time of the Accident – N4982U

COMMERICAL PILOT (issued January 6, 1992)
Airplane Single-Engine Land and Sea
Airplane Multiengine Land
Instrument Airplane

FLIGHT INSTRUCTOR (dated September 18, 2018)
Airplane Single-Engine

MEDICAL CERTIFICATION SECOND CLASS (issued June 12, 2020)
Limitation: Must wear corrective lenses for near and distant vision.

2.1.3 Pilot Flight Times – N4982U

According to records and information provided by the operator, the pilot had the following approximate flight experience.[8]

Preceding 24 hours	4.5
Preceding 7 days[9]	17.4
Preceding 30 days	90.0
Preceding 90 days	130.0
Preceding 1 year	150.0
Total Flight Experience	19,530.0
Total Pilot in Command (PIC) Experience	19,030.0
Total Flight Experience – DHC2	13,480.0
Total PIC Experience – DHC2	13,450.0

[7] Renewals prior to and including November 22, 1998 were accomplished via a Flight Instructor Refresher Course (FIRC). The renewals from November 6, 2000 to the date of the accident were accomplished by an FAA inspector.
[8] Source: Attachment 4 - N4982U Pilot Information and the NTSB 6120.1 Pilot/Operator Aircraft Accident/Incident Report.
[9] Time does not include the accident flight time.

2.1.4 Pilot Duty Time – N4982U[10]

According to documentation provided by the operator, the pilot's previous 30 days included five days off.[11] In the previous seven days, his most recent day off was on July 25, 2020.

2.1.5 The Pilot's Training and Proficiency Checks Completed – N4982U

The following information was provided by the operator[12]:

Initial Checkout in a DHC2	May 27, 1993
Initial Check Airman Authorization[13]	June 2008
Most Recent FAA Observation[14]	July 14, 2020
Recurrent Basic Indoctrination[15]	June 2, 2020
Recurrent Hazardous Material[16]	June 3, 2020
Most Recent Proficiency Flight Training	June 5, 2020

2.1.5.1 Title 14 *CFR* Parts 135.293 & 135.299

CFR Part 135.293 and Part 135.299 described the minimum training requirements for Part 135 operators. The following information, in part, is as follows:

> ***§ 135.293 Initial and recurrent pilot testing requirements.***
> *(a) No certificate holder may use a pilot, nor may any person serve as a pilot, unless, since the beginning of the 12th calendar month before that service, that pilot has passed a written or oral test, given by the Administrator or an authorized check pilot, on that pilot's knowledge in the following areas -*
>
> *(1) The appropriate provisions of parts 61, 91, and 135 of this chapter and the operations specifications and the manual of the certificate holder;*
>
> *(2) For each type of aircraft to be flown by the pilot, the aircraft powerplant, major components and systems, major appliances, performance and operating limitations, standard and emergency operating procedures, and the contents of the approved Aircraft Flight Manual or equivalent, as applicable;*
>
> *(3) For each type of aircraft to be flown by the pilot, the method of determining compliance with weight and balance limitations for takeoff, landing and en route operations;*

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[10] Source: Operational Factors Attachment 4 - N4982U Pilot Information.
[11] *CFR* 135.267(f) states – *the certificate holder must provide each flight crewmember at least 13 rest periods of at least 24 consecutive hours each in each calendar quarter*. https://ecfr.io/Title-14/se14.3.135_1267
[12] Source: Operational Factors Attachment 4 - N4982U Pilot Information
[13] The accident pilot was qualified to instruct both the ground and flight portion of pilot training.
[14] FAA Observation was conducted during a High Adventure Air Charter, Guides and Outfitters Airman Competency Check in which the accident pilot was the line checkairman conducting the airman's proficiency check.
[15] According to documentation provided by the operator, the training was conducted over an 8.0-hour training session.
[16] According to documentation provided by the operator, the training was conducted over a 2.0-hour training session.

(4) Navigation and use of air navigation aids appropriate to the operation or pilot authorization, including, when applicable, instrument approach facilities and procedures;

(5) Air traffic control procedures, including IFR procedures when applicable;

(6) Meteorology in general, including the principles of frontal systems, icing, fog, thunderstorms, and windshear, and, if appropriate for the operation of the certificate holder, high altitude weather;

(7) Procedures for -

(i) Recognizing and avoiding severe weather situations;

(ii) Escaping from severe weather situations, in case of inadvertent encounters, including low-altitude windshear (except that rotorcraft pilots are not required to be tested on escaping from low-altitude windshear);

(iii) Operating in or near thunderstorms (including best penetrating altitudes), turbulent air (including clear air turbulence), icing, hail, and other potentially hazardous meteorological conditions; and

(8) New equipment, procedures, or techniques, as appropriate

§ 135.299 Pilot in command: Line checks: Routes and airports.

(a) No certificate holder may use a pilot, nor may any person serve, as a pilot in command of a flight unless, since the beginning of the 12th calendar month before that service, that pilot has passed a flight check in one of the types of aircraft which that pilot is to fly. The flight check shall -

(1) Be given by an approved check pilot or by the Administrator;

(2) Consist of at least one flight over one route segment; and

(3) Include takeoffs and landings at one or more representative airports. In addition to the requirements of this paragraph, for a pilot authorized to conduct IFR operations, at least one flight shall be flown over a civil airway, an approved off-airway route, or a portion of either of them.

(b) The pilot who conducts the check shall determine whether the pilot being checked satisfactorily performs the duties and responsibilities of a pilot in command in operations under this part, and shall so certify in the pilot training record.

(c) Each certificate holder shall establish in the manual required by § 135.21 a procedure which will ensure that each pilot who has not flown over a route and into an airport within

the preceding 90 days will, before beginning the flight, become familiar with all available information required for the safe operation of that flight.

2.2 Pilot – N2587M

The pilot was 63 years old. According to the most recent FAA Form 8500-8 "Application for Airman Medical Certificate," dated March 13, 2012, he had approximately 1,600 hours of total flight experience and approximately 10 of those hours were within the preceding six months. The most recent pilot's logbook located at the time of this writing was last dated on January 12, 2011 and at that time indicated 1,299.7 total hours of flight experience, with 1,082.1 hours of PIC time and 248.4 hours of dual instruction received.[17] The investigation was unable to recover any logbooks of recorded flight time dated after January 12, 2011.

A review of the FAA AIDS, EIS and PTRS databases indicated no records or reports of any previous aviation incidents or accidents involving the pilot.

2.2.1 Pilot's Certification Record – N2587M

FAA records of the pilot indicated the following:

Private Pilot – Airplane Single-Engine Land certificate issued July 18, 1988.

Private Pilot – Airplane Single-Engine Land and Sea certificate issued June 14, 1994.

Private Pilot – Airplane Single-Engine Land and Sea; Instrument – Airplane certificate issued August 2, 2001.

Commercial Pilot – Airplane Single Engine Land; Instrument – Airplane; Private Privileges Airplane Single-Engine Sea certificate issued January 25, 2002.

Flight Instructor – Airplane Single-Engine certificate issued February 15, 2002.

Flight Instructor – Airplane Single-Engine; Instrument Airplane certificate issued March 12, 2002.

Commercial Pilot – Airplane Single and Multiengine Land; Instrument Airplane; Private Privileges Airplane Single-Engine Sea certificate issued March 15, 2002.

Flight Instructor – Airplane Single and Multiengine, Instrument Airplane certificate issued April 1, 2002. Renewed April 30, 2004, April 28, 2006,[18] April 30, 2014, April 29, 2016, April 30, 2018, April 30, 2020.[19]

[17] Source: Operational Factors Attachment 5 – N2587M Pilot Information.

[18] According to a representative of the FAA, a temporary Airman Certificate is not required to be issued for a flight instructor refresher course. A review of the airman's records indicated that the "Temporary Certificate Issued (Original Attached)" portion of the FAA 8710-1 form was struck through and no associated attachment was included.

[19] According to a representative of the Aircraft Owners and Pilots Association (AOPA), the pilot completed his flight instructor reference course with them in 2016, 2018, and 2020 which included the Runway Safety modules and Pilot Deviations and Safety Trends in General Aviation modules.

