National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

WPR22FA151

OPERATIONAL FACTORS

Specialist's Factual Report

July 23, 2022

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A. ACCIDENT

Location: Heyburn, Idaho
Date: April 13, 2022
Time: 0832 Local
1432 coordinated universal time (UTC)
Airplane: Cessna CE-208B; N928JP

B. OPERATIONAL FACTORS SPECIALIST

Specialist David Lawrence
National Transportation Safety Board
Washington, DC

C. SUMMARY

On April 13, 2022, about 0832 mountain daylight time,[1] GEM Air 1826, a Cessna CE-208B Grand Caravan, N928JP, was substantially damaged when it was involved in an accident near Heyburn, Idaho. The pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulation (CFR)* Part 135 cargo flight. The pilot was transporting cargo on an instrument flight rules flight from the Salt Lake City International Airport (SLC), Salt Lake City, Utah, to the Burley Municipal Airport (BYI), Burley, Idaho.

D. DETAILS OF THE INVESTIGATION

The Operations Specialist did not launch to the accident site. Between April 13, 2022 and May 13, 2022 requests for information and data from the operator (Gem Air LLC) and Federal Aviation Administration (FAA) were made and received. Between May 16, 2022 and May 24, 2022 interviews were conducted for the Gem Air operations manager, director of operations (DO), chief pilot, CE-208B check pilot, and CE-208B training captain.

E. FACTUAL INFORMATION

1.0 History of Flight

According to Foreflight records, the pilot received an online weather briefing for BYI at 0506:35 on April 13, 2022 and subsequently filed an instrument flight rules

[1] All times in this Specialist Report are mountain daylight time, unless otherwise noted.

(IFR) flight plan from SLC to BYI at 0553:52. The flight plan for Gem Air 1826 indicted a proposed departure time of 0700 (1300:00Z), an estimated time enroute (ETE) of 1 hour and 7 minutes at an altitude of 12,000 feet mean sea level (msl) and 4 hours of fuel onboard. According to ADS-B data,[2] the airplane began to taxi out in SLC about 0655 and departed runway 16L about 0700. The climb and enroute portions of the flight to BYI were uneventful.

As the airplane approached BYI, the air traffic control (ATC) approach controller issued the pilot the current altimeter setting and verified that the pilot had the current weather for BYI. Subsequently, the controller cleared the pilot for the RNAV[3] runway 20 approach via the MALTT transition at BYI.[4] According to ADS-B data the pilot executed the approach, and a security camera subsequently captured the airplane flying low over the runway. About 0813 the pilot reported a missed approach. The controller then instructed the pilot to execute the published missed approached and to report established in the hold at the IREME fix,[5] and to expect the same approach.[6]

BYI had an automated surface observation system (ASOS).[7] Automated BYI weather at 0810 was wind from 190° at 8 kts, visibility 1-mile, light snow, mist, broken ceiling at 2,300 ft above ground level (agl), overcast skies at 2,800 ft agl, temperature of -3° C, dew point temperature -5° C, and an altimeter setting of 29.96 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, a trace of precipitation since 0753 MDT, temperature -3.3°C, dew point temperature -5.0°C.

After the pilot reported established at IREME following the first approach, the controller cleared the pilot for a second approach. About one minute later, the controller asked the pilot if she had crossed the initial approach fix. The pilot initially replied negative, then subsequently replied that she had crossed the fix. ADS-B data showed the airplane crossed IREME inbound on the approach about 0827 at an altitude of about 6,950 feet msl and ground speed of about 124 kts. The controller then approved a change to BYI advisory frequency.

[2] According to the Federal Aviation Administration (FAA), Automatic Dependent Surveillance–Broadcast (ADS–B) is an advanced surveillance technology that combines an aircraft's positioning source, aircraft avionics, and a ground infrastructure to create an accurate surveillance interface between aircraft and ATC. ADS–B is a performance–based surveillance technology that is more precise than radar and consists of two different services: ADS–B Out and ADS–B In. For additional information, see Air Traffic Control Group Chairman's Factual Report.

[3] Area Navigation.

[4] The MALTT intersection was located about 5 nautical miles southeast of the BYI airport.

[5] The IREME fix on the RNAV 20 approach was about 11 nautical miles from the runway 20 threshold. See Section 6.1.3 of this report.

[6] For additional information, see Air Traffic Control Group Chairman's Factual Report.

[7] ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure. ASOS are maintained by the National Weather Service (NWS).

ADS-B data indicated the airplane began descending on the approach and crossed the HIKLO[8] final approach fix about 0829 at an altitude of 6,050 feet and a ground speed of about 131 kts. The airplane continued to descend. About 0831 the airplane crossed the JAMID[9] fix at an altitude of about 4,750 feet msl and a ground speed of about 101 kts. The last ADS-B return for the airplane was about 0832 at an altitude of about 4,350 feet msl (198 feet above touchdown zone elevation for runway 20),[10] and occurred when the airplane was about 3,950 feet from the end of the runway. The minimum descent altitude (MDA) for the RNAV 20 approach was 4,560 feet and 408 feet above the touchdown zone elevation (TDZE) for runway 20.

Video footage recovered from a security camera located on a processing plant along the approach to runway 20 showed a view of the rooftop of the processing plant, along with a smokestack supported by steel framework on the roof. Snow was observed falling. About 0832:25, the airplane came into view in a wings-level, nose-high descent. The airplane subsequently struck the smokestack and fell to the rooftop.

Automated BYI weather at 0840 recorded wind from 210° at 8 kts, visibility 2.5 miles, light snow, broken ceiling at 3,000 ft agl, overcast skies at 4,700 ft agl, temperature of -3°C, dew point temperature -6°C, and an altimeter setting of 29.97 inHg. Remarks: automated station with a precipitation discriminator, a trace of precipitation since 0753 MDT, temperature -2.8°C, dew point temperature -5.6°C.[11]

According to a witness, located about one quarter mile away, he first heard and then observed the airplane descend out of the clouds then immediately went into a steam cloud, which was produced from a set of six smokestacks located on the Gem State Processing building.[12] The witness heard the engine increase in sound and saw the nose lift shortly before the airplane struck the smokestack and descend to the rooftop.[13]

2.0 Pilot Information

The pilot was 30 years-old and resided in Salmon, Idaho. Gem Air LLC received a resume from the pilot when she first applied, but according to the Gem Air LLC operations manager it was not retained by the company. According to the chief pilot,

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[8] The HIKLO final approach fix on the RNAV 20 approach was about 5 nautical miles from the runway 20 threshold. See Section 6.1.3 of this report.

[9] The JAMID fix on the RNAV 20 approach was about 1.6 nautical miles from the runway 20 threshold. See Section 6.1.3 of this report.

[10] No ground speed was recorded with this final ADS-B return.

[11] For additional weather information, see Meteorological Group Chairman's Factual Report.

[12] The Gem State Processing building was located about ½ mile from the runway 20 threshold. For additional information on the obstacles associated with approach to runway 20 at BYI, se Airports Group Chairman's Factual Report.

[13] See Attachment 2 – Witness Statements.

Gem Air LLC does not require applicants to complete an application for employment.[14] Gem Air LLC conducted a Pilot Records Improvement Act (PRIA) background check on the pilot on June 21, 2021.[15]

According to the Gem Air chief pilot, the accident pilot received initial pilot instruction while at Gem Air LLC, and according to Gem Air LLC records the pilot previously worked for the company in August 2018 riding in the BN-2-A20 Islander to gain experience while she worked on getting her private pilot license and ratings. The pilot also began flying the Cessna 172, Cessna T206H and Cessna T210M for Gem Air LLC, and obtained additional ratings at Utah State University. She completed her commercial license, multi-engine rating and certified flight instructor certificates from a flight school in Arizona. The pilot's previous employment records indicated she attended Aero Guard Flight Training Center near Phoenix, Arizona prior to being employed full-time with Gem Air LLC.[16]

A review of the FAA Program Tracking and Reporting Subsystem (PTRS),[17] Accident/Incident Data System (AIDS) and Enforcement Information System (EIS) showed no records or reports of any previous aviation accidents or incidents involving the accident pilot.[18]

According to Gem Air LLC records, pilot new hire minimum qualifications included the following:

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[14] See Attachment 2 – Witness Statements.