2.2.2 Pilot Certificates and Ratings Held at Time of the Accident – N2587M

COMMERICAL PILOT (issued March 15, 2002)
Airplane Single-Engine Land
Airplane Multiengine Land
Instrument Airplane

PRIVATE PILOT PRIVILEGES (originally issued June 14, 1994)
Airplane Single-Engine Sea

FLIGHT INSTRUCTOR (originally issued April 1, 2002)
Airplane Single-Engine
Airplane Multiengine
Instrument Airplane

MEDICAL CERTIFICATION DENIED (March 13, 2012)[20]

2.3 Basic Medical Requirements

FAA regulations associated with Basic Medical requirements were located in *CFR* Part 68 "*Requirements for Operating Certain Small Aircraft without a Medical Certificate*," and prescribed the medical education and examination requirement for operating an aircraft under *CFR* 61.113(i) without holding a medical certificate issued under part 67. Specifically, *CFR* Part 68.7 contained the comprehensive medical checklist and stated, in part:

> *The comprehensive medical examination required to conduct operations under § 61.113(i) must include a checklist containing the following:*
> ***(a)** A section, for the individual to complete that contains -*
> ***(1)** Boxes 3 through 13 and boxes 16 through 19 of the FAA Form 8500-8 (3-99); and*
> ***(2)** A signature line for the individual to affirm that -*
> ***(i)** The answers provided by the individual on that checklist, including the individual's answers regarding medical history, are true and complete;*
> ***(ii)** The individual understands that he or she is prohibited under FAA regulations from acting as pilot in command, or any other capacity as a required flight crew member, if he or she knows or has reason to know of any medical deficiency or medically disqualifying condition that would make the individual unable to operate the aircraft in a safe manner; and*
> ***(iii)** The individual is aware of the regulations pertaining to the prohibition on operations during medical deficiency and has no medically disqualifying conditions in accordance with applicable law.*

[20] For further information reference the NTSB Medical Officer Report associated with this accident.

3.0 Aircraft Information

3.1 N4982U

Photo 1: Accident Airplane (Courtesy of jetphotos.com)

The accident airplane, registered as N4982U, serial number 904, was a de Havilland DHC-2MK, and was manufactured in 1956. The airplane was owned and operated by Soldotna Aircraft and Equipment Leasing LLC since 1985, and according to FAA records held a standard and restricted airworthiness certificate dated September 13, 1996, for additional information reference the NTSB System Specialist Report.

3.1.1 High Adventure Air Charter, Guides and Outfitters Company Information

High Adventure Air Charter, Air Charter, Guides and Outfitters was a full-service air charter business that operated under *CFR* Part 135. According to the operator's website,[21] they had three de Havilland DHC-2 Beaver aircraft and had been in business for over 30 years.[22] According to a representative of the operator, there were seven employees and of those, four were designated as flight crewmembers. According to the FAA documentation the accident pilot was the operator's director of operations and co-owner.[23]

3.1.2 Weight and Balance

According to High Adventure Air Charter, Guides and Outfitters' Operational Specification A096 provided the guidance for the company's weight and balance program for all flights.[24] The Operational Specification stated in part:

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[21] Source: https://highadventureair.com/

[22] The three aircraft included the accident aircraft.

[23] Source: High Adventure Air Charter, Guides, and Outfitters Operational Specifications A006.

[24] Title 14 *CFR* 135.63(c) required the following: *For multiengine aircraft, each certificate holder is responsible for the preparation and accuracy of a load manifest in duplicate containing information concerning the loading of the aircraft.* There was no duplicate requirement listed for single-engine aircraft.

a. *The certificate holder is authorized to use* *<u>only actual</u>* *weights when determining the aircraft weight and balance.*
   (1) *This includes the passenger weights, carry-on bag weights, checked bag weights, plane-side loaded bag weights, and heavy bag weights, and/or*
   (2) *Actual weights of all passengers and bags or solicited ("asked") passenger weight plus 10 pounds and actual weight of bags.*

3.2 N2587M

Photo 2: Accident Airplane (Courtesy of the pilot's family)

The accident airplane registered as N2587M,[25] Serial number 12-592, was a Piper PA-12, manufactured in 1946. The airplane was owned by the pilot, and according to FAA records held a standard airworthiness certificate dated July 25, 1957.

4.0 Meteorological Information

The closest official weather reporting facility to the accident site was from Soldotna Airport (PASX), Soldotna, Alaska, at an elevation of 113 ft msl, located approximately 2 miles southwest of the accident site. PASX had an Automated Weather Observing System (AWOS), those reports were not supplemented. The following observations were reported and disseminated prior to the accident:

[0756 AKDT] METAR PASX 311556Z AUTO 11003KT 10SM BKN110 11/09 A2993 RMK AO2 SLP146 T01110094=

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[25] The exterior markings on the airplane indicated N1904T, which was associated with a deregistered Piper PA-23-250 and subsequently the N-Number was reserved by the accident pilot in July of 2016.

The report, in plain language, taken from standard code and abbreviations, with altitudes in ft above msl:

> PASX weather at 0756 AKDT, automated, wind from 110° at 3 knots, 10 miles visibility or greater, a broken ceiling at 11,000 ft above ground level (agl), temperature of 11°C, dew point temperature of 9°C, and an altimeter setting of 29.93 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea level pressure 1014.6 hectopascal (hPa), temperature 11.1°C, dew point temperature 9.4°C.

For additional meteorological information reference the Meteorologist Specialist Report located in the docket associated with this accident.

5.0 Airport Information

5.1 Soldotna Airport

Soldotna Airport was located approximately one mile southeast of Soldotna, Alaska, had a surveyed field elevation of 113.4 ft msl, and was located at N60°28'30.5"/W151°02'22.7". The airport was a public use airport and did not have an air traffic control tower (ATCT). Communication at the airport with other aircraft was accomplished via the CTAF[26] frequency of 122.5 MHz.[27] The airport had one paved and one gravel/dirt landing surfaces. The paved asphalt surface was designated runway 7/25 and was 5001-foot-long and 130 foot-wide. Runway 7 had a right-hand traffic pattern and runway 25 had a left-hand traffic pattern. The gravel/dirt surface was designated runway 7S/25S. It was 2,300-foot-long and 60-foot-wide runway and ran parallel and to the north of the paved surface. Both runways had a left-hand traffic pattern. In addition, the FAA Chart Supplement - Alaska, airport remarks section for PASX stated "*RWY 07-25 and Rwy 07-25S, no simultaneous/parallel ops allowed. Sequence on CTAF.*"

[26] Common Traffic Advisory Frequency. According to the FAA Aeronautical Information Manual (AIM, page 4-1-2), a CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

[27] Megahertz

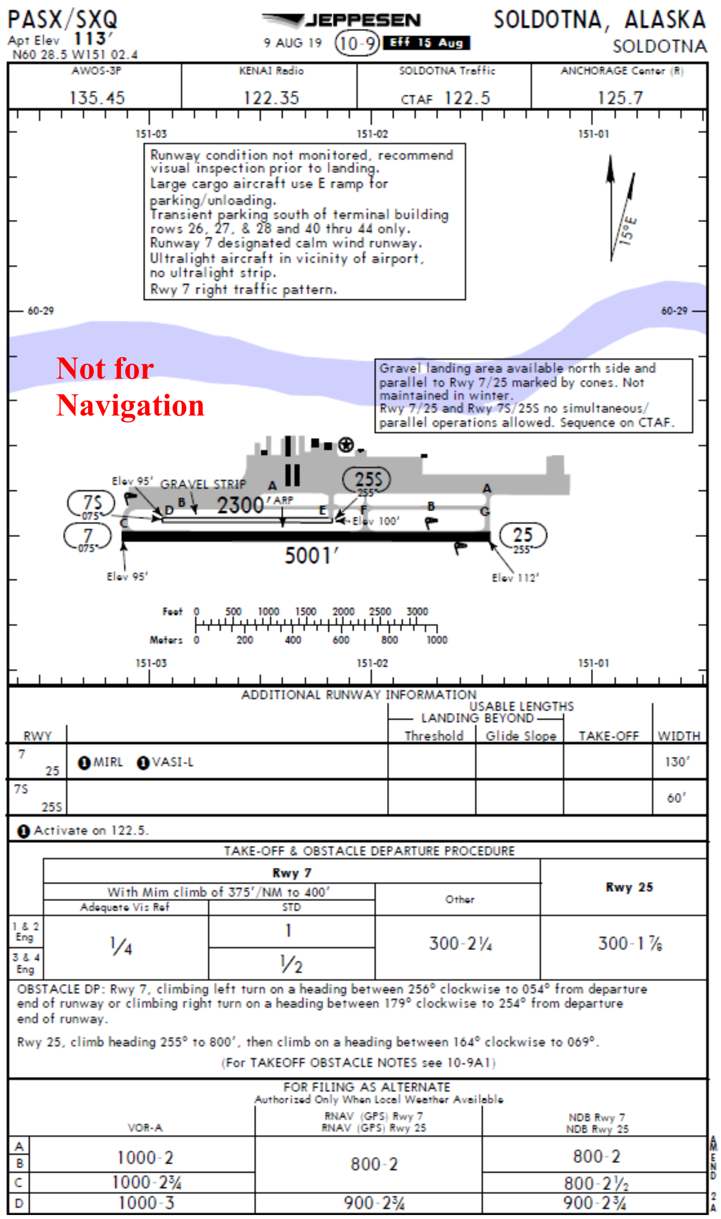

Figure 1: Soldotna Alaska Airport Chart (Source: Jeppesen).

5.2 Longmere Lake

The Alaska Department of Fish and Game[28] reported that Longmere Lake was located at 60.509423°N/150.90839°W. [29] It was located approximately 2.5 nm to the east of the accident location, approximately 4.5 nm to the east northeast of the city of Soldotna, and approximately 4 nm to the northeast of PASX. The lake encompassed approximately 172 acres and consisted of about 3.3 miles of shoreline. The maximum depth of the lake was about 28.0 ft with a mean depth of 10.4 ft. The elevation of the lake was listed as 249 ft above msl and was oriented in a northeast to southwest direction. The lake was approximately 6,800 ft long and about 1,100 ft wide. The

[28] Source: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportLakeData.lakeDetail&LakeID=220

[29] Alaska Department of Fish and Game also listed Longmere Lake as Longmare Lake.

lake was not listed in the FAA Chart Supplement - Alaska nor on the VFR[30] Sectional Chart as a charted sea plane base.

5.3 Sectional Chart

The following excerpt was taken from the Anchorage section chart dated November 5, 2020 and listed as Edition No. 107. The excerpt contains the area in the vicinity of PASX.

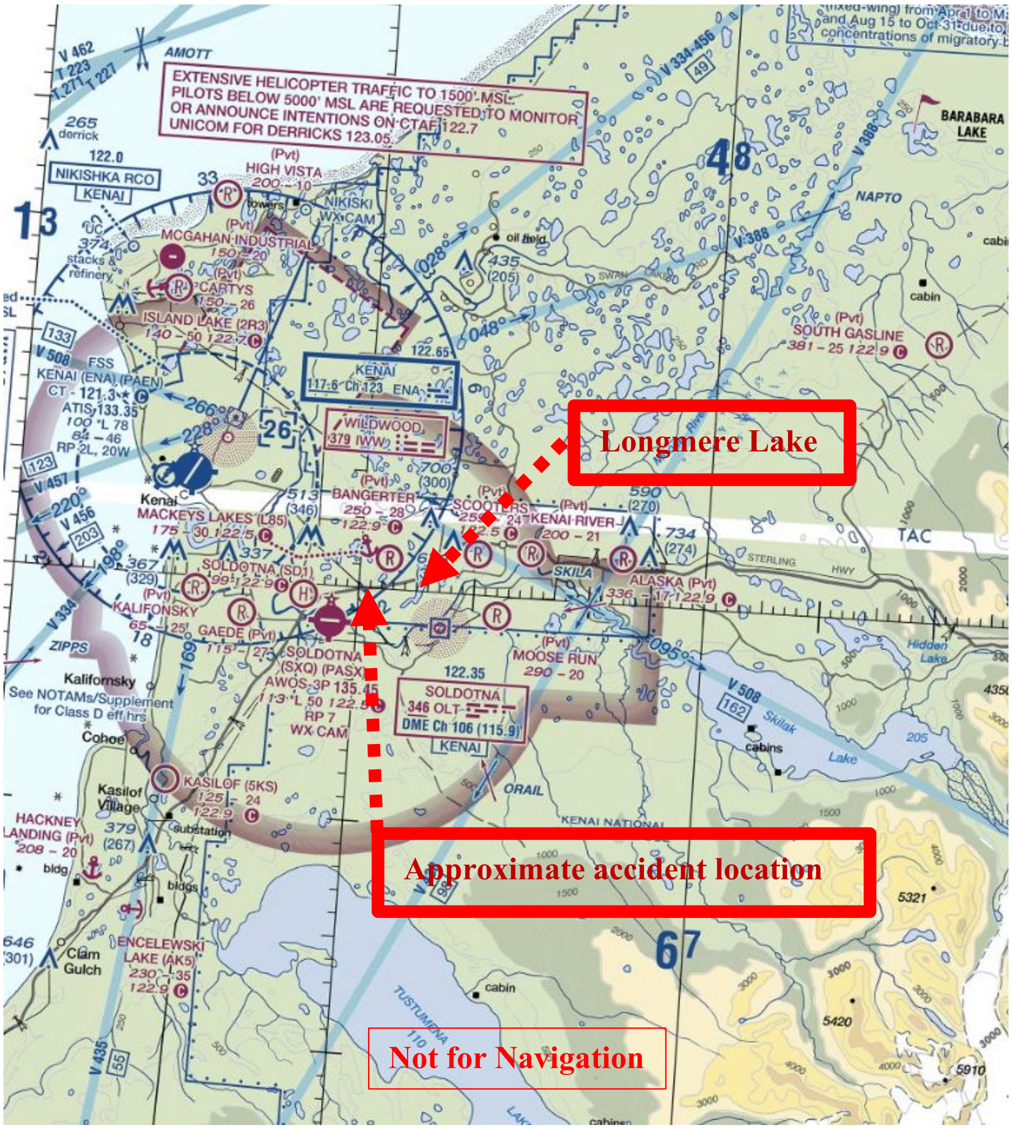

Figure 2: Anchorage Sectional Chart Excerpt of the Soldotna Area.

Figure 3 below depicts a 30-mile radius around PASX in Google Earth. Within the ring were 21 charted airports of which 16 were land-based airports, 4 were sea plane bases, and 1 charted heliport.[31] Additionally, four airports or sea plane bases were not charted on the VFR Sectional nor the FAA Chart Supplement – Alaska but were located using Google Earth imagery

[30] Visual Flight Rules.

[31] Charted airports for this report consisted of airports or sea plane bases that were listed on the VFR section and/or in the FAA Chart Supplement - Alaska.

dated December 13, 2015. Those airports or sea plane bases were photographed with an airplane or helicopter on the ground or water.[32]

Of those airports within a 30-mile radius of PASX, a 5-statue mile ring was placed around each landing area.[33] Of those, one airport had an associated air traffic control tower with a dedicated frequency, as indicated with a dark blue ring. The green ring indicated airports listed as private airports or sea plane bases and do not have a charted frequency to facilitate communicating with other aircraft. The light blue ring indicated airports or sea plane bases that had a charted frequency of 122.5 MHz associated with that airport, which included PASX. The orange ring indicated airports or sea plane bases and one heliport with a charted frequency of 122.9 MHz associated with the landing area. The yellow ring indicated an airport listed with a charted frequency of 122.7 MHz associated with the landing area.

N4982U departed from Longmere Lake, which had no information located on the VFR sectional nor in the FAA's Chart Supplements. Additionally, there were no charted frequencies for operating on or near Longmere Lake. According to the Chief Pilot, as part of their normal procedures, they tuned in 122.5 MHz to monitor PASX.

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[32] Note: Although it is possible not all private landing areas were located as there appeared to be some landing areas available with no indication of an aircraft in its vicinity nor did it capture any oil platform helipads in the Cook inlet who, according to the VFR sectional, monitor or announce intentions on CTAF frequency of 122.7 MHz and the derricks have a frequency of 123.05

[33] FAA AC 90-66B, Section 10.1 recommends "*all traffic within a 10-mile radius of a non-towered airport or a part-time towered airport when the control tower is no operating should continuously monitor and communicate, as appropriate, on the designated CTAF until leaving the area or until clear of the movement area.*" However, a 5-mile radius was used to replicate the lateral dimensions of the towered controlled airport.