[15] The "Pilot Records Improvement Act of 1996" (PRIA), as amended, was enacted to ensure that air carriers and air operators adequately investigate a pilot's background before allowing that pilot to conduct commercial air carrier flights. Under PRIA, a hiring employer cannot place a pilot into service until the employer obtains and reviews the last 5 years of the pilot's background and other safety-related records, as specified in PRIA. PRIA required that a hiring air carrier under14 *CFR* Parts 121 and 135, or a hiring air operator under 14 *CFR* Part 125, request, receive, and evaluate certain information concerning a pilot/applicant's training, experience, qualification, and safety background, before allowing that individual to begin service as a pilot with their company. The Pilot Records Database (PRD) was used to facilitate the sharing of pilot records among air carriers in a clearinghouse managed by the FAA. All Part 119 certificate holders and fractional ownerships can register to access the PRD and evaluate the available FAA data for each individual pilot candidate prior to making a hiring decision. Air carriers must began using the PRD for FAA record evaluations no later than Dec. 7, 2021, and for all other records no later than June 10, 2022. Guidance for compliance with PRIA and PRD was in FAA Advisory Circular (AC) 120-68J Pilot Records Improvement Act and the Pilot Records Database, dated June 28, 2021.

[16] No records were received from Aero Guard, nor was it required under PRIA for a flight school.

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

[18] Source: FAA.

• VFR only/summer pilots: IFR SEL/MEL ratings. ~ 1,000hrs total time, 25 hours night, 100 hrs. cross country. Pilots must also satisfactorily pass a pre-employment simulator ride and a pre- employment written exam.

• IFR pilots: IFR SEL/MEL ratings. 1,200hrs minimum total time, 100 hours night, 500 hrs. cross-country, 75 hours instrument. Pilots must also satisfactorily pass a pre-employment simulator ride and a pre-employment written exam.

2.1 The Pilot's Certification Record[19]

Private Pilot – Airplane Single Engine Land certificate issued February 17, 2012.

Private Pilot – Airplane Single Engine Land; Instrument Airplane certificate issued May 31, 2019.

Notice of Disapproval – Commercial Pilot – Single Engine Land issued on July 22, 2019.
Areas of reexamination: Applicant landed short while performing power off 180
other areas tested satisfactory.

Commercial Pilot – Airplane Single Engine Land; Instrument Airplane certificate issued July 30, 2019.

Commercial Pilot – Airplane Single Engine Land; Airplane Multiengine Land; Instrument Airplane certificate issued August 11, 2019.[20]

Flight Instructor – Airplane Single Engine certificate issued October 23, 2019.

Remote Pilot – Small Unmanned Aircraft System certificate issued October 30, 2019.[21]

Flight Instructor – Airplane Single Engine; Instrument Airplane certificate issued November 5, 2019.

Flight Instructor – Airplane Single Engine; Airplane Multiengine; Instrument Airplane certificate issued November 25, 2019.
Renewed: November 24, 2021.[22]

[19] Source: FAA.
[20] According to FAA Form 8710-1, the pilot requested this certificate to be mailed to an address in Gilbert, Arizona.
[21] The pilot completed the FAA Part 107 Small Unmanned Aircraft Systems Initial online course on October 29, 2019. Source: FAA.
[22] The pilot's flight times on her November 24, 2021 FAA Form 8710-1 indicated she had 1,050.81 total flight hours, 761.01 hours PIC, 1.50 hours instrument time, and 57.70 hours night flight time.