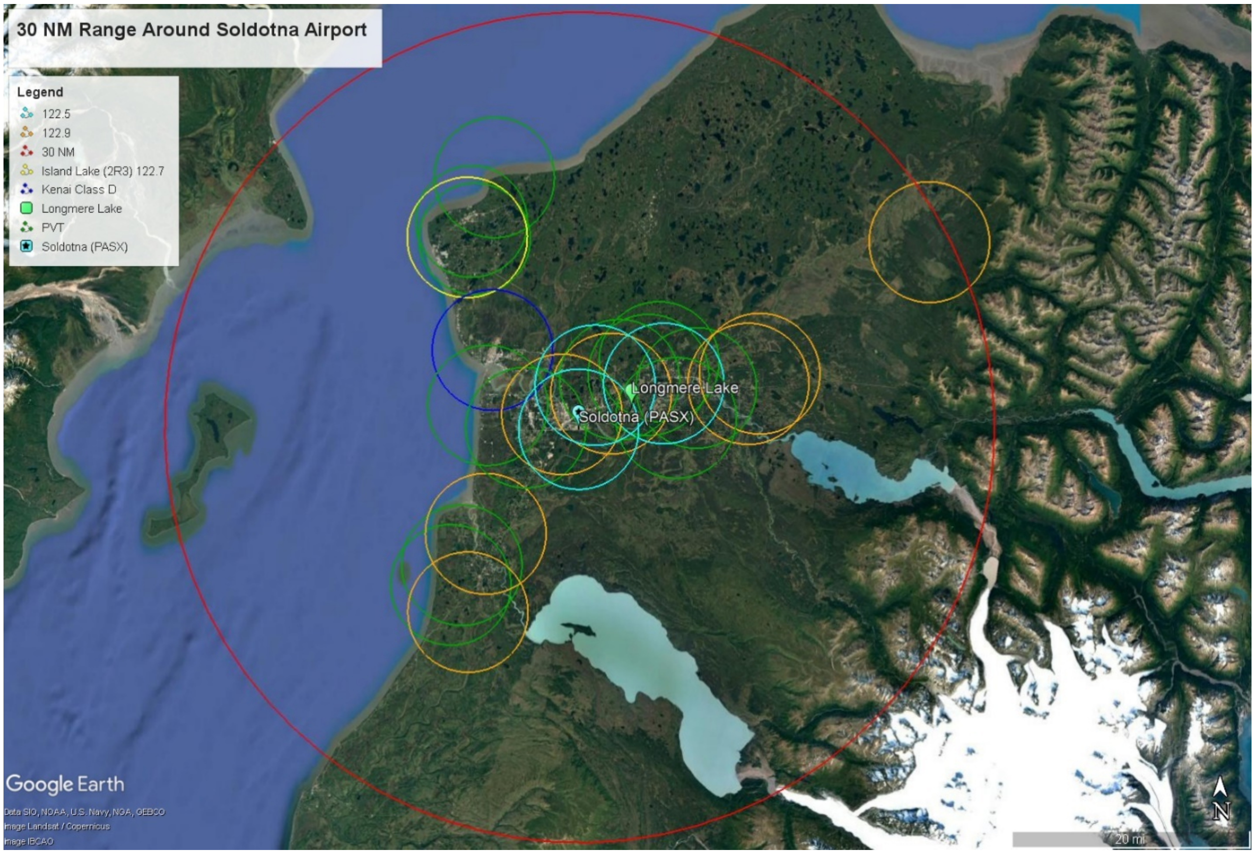


Figure 3: 30-mile Radius Around PASX in Google Earth

5.1 Alaskan Region Aviation Fact Sheet

FAA publication "Alaskan Region Aviation Fact Sheet," dated January 2016 provided the following information, in part:[34]

> *Alaska's 2,427,971 square miles of airspace are served by…8 FAA control towers and 5 military towers.*
>
> *There were 7,933 active pilots….and 9,346 registered aircraft in Alaska.*
>
> *There were 400 public use airports, 282 land-based, 4 heliports (only public use listed this year), 114 seaplane base, and approximately 747 recorded landing areas (private, public and military) total. Of course pilots land on many of the thousands of lakes and gravel bars across the state where no constructed facility exists.*

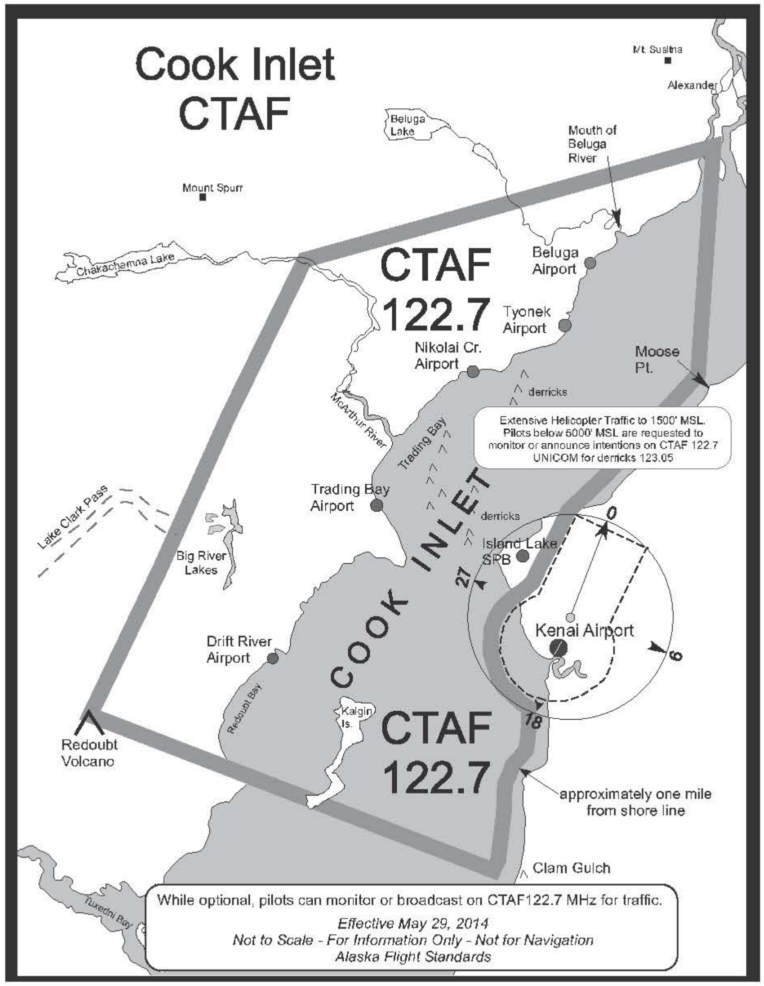
5.2 Cook Inlet CTAF

According to the FAA Chart Supplement - Alaska, effective from November 5, 2020 to December 31, 2020 pg. 418, Cook Inlet, which was located directly to the west of PASX, had a

[34] Source: https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/artcc/anchorage/media/Alaska_Aviation_Fact_Sheet.pdf#navpanes=0?id=10.26616/NIOSHPUB2015120

charted En Route CTAF area, which had been in effect since May 29, 2014. Figure 4 below is the visual depiction located within the Chart Supplement – Alaska and begins "approximately one mile" from to the west of the eastern shoreline of the waterway.

418 NOTICES



AK, 5 NOV 2020 to 31 DEC 2020

Figure 4: Cook Inlet CTAF
(Source: FAA Chart Supplement – Alaska Pg. 418)

The FAA Chart Supplement - Alaska Section 3 "Notices" listed seven En Route CTAF areas around the state of Alaska.[35] Those areas were interspersed among VFR reporting points,

[35] Source: Operational Factors Attachment 8 – FAA Chart Supplement – Alaska [Excerpt].

various oilfield corridors, and other notices. The En Route CTAF Areas were charted using the following chart title:

Cook Inlet CTAF
Denali North/South CTAF
Juneau CTAF
Knik
Lake Clark Pass
Matanuska Susitna (MAT-SU) Valley
North Slope Oilfield Aviation Operations CTAF

6.0 Relevant Procedures

6.1 High Adventure Air Charter, Guides and Outfitters Procedures

The following procedures were provided to employees of High Adventure Air Charter, Guides and Outfitters and were located within the company manuals.

6.1.1 Flight Preparation

The following guidance was provided to pilots of High Adventure Air Charter, Guides and Outfitters, Inc. and was listed under "Flight Operations Procedures":

FLIGHT PREPARATION

A. Prior to originating the flight, the Pilot-In-Command will:

1. *Insure that proper airway manuals and charts are in his possession.*
2. *Will check current NOTAMS, Alaska Airman's Information Manual and any other information pertinent to the flight.*
3. *Familiarize himself with appropriate en route and ARTC procedures, radio navigation facilities, approach and holding procedures.*
4. *Check en route, destination and alternate weather.*
5. *File FAA Flight Plan. If FAA Flight Plan is not filed, a company flight plan will be completed providing at least the information contained within an FAA Flight Plan. The Company flight plan will be filed with the person responsible for flight scheduling. If the flight will operate to an area where radio communications cannot be maintained, the Pilot-In-Command will provide the following additional information on an FAA Flight Plan or Company flight plan: Location, date and estimated time for re-establishing radio or telephone communication.*
6. *The person responsible for flight scheduling will notify the nearest FAA Flight Service Station in the event a company aircraft becomes overdue or missing. An aircraft is considered to be overdue when one hour past the estimated time of arrival time.*

According to the NTSB Form 6120.1 “Pilot/Operator Aircraft Accident/Incident Report” completed by a representative of High Adventure Air Charter, Guides and Outfitters, a company VFR flight plan was filed.

7.0 FAA Regulations

7.1 Title *CFR* 91.113

Federal regulation 91.113 stated, in part:

(b) General. When weather conditions permit, regardless of whether an operation is conducted under ŋ*flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear…*

(d) Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way.

(e) Approaching head-on. When aircraft are approaching each other head-on, or nearly so, each pilot of each aircraft shall alter course to the right.

7.2 Title *CFR* 91.225

Federal regulations *CFR* 91.225 stated, in part, the following:

(b) *After January 1, 2020, and unless otherwise authorized by ATC, no person may operate an aircraft below 18,000 feet MSL and in airspace described in paragraph (d) of this section unless the aircraft has equipment installed that -*

(1) *Meets the performance requirements in -*

(i) *TSO-C166b; or*

(ii) *TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz;*

(2) *Meets the requirements of § 91.227...*

(d) *After January 1, 2020, and unless otherwise authorized by ATC, no person may operate an aircraft in the following airspace unless the aircraft has equipment installed that meets the requirements in paragraph (b) of this section:*

(1) *Class B and Class C airspace areas;*

(2) *Except as provided for in paragraph (e) of this section, within 30 nautical miles of an airport listed in appendix D, section 1 to this part from the surface upward to 10,000 feet MSL;*

(3) Above the ceiling and within the lateral boundaries of a Class B or Class C airspace area designated for an airport upward to 10,000 feet MSL;

***(4)** Except as provided in paragraph (e) of this section, Class E airspace within the 48 contiguous states and the District of Columbia at and above 10,000 feet MSL, excluding the airspace at and below 2,500 feet above the surface; and*

***(5)** Class E airspace at and above 3,000 feet MSL over the Gulf of Mexico from the coastline of the United Stated out to 12 nautical miles…*

***(f)** Each person operating an aircraft equipped with ADS-B Out must operate this equipment in the transmit mode at all times unless -*

***(1)** Otherwise authorized by the FAA when the aircraft is performing a sensitive government mission for national defense, homeland security, intelligence or law enforcement purposes and transmitting would compromise the operations security of the mission or pose a safety risk to the aircraft, crew, or people and property in the air or on the ground; or*

***(2)** Otherwise directed by ATC when transmitting would jeopardize the safe execution of air traffic control functions.*

8.0 FAA Guidance

8.1 Aeronautical Information Manual

FAA Aeronautical Information Manual (AIM), section 5-5-8 provided the following excerpts about see and avoid:

Pilot. When meteorological conditions permit, regardless of type of flight plan or whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles.

Additionally, AIM section 4-1-9, "Traffic Advisory Practices at Airports Without Operating Control Towers" provided the following information, in part, about operating near a nontowered airport:

There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

An airport may have a full or part-time tower or FSS located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

NOTE− *FSS airport advisories are available only in Alaska.*

		Communication/Broadcast Procedures		
Facility at Airport	**Frequency Use**	**Outbound**	**Inbound**	**Practice Instrument Approach**
UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7; 122.8; 122.725; 122.975; or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing final approach fix (name) or on final approach segment inbound.
No Tower in operation, FSS open (Alaska only)	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Approach completed/ terminated.
FSS Closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	

Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
Designated CTAF Area (Alaska Only)	Self-announce on CTAF designated on chart or Chart Supplement Alaska.	Before taxiing and before taxiing on the runway for departure until leaving designated area.	When entering designated CTAF area.	

Table 1:Summary of Recommended Communication Procedures. (Source: AIM Table 4-1-1)

CTAF (Alaska Only)*. In Alaska, a CTAF may also be designated for the purpose of carrying out advisory practices while operating in designated areas with a high volume of VFR traffic.*

8.2 Pilots Handbook of Aeronautical Knowledge

The Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), Section 14 "Airport Operations", provided the following information:

Collision Avoidance

Title 14 of the CFR part 91 has established right-of-way rules, minimum safe altitudes, and VFR cruising altitudes to enhance flight safety. The pilot can contribute to collision avoidance by being alert and scanning for other aircraft. This is particularly important in the vicinity of an airport.

Effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10°, and each should be observed for at least 1 second to enable detection. Although back and forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning. Even if entitled to the right-of way, a pilot should yield if another aircraft seems too close.

Clearing Procedures

The following procedures and considerations are in place to assist pilots in collision avoidance under various situations:

- *Before takeoff—prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach area for possible landing traffic, executing appropriate maneuvers to provide a clear view of the approach areas.*

- *Climbs and descents—during climbs and descents in flight conditions that permit visual detection of other traffic, pilots should execute gentle banks left and right at a frequency that permits continuous visual scanning of the airspace.*
- *Straight and level—during sustained periods of straight-and-level flight, a pilot should execute appropriate clearing procedures at periodic intervals.*
- *Traffic patterns—entries into traffic patterns while descending should be avoided.*
- *Traffic at VOR sites—due to converging traffic, sustained vigilance should be maintained in the vicinity of VORs and intersections.*
- *Training operations—vigilance should be maintained and clearing turns should be made prior to a practice maneuver. During instruction, the pilot should be asked to verbalize the clearing procedures (call out "clear left, right, above, and below").*

High-wing and low-wing aircraft have their respective blind spots. The pilot of a high-wing aircraft should momentarily raise the wing in the direction of the intended turn and look for traffic prior to commencing the turn. The pilot of a low-wing aircraft should momentarily lower the wing and look for traffic prior to commencing the turn.

8.3 Advisory Circulars

8.3.1 Advisory Circular 90-66B

FAA AC 90-66B "Non-Towered Airport Flight Operations" provided, in part, the following information:

Collision Avoidance. *The pilot in command's (PIC) primary responsibility is to see and avoid other aircraft and to help them see and avoid his or her aircraft. Keep lights and strobes on. The use of any traffic pattern procedure does not alter the responsibility of each pilot to see and avoid other aircraft. Pilots are encouraged to participate in "Operation Lights On," a voluntary pilot safety program described in the AIM, paragraph 4-3-23, that is designed to improve the "see-and-avoid" capabilities.*

Recommended Traffic Advisory Practices. *All traffic within a 10-mile radius of a non-towered airport or a part-time-towered airport when the control tower is not operating should continuously monitor and communicate, as appropriate, on the designated CTAF until leaving the area or until clear of the movement area. After first monitoring the frequency for other traffic present passing within 10 miles from the airport, self-announcing of your position and intentions should occur between 8 and 10 miles from the airport upon arrival. Departing aircraft should continuously monitor/communicate on the appropriate frequency from startup, during taxi, and until 10 miles from the airport, unless 14 CFR or local procedures require otherwise.*

Self-Announce Position and/or Intentions. *"Self-announce" is a procedure whereby pilots broadcast their aircraft call sign, position, altitude, and intended flight activity or ground operation on the designated CTAF. This procedure is used almost exclusively at airports that do not have an operative control tower or an FSS on the airport. If an airport* *has a control tower that is either temporarily closed or operated on a part-time basis, and there is no operating FSS on the airport, pilots should use the published CTAF to self-announce position and/or intentions when entering within 10 miles of the airport.*

8.3.2 Advisory Circular 90-48D

FAA AC 90-48D "Pilot's Role in Collision Avoidance" dated April 19, 2016 provided in part the following guidance:

Vigilant Lookout. Pilots should also keep in mind their responsibility for continuously maintaining a vigilant lookout regardless of the type of aircraft being flown. Remember that most midair collision accidents and reported NMAC incidents occurred during good VFR weather conditions and during the hours of daylight.