Commercial Pilot – Airplane Single Engine Land; Airplane Single Engine Sea; Airplane Multiengine Land; Instrument Airplane certificate issued January 3, 2020.

2.2 The Pilot's Certificates Held at the Time of the Accident

Commercial Pilot Certificate (Issued January 3, 2020)
Airplane Single Engine Land; Airplane Single Engine Sea; Airplane Multiengine Land; Instrument Airplane.

Flight Instructor Certificate (Issued November 24, 2021)
Airplane Single Engine and Multiengine, Instrument Airplane

Remote Pilot Certificate (Issued October 30, 2019)
Small Unmanned Aircraft System

First Class Medical Certificate (Issued February 16, 2022)
Limitations: None

2.3 The Pilot's Training and Proficiency Checks Completed[23]

Gem Air LLC Date of Hire	May 24, 2021
Date of Initial CE-208B Training[24]	November 16, 2021
Date of Most Recent Proficiency Check (CE-208B)[25]	February 17, 2022
Date of Most Recent PIC Line Check (CE-208B)	February 17, 2022

Prior to employment, Gem Air LLC required new-hire pilots to demonstrate basic flight skills, knowledge and basic and advance procedures in an ATC610 simulator. The simulator was also used for bi-annual IFR refresher training prior to pilots receiving their Part 135 IFR check ride. According to Gem Air LLC, the company also utilized a Garmin G1000 trainer that included a duplicate of the primary flight display (PFD) and multi-function display (MFD) screens along with buttons, knobs, and software found in the airplane. This simulator was used to train pilots on the functions

[23] Source: Gem Air LLC and FAA.

[24] According to Gem Air LLC records, the pilot attended initial CE-208 training between October 22, 2021 and November 16, 2021

[25] According to the pilot's FAA 8410-3 "Airman Competency/Proficiency Check Part 135" form dated February 17, 2022, the pilot completed Part 135.293, Part 135.297 and Part 135.299 requirements (See Attachment 3 – Pilot Information). Title 14 *CFR* 135.293(a) required pilots to pass a written or oral test every 12 calendar months covering topics such as regulations, airplane systems, weight and balance, and weather. Title 14 *CFR* 135.293(b) required pilots to pass a competency check every 12 calendar months. Title 14 *CFR* 135.297 required pilots to pass an instrument proficiency check each 6 months. Title 14 *CFR* 135.299 required pilots to pass a line check every 12 calendar months that included at least one flight over one route segment, and takeoffs and landings at one or more representative airports.

of the G1000 and glass cockpit operations in all phases and conditions of flight and was used in conjunction with their FAA-approved global positioning system (GPS) training program.[26]

From May 23, 2021 to May 27, 2021 the pilot attended basic indoctrination training that included crew resource management (CRM) training on May 26, 2021.[27]

On June 10, 2021 the pilot successfully completed a 14 *CFR* 135.293 and 135.299 check. According to the pilot's FAA 8410-3 "Airman Competency/Proficiency Check Part 135" form, the pilot was graded satisfactory on all required flight maneuvers in a Cessna T210 (N7067Z). The check did not include a Part 135.297 instrument competency check.[28] The pilot was graded satisfactory for "judgement."

According to Gem Air LLC records, the pilot attended initial CE-208B training between October 22, 2021 and November 16, 2021.

On November 18, 2021 the pilot successfully completed a 14 *CFR* 135.293 and 135.299 check ride. According to the pilot's FAA 8410-3 "Airman Competency/Proficiency Check Part 135" form, the pilot was graded satisfactory on all required flight maneuvers in a CE-208B (N928JP). The check did not include a 14 *CFR* 135.297 instrument competency check. The box for "judgement" was not checked on the form.

On November 23, 2021 and November 28, 2021 the pilot received initial training as a ground instructor and flight instructor for Gem Air LLC.