Attention and Response to Traffic Movement. The pilot's responsibility is to fly the aircraft safely. All other duties should be secondary while flying. Pilots should remain constantly alert to all traffic movement within their field of vision, as well as periodically scanning the entire visual field outside of their aircraft to ensure detection of conflicting traffic. Remember that the performance capabilities of many aircraft, in both speed and rates of climb/descent, result in high closure rates limiting the time available for detection, decision, and evasive action. Research has shown that the average person has a reaction time of 12.5 seconds. This means that a small or high-speed object could pose a serious threat if some other means of detection other than see and avoid were not utilized, as it would take too long to react to avoid a collision. This is particularly important with small Unmanned Aircraft Systems (sUAS).

Event	***Seconds***
See Object	*0.1*
Recognize Aircraft	*1.0*
Become Aware of Collision Course	*5.0*
Decision to Turn Left or Right	*4.0*
Muscular Reaction	*0.4*
Aircraft Lag Time	*2.0*
TOTAL	*12.5*

Figure 5: Aircraft Identification and Reaction Time Chart

Refocusing Eyes. The probability of spotting a potential collision threat increases with the time spent looking outside, but certain techniques may be used to increase the effectiveness of the scan time. The human eyes tend to focus somewhere, even in a featureless sky. If there is nothing specific on which to focus, your eyes revert to a relaxed intermediate focal distance (10 to 30 feet). This means that you are looking without actually seeing anything, which is dangerous. In order to be most effective, the pilot should shift glances and refocus at intervals. Most pilots do this in the process of scanning the instrument panel, but it is also important to focus outside to set up the visual system for effective target acquisition.

Eye Movements. Effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10 degrees, and each area should be observed for at least 1 second to enable detection. Although most pilots seem to prefer horizontal back-and-forth eye movements, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

Spotting Threats. Peripheral vision can be most useful in spotting collision threats from other aircraft. Each time a scan is stopped and the eyes are refocused, the peripheral vision takes on more importance because it is through this element that movement is detected. Apparent movement is almost always the first perception of a collision threat, and probably the most important, because it is the discovery of a threat that triggers the events leading to proper evasive action. It is essential to remember, however, that if another aircraft appears to have no relative motion, it is likely to be on a collision course with you. If the other aircraft shows no lateral or vertical motion, but is increasing in size, take immediate evasive action.

Physical Obstructions. Pilots are reminded of the requirement to move one's head in order to search around the physical obstructions, such as door and window posts. The doorpost can cover a considerable amount of sky, but a small head movement may uncover an area which might be concealing a threat.

> *1. Prior to taxiing onto a runway or landing area for takeoff, scan the approach areas for possible landing traffic by maneuvering the aircraft to provide a clear view of such areas. It is important that this be accomplished even though a taxi or takeoff clearance has been received.*
>
> *2. During climbs and descents in flight conditions which permit visual detection of other traffic, execute gentle banks left and right at a frequency which permits continuous visual scanning of the airspace about them.*
>
> *3. Execute appropriate clearing procedures before all turns, abnormal maneuvers, or acrobatics.*
>
> *4. Following the AIM, chapter 4, Air Traffic Control, section 3, execute pattern entries and departures for the runway in*

Collision-Avoidance Technologies. Understanding the differences between TAS, TCAS, and ADS-B is an important part of using such technologies to minimize workload and aid in collision avoidance. Pilots should make every effort to communicate with other aircraft and coordinate activities whenever practical, particularly in areas known to contain traffic related to air tour operations, low-level sightseeing, operations over congested areas, or news-gathering operations. Pilots should respond to traffic advisories (TA) by attempting to establish visual contact with the alerting aircraft and other aircraft which may be in the vicinity.

A TAS independently interrogates nearby transponder-equipped aircraft and determines bearing and range from the replies within a given range (depending on the power of the system installed). TAS is not radar-coverage limited. It is important to recognize this system will not see aircraft that are not currently using a transponder that is not transmitting in the "ON" or "ALT" modes. Depending on the system, it may provide TAs in addition to displaying nearby traffic.

ADS-B is a system for air traffic surveillance. The FAA has mandated ADS-B Out by 2020 on all aircraft operating in current Mode C airspace (around Class B and C airspace and above 10,000 feet). With ADS-B, each aircraft broadcasts its own Global Positioning System (GPS) position along with other information like heading, ground track, groundspeed, and altitude (ADS-B Out). To see other aircraft, you must be equipped with ADS-B In to process the data signals. Depending on the system, it may provide TAs in addition to displaying nearby traffic.

8.4 How to Avoid a Mid Air Collision – P-8740-51

The FAA produced a resource title "How to Avoid a Mid Air Collision" and published it on their website.[36] The publication provided, in part, the following:

Collision avoidance involves much more than proper eyeball techniques. You can be the most conscientious scanner in the world and still have an in-flight collision if you neglect other important factors in the overall see-and-avoid picture. It might be helpful to use a collision avoidance checklist as religiously as you do the pretakeoff and landing lists. Such a checklist might include the following nine items:

Check Yourself
Start with a check of your own condition. Your eyesight, and consequently your safety, depend on your mental and physical condition…

Scan, Scan, Scan!

The most important part of your checklist, of course, is to keep looking where you're going and to watch for traffic. Make use of your scan constantly.

Basically, if you adhere to good airmanship, keep yourself and your plane in good condition, and develop an effective scan time-sharing system, you should have no trouble avoiding in-flight collisions. As you learn to use your eyes properly, you will benefit in other ways. Remember, despite their limitations, your eyes provide you with color, beauty, shape, motion and excitement. As you train them to spot minute targets in the sky, you'll also learn to see many other important "little" things you may now be missing, both on the ground and in the air. If you couple your eyes with your brain, you'll be around to enjoy these benefits of vision for a long time.

[36] Source: https://www.faasafety.gov/gslac/ALC/libview_normal.aspx?id=6851

8.5 Traffic Advisories at Non-Tower Airport

The following information was provided, in part, to all pilots in the FAA Chart Supplement – Alaska, effective from July 16, 2020 to September 10, 2020, about the various traffic advisories available within the state of Alaska, via CTAF:

> *The current frequency for obtaining traffic advisory information at non–tower airports in Alaska is listed as the Common Traffic Advisory Frequency (CTAF) under the name of each airport in the Airport/Facility Directory section of the Alaska Supplement. Procedures for obtaining traffic information on the CTAF are as follows:*
>
> ***1. AIRPORT ADVISORY SERVICE AIRPORTS.***
>
> *Flight Service Stations located at airports where there are no control towers in operation provide advisory information to arriving and departing aircraft on the CTAF. Traffic control is not provided. Airport advisories provide: wind direction (magnetic) and velocity, favored or designated runway, altimeter setting, known traffic (CAUTION: all aircraft in the airport vicinity may not be communicating with the FSS), notices to airmen, airport taxi routes, airport traffic patterns, and instrument approach procedures. Pilots using other than the favored or designated runways should advise the FSS immediately.*
>
> ***DEPARTING:*** *When ready to taxi, the pilot should notify the station of the aircraft identification and type, location, type of flight planned (VFR or IFR), and destination. Report departure time as soon as practicable….*
>
> ***2. NON-FSS AIRPORTS WHERE THE UNICOM OPERATOR OR MILITARY UNIT PROVIDES ADVISORY INFORMATION ON THE CTAF FREQUENCY.***
>
> ***DEPARTING:*** *Monitor the CTAF as appropriate while taxiing and report on the CTAF before taking the runway for takeoff. The UNICOM/MILITARY operator normally provides runway, wind and at his discretion, traffic information…*
>
> ***3. BLIND BROADCASTS OF POSITION OR INTENTIONS.***
>
> *If there is no operating tower, operating FSS, or UNICOM/MILITARY, or when unable to communicate with an FSS on the CTAF or UNICOM/MILITARY operator: a. Blind–broadcast your intentions and position using the appropriate CTAF within 10 miles of the airport. b. Listen for other aircraft who may be broadcasting in the blind. (CAUTION: all aircraft may not be complying with the recommended blind–broadcast procedures).*