On February 17, 2022 the pilot successfully completed a 14 *CFR* 135.293 and 135.299 check ride. The check included a 14 *CFR* 135.297 instrument competency check. According to the pilot's FAA 8410-3 "Airman Competency/Proficiency Check Part 135" form, the pilot was graded satisfactory on an instrument landing system (ILS) precision approach at Jackson Hole Airport (JAC), Jackson, Wyoming and an RNAV D non-precision circle-to-land approach at Lemhi County Airport (SMN), Salmon, Idaho in a CE-208B (N5855A). The pilot was also graded satisfactory for "judgement."[29]

[26] Pilot qualification requirements were found in the Gem Air LLC Flight Operations Manual.
[27] According to an email to the NTSB from the Gem Air LLC chief pilot dated July 13, 2022, Gem Air LLC taught CRM as single-pilot CRM.
[28] According to the Gem Air LLC chief pilot, the accident pilot was missing the Part 135 nighttime requirement of 100 hours and was limited to VFR flights only. Title 14 *CFR* 135 (c)(2) requires a pilot in command (PIC) to have at least 1,200 hours of flight time, including 500 hours of cross country flight time, 100 hours of night flight time, and 75 hours of actual or simulated instrument times at least 50 hours of which were in actual flight.
[29] See Attachment 7 – Pilot Training Records.

Gem Air LLC provided the NTSB a copy of an undated "Winter Season Operations Review" that was completed by the pilot. Question 22 of the document asked the following questions (the pilot's answers are in parenthesis):

> *(22) You are flying from Salt Lake to Burley what forecast weather minimums can you [have] before you need to file an alternate? (1900 ceiling 3 mile visibility)*
>
> *(B) What is the alternate? (Twin Falls)*
>
> *(C) What course of action if Burley is snowing at the time of your arrival? (Divert Twin Falls, ATC, let ops know & UPD drivers)*
>
> *(D) fuel requirement for this flight? (2 hours or 3 with alternate)*

2.3.1 Single-Pilot Resource Management

According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), while CRM focuses on pilots operating in crew environments, many of the concepts apply to single-pilot operations. Many CRM principles have been successfully applied to single-pilot aircraft and led to the development of Single-Pilot Resource Management (SRM). SRM is defined as the art and science of managing all the resources (both on-board the aircraft and from outside sources) available to a single pilot (prior to and during flight) to ensure the successful outcome of the flight. SRM includes the concepts of ADM, risk management (RM), task management (TM), automation management (AM), controlled flight into terrain (CFIT) awareness, and situational awareness (SA). SRM training helps the pilot maintain situational awareness by managing the automation and associated aircraft control and navigation tasks. This enables the pilot to accurately assess and manage risk and make accurate and timely decisions.

SRM is about how to gather information, analyze it, and make decisions. Learning how to identify problems, analyze the information, and make informed and timely decisions is not as straightforward as the training involved in learning specific maneuvers. Learning how to judge a situation and "how to think" in the endless variety of situations encountered while flying out in the "real world" is more difficult. There is no one right answer in aeronautical decision-making (ADM), rather each pilot is expected to analyze each situation in light of experience level, personal minimums, and current physical and mental readiness level, and make his or her own decision.

2.4 The Pilot's Flight Times

Estimated pilot flight times, according to Gem Air LLC:

Total pilot flying time	1,400[30]

[30] According to the pilot's most recent medical application dated February 16, 2022, the pilot reported

Total Pilot-In-Command (PIC) time	1,100
Total CE-208B flying time	192.9
Total CE-208B PIC time	192.9
Total flying time last 24 hours	4.2[31]
Total flying time last 30 days	85.9
Total flying time last 90 days	213.5
Total flying time last 12 months	590.2

2.5 Pilot Experience at BYI

Date	Route		Aircraft	Flight No	Co-Pilot	Total Pax	Times				Blk Time Hrs	Flt Time Hrs
	From	To					Blk Off	Takeoff	Land	Blk On		
Jan 28 2022	Salt Lake City	Burley	N928JP	1826	-	0	Jan 28 2022 6:45AM			Jan 28 2022 8:10AM	1.42	1.10
Jan 28 2022	Burley	Salt Lake City	N928JP	1826.1	-	0	Jan 28 2022 8:20AM			Jan 28 2022 9:25AM	1.08	1.00
Jan 31 2022	Salt Lake City	Burley	N928JP	1826	-	0	Jan 31 2022 6:30AM			Jan 31 2022 8:00AM	1.50	1.30
Jan 31 2022	Burley	Salt Lake City	N928JP	1826.1	-	0	Jan 31 2022 8:15AM			Jan 31 2022 9:20AM	1.08	0.90
Feb 24 2022	Salt Lake City	Burley	N247JP	1834	-	0	Feb 24 2022 8:10AM			Feb 24 2022 9:45AM	1.58	1.20
Feb 24 2022	Burley	Salmon	N247JP	1834.3	-	0	Feb 24 2022 10:10AM			Feb 24 2022 11:30AM	1.33	1.20
Mar 02 2022	Salt Lake City	Burley	N928JP	1826	-	0	Mar 2 2022 6:55AM			Mar 2 2022 8:10AM	1.25	1.10
Mar 02 2022	Burley	Salt Lake City	N928JP	1826.1	-	0	Mar 2 2022 8:25AM			Mar 2 2022 9:35AM	1.17	0.90
Apr 07 2022	Salt Lake City	Burley	N928JP	1826	-	0	Apr 7 2022 6:30AM			Apr 7 2022 7:45AM	1.25	1.10
Apr 07 2022	Burley	Salt Lake City	N928JP	1826.1	-	0	Apr 7 2022 9:30AM			Apr 7 2022 10:35AM	1.08	0.90
Apr 12 2022	Salt Lake City	Burley	N928JP	1826	-	0	Apr 12 2022 7:30AM			Apr 12 2022 9:10AM	1.67	1.50
Apr 12 2022	Burley	Salt Lake City	N928JP	1826.1	-	0	Apr 12 2022 10:10AM			Apr 12 2022 11:40AM	1.50	1.10

Figure 1: Accident pilot recent experience at BYI Airport.[32]

2.6 The Pilot's Recent Flight Activities

On April 9, 2022 the pilot was on duty between 0630 and 1000 and flew a roundtrip from SLC to BYI and logged a total of 2.4 hours in the CE-208B (N928JP).

On April 10, 2021 the pilot was free from duty.

On April 11, 2022 the pilot was on duty between 0600 and 1900 and logged a total of 5.0 hours (no routing information provided).

On April 12, 2022 the pilot was on duty between 0600 and 1030 and was scheduled to fly a roundtrip from SLC to BYI. According to Gem Air LLC interviews, the pilot had to divert from BYI to Joslin Field/Magic Valley Regional Airport (TWF), Twin

a total of 1,325 total flight hours and 150 hours in the last six months.

[31] Time includes the accident flight. Flight time limitations and rest requirements are defined in 14 *CFR* 135.267.

[32] Source: Gem Air LLC.

Falls, Idaho due to "ground icing conditions" at BYI.[33] The pilot logged a total of 3.2 hours in the CE-208B (N928JP) for the day.

On April 13, 2022 (the day of the accident) the pilot went on duty at 0600.

3.0 Medical and Pathological

According to the pilot's First Class medical exam dated February 16, 2022, no concerns were reported by the pilot and no significant issues were identified by the FAA Aviation Medical Examiner (AME). The pilot had six prior exams from a 2011 Second Class exam through a January 2021 First Class exam. No concerns were reported by the captain and no significant issues were identified by previous AMEs.[34]

According to Gem Air LLC records, the pilot tested negative on a pre-employment drug test on June 14, 2021.