9.0 Industry Guidance

9.1 AOPA Safety Spotlight: Collision Avoidance

The Aircraft Owners and Pilots Association (AOPA) provided additional pilot training and guidance on collision avoidance via their on-line training modules.[37] One training topic available on their website[38] was "Safety Spotlight: Collision Avoidance." The training provided, in part, the following:

> *A proper scan optimizes our vision for collision avoidance. However, the term may be a misnomer; scan implies a sweep of the eyes, while the correct scan for conflicting traffic is actually a sequence of intense, fixated observations. The eyes need one to two seconds to adjust before they can focus; a continuous sweep blurs the vision.*
>
> *While there is no "one size fits all" technique for an optimum scan, many pilots use some form of the "block" system scan.*
>
> - ***Block System Scan***
>
> *Divide the sky into blocks, each spanning 10 to 15 degrees of the horizon, and 10 degrees above and below it—for a total of 9 to 12 scan areas. Imagine a point in space at the center of each block. Focus on each point to allow the eye to detect a conflict within the foveal field (see sidebar), as well as objects in the peripheral area between the center of each scanning block. Also, scan vertically—10 degrees above and below your flight path—for potentially conflicting traffic.*
>
> - ***Center-to-Side Scan****—Start at the windshield center and scan to the left, focusing in each block. At the end of the scan to the left, return to the center and repeat the scan process to the right.*

[37] AOPA is a Frederick, Maryland-based American not-for-profit organization dedicated to general aviation. Source: https://www.aopa.org/about/history-of-aopa

[38] Source: https://www.aopa.org/training-and-safety/online-learning/safety-spotlights/collision-avoidance/the-scan

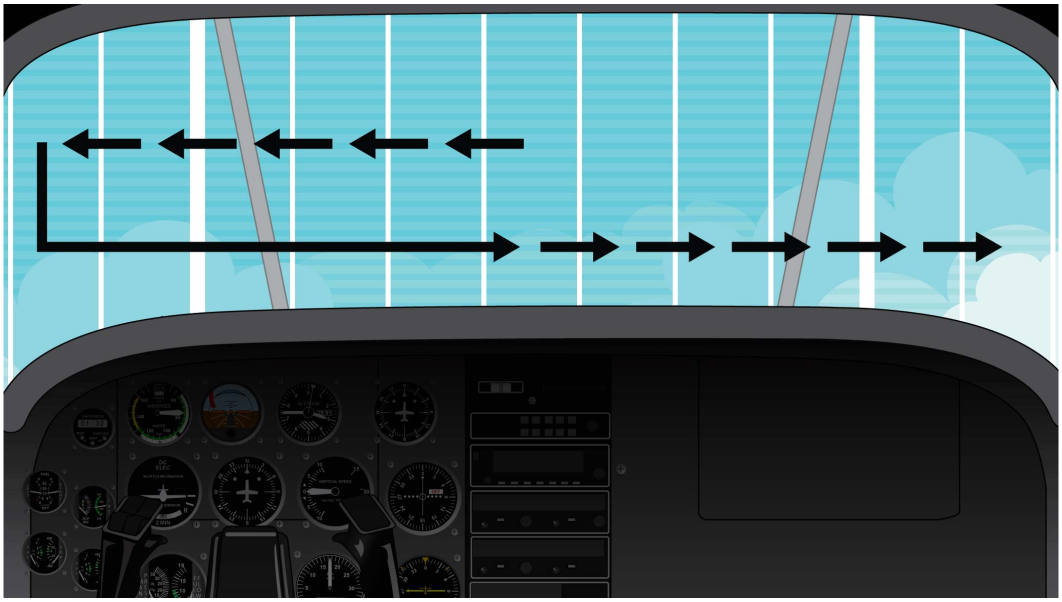


Figure 6: Center-to-Side Scan

- ***Side-to-Side Scan****—Start at the windshield's left side and scan to the right, focusing in each block.*

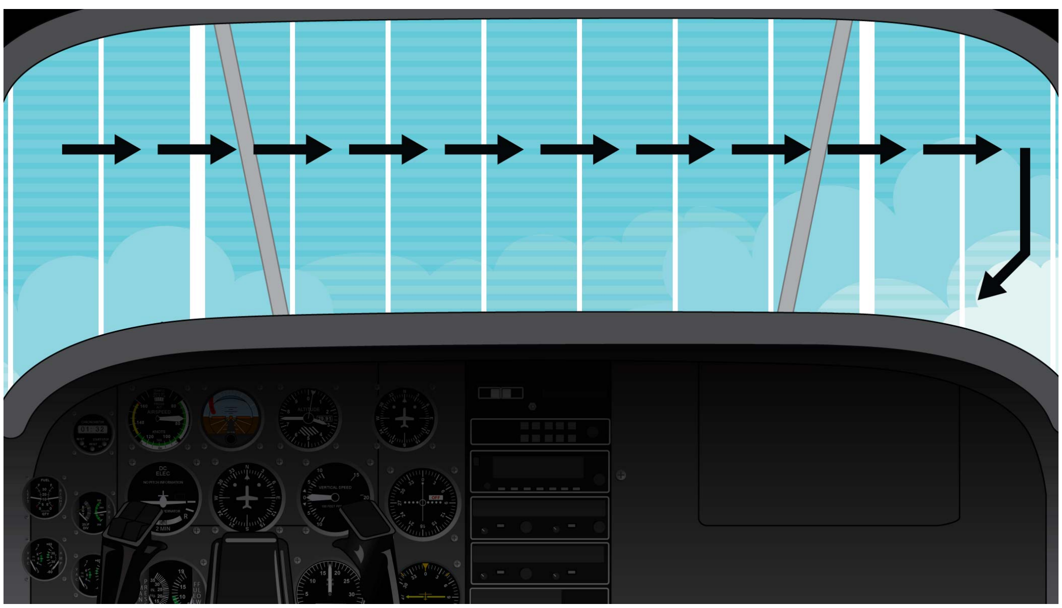


Figure 7: Side-to-Side Scan

MACs[39] are frequently the result of one aircraft overtaking another, so check for overtaking aircraft after every few scans, especially during approach and landing when midair collisions are most likely to occur.

- ***The Blossom Effect***

[39] Midair Collision

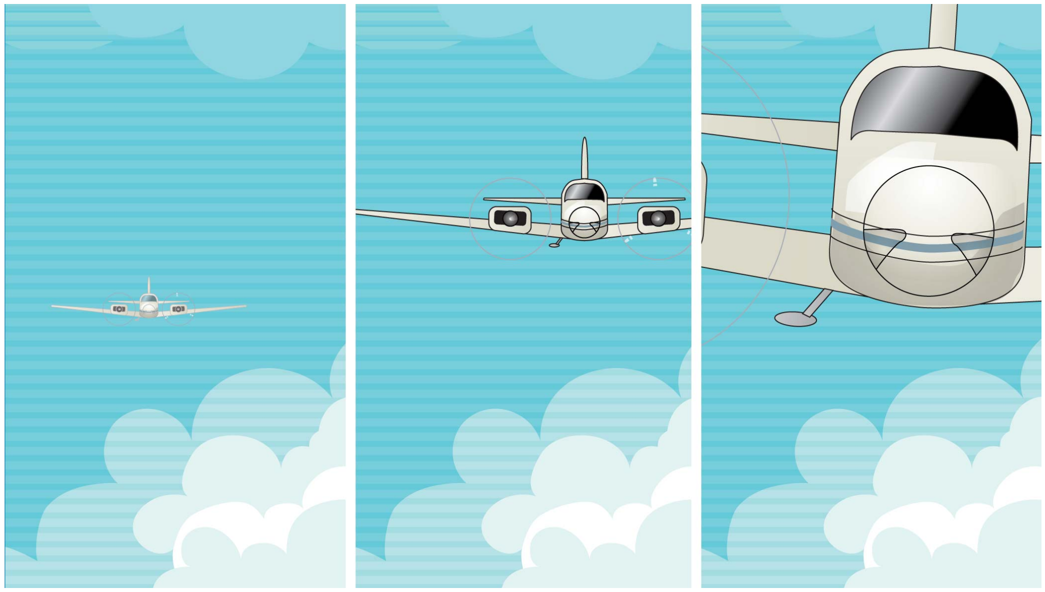


Figure 8: Blossom Effect

Motion is invaluable in drawing the eye's attention. Yet two aircraft on a collision course will appear virtually motionless to each other. When observed from the cockpit, the conflicting target will look like a small, stationary speck until it is at a distance from which it may be too close to avoid. This is called the "blossom effect." If a pilot sees an aircraft that remains in the same spot in the windshield (unless it is directly ahead and moving in the same direction), there is a high probability the two aircraft will collide unless one changes their course. Once a threat has been identified, it's essential to keep the other aircraft in sight until the threat is resolved.

9.1.1 Physiology of Vision

AOPA's training also provided the following information on the "*Physiology of Vision*:"

Eighty percent of the information we absorb in everyday life is obtained through our eyes. An effective scan begins with an understanding of how vision works.

- ***The Foveal Field****—This is the central part of the retina, where vision is most acute. But it comprises just one degree of horizontal and vertical vision—a focus the equivalent of a quarter seen from one eye at a distance of four and a half feet. Anything outside this small area will not be seen in detail. In practical terms, an aircraft that was visible in the foveal field from 5,000 feet away would only be visible at 500 feet or less if it was more than five degrees on either side of this central vision. Therefore, if you're simply staring straight ahead while flying, you're missing a vast amount of the sky.*

- ***Focus****—Without proper focus, an object can be right in front of us yet still remain unseen. In order to spot aircraft at a distance, the eyes must be focused for distant vision. Yet without something distant to focus on, after 60 to 80 seconds the eyes naturally relax to an intermediate focal distance somewhere just in front of the* *propeller. To counteract this tendency, known as "empty field myopia," the eyes must periodically refocus on the farthest object within sight—a cloud on the horizon, another aircraft at a distance, or a point on the ground. Incorporate refocusing in your scan technique.*

9.1.2 Aircraft Design

AOPA's online training provided the following information about aircraft design and its effect on visual limitations:

All aircraft have blind spots. High-wing aircraft have reduced visibility of aircraft above them, and can have their view of traffic blocked when making turns in the pattern as the wing is lowered in the direction of the turn. Low-wing aircraft have a large blind spot beneath them that may obscure conflicting traffic when descending into the pattern or while on final approach. Recognize and compensate for visual limitations, whether it's raising a wing to check for traffic before making a turn in a high-wing airplane, or making shallow S-turns when climbing or descending in any aircraft.

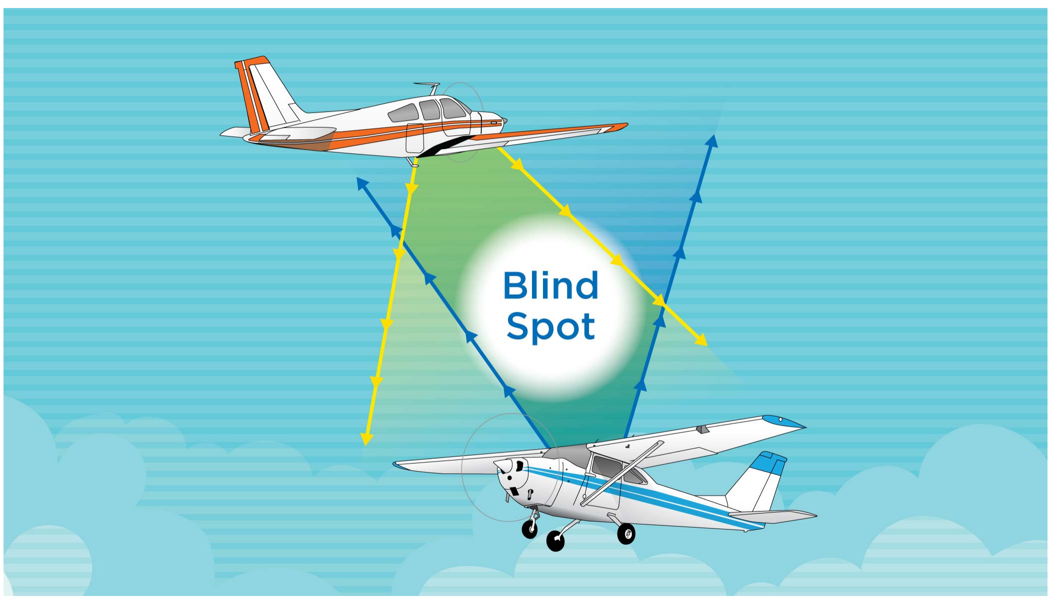


Figure 9: Airplane Blind Spot (Source: AOPA Online Training)

Windshield distortion, placement of window and windshield posts, and other structural elements can also hinder visibility. The brain requires input from both eyes to accurately interpret the visual cues it receives. If a windshield post or other obstruction blocks the vision of one eye, the brain may not perceive the object—even with the other eye providing input. A high glareshield can also block vision, which is especially problematic during climbout.

10.0 NTSB Safety Alert 058

NTSB Safety Alert 058 provided the following information to pilots on midair collision prevention in November 2016:

The problem

• The "see-and-avoid" concept has long been the foundation of midair collision prevention. However, the inherent limitations of this concept, including human limitations, environmental conditions, aircraft blind spots, and operational distractions, leave even the most diligent pilot vulnerable to the threat of a midair collision with an unseen aircraft.

• Technologies in the cockpit that display or alert of traffic conflicts, such as traffic advisory systems and automatic dependent surveillance–broadcast (ADS-B), can help pilots become aware of and maintain separation from nearby aircraft (1).Such systems can augment reality and help compensate for the limitations of visually searching for traffic. (1 To receive a complete traffic picture and benefit fully from this technology, aircraft must be equipped with both ADS-B In and ADS-B Out. Due to the design of the ADS-B system, aircraft equipped with only ADS-B In may be presented with incomplete traffic information. Although the information could be useful when operating near an ADS-B Out-equipped aircraft, in other situations, a pilot could potentially receive a traffic picture that omits the closest traffic, resulting in false security.)

What can you do?

- *Educate yourself about the benefits of flying an aircraft equipped with technologies that aid in collision avoidance. Whether you are flying in congested airspace or a remote location, a cockpit display or alert of traffic information will increase your awareness of surrounding traffic.*
- *Become familiar with the symbology, display controls, alerting criteria, and limitations of such technologies in your aircraft, whether the systems are portable or installed in the cockpit. High-density traffic around airports can make interpreting a traffic display challenging due to display clutter, false traffic alerts, and system limitations.*
- *Use information provided by such technologies to separate your aircraft from traffic before aggressive, evasive maneuvering is required. Often, slight changes in rate of climb or descent, altitude, or direction can significantly reduce the risk of a midair collision long before the conflicting aircraft has been seen.*
- *Remember that while such technologies can significantly enhance your awareness of traffic around you, unless your system is also capable of providing resolution advisories, visual acquisition of and separation from traffic is your primary means of collision avoidance (when weather conditions allow).*

F. LIST OF ATTACHMENTS

Attachment 1 – Record of Conversation Eyewitness Interview
Attachment 2 – Interview Transcript with Inspector Dahl – FAA
Attachment 3 – Interview Transcript with High Adventure Air Charter, Guides and Outfitters Chief Pilot
Attachment 4 – Pilot Information – N4982U
Attachment 5 - Pilot Information – N2587M
Attachment 6 – High Adventure Air Charter, Guides and Outfitters Policies and Procedures

[Excerpts]
Attachment 7 – Flight Schedule and Plan – N4982U
Attachment 8 – FAA Chart Supplement – Alaska [Excerpts]
Attachment 9 – FAA How to Avoid a Mid Air Collision – P-8740-51
Attachment 10 – FAA AC 90-66B – Non-Towered Airport Flight Operations
Attachment 11 – FAA AC 90-48D – Pilots Role in Collision Avoidance

Submitted by:

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Shawn Etcher
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