4.0 Airplane Information

Photo 1: Accident airplane (N928JP).[35]

The accident airplane was a Cessna 208B Caravan, registration N928JP, serial number 208B2428 with a certification date of July 26, 2017. It was a single engine

[33] See Attachment 1 – Interview Transcripts.
[34] Source: FAA.
[35] Source: https://www.airport-data.com/aircraft/photo/001344396.html.

airplane manufactured in 2013 and the registered owner was Spirit Air Inc. of Salmon, Idaho. It was powered by a single Pratt & Whitney PT6A-114A engine, serial number PCE-PC2051, with an airworthiness date of January 29, 2016.

According to inspection records provided by Gem Air LLC, the airplane and engine were last inspected for airworthiness on March 25, 2022 when the airplane had a total of 5,116.90 airframe hours and 4,497 airframe landings.[36]

According to the Gem Air LLC Operations Specifications, the CE-208B was authorized to conduct commuter and on-demand operations in IFR/VFR and day/night.[37]

4.1 CE-208B Limitations

CE-208B limitations were found in the Cessna MODEL 208B G1000 Pilot Operating Handbook (POH).

	SPEED	KCAS	KIAS	REMARKS
V_{MO}	Maximum Operating Speed	175	175	Do not exceed this speed in any operation.
V_A	Maneuvering Speed: 8750 Pounds 7500 Pounds 6250 Pounds 5000 Pounds	 148 137 125 112	 148 137 125 112	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: UP - 10° Flaps 10° - 20° Flaps 20° - FULL	 175 150 125	 175 150 125	Do not exceed these speeds with the given flap settings.
	Maximum Open Window Speed	175	175	Do not exceed this speed with window open.

G208B675-00

Figure 2: CE-208B airspeed limitations.

FLAP LIMITATIONS

Approved Takeoff Range . . . . UP to 20°
Approved Landing Range . . . . .UP to FULL
Approved Landing Range in Icing Conditions . . . . UP to 20°

Figure 3: CE-208B flap limitations.

[36] See Attachment 4 – Airplane Information.
[37] Source: Gem Air LLC Operations Specifications A003.

5.0 Weight and Balance

The Cessna MODEL 208B G1000 POH provided the following weight limitations:

Maximum Ramp Weight . . . . 8785 Pounds
Maximum Takeoff Weight . . . . 8750 Pounds
Maximum Landing Weight . . . . 8500 Pounds

Title 14 *CFR* 91.103 Preflight Action stated in part that each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight.

Title 14 *CFR* Part 91.9 covered general operating and flight rules for all aircraft, and stated the following in part:

> *(b) Except as provided in paragraph (d) of this section, no person may operate a civil aircraft without complying with the operating limitations specified in the approved Airplane or Rotorcraft Flight Manual, markings, and placards, or as otherwise prescribed by the certificating authority of the country of registry.*

Loading instructions and schedules for the CE-208B were found in the Gem Air LLC Operations Specifications A-096. Pilots were required to use the loading schedule located in the CE-298B Pilot Operating Handbook and weight and balance procedures from the Gem Air LLC company Flight Operations Manual. Gem Air LLC pilots manually calculated the weight and balance for each flight.[38] The takeoff weight of the accident flight calculated by the pilot was 8,762.6 pounds and an arm of 201.4 with a fuel load of 140 gallons.[39]

Based on available information from the investigation, Textron Aviation (FAA Type Certificate number A37CE) calculated the following estimated weight and balance of the accident flight:

Table 1: CE-208B Weight and Balance.

2013 Cessna 208B G1000 675 SHP
S/N: 208B0000; N000A
D/A: 00/00/00; No Where, ND

Max TO wt.	8750
max ldg. wt.	8500
useful load =	3749.4

[38] For additional weight and balance information specific to the accident flight, see Attachment 5 – Weight and Balance Information.
[39] See Attachment 5 – Weight and Balance Information.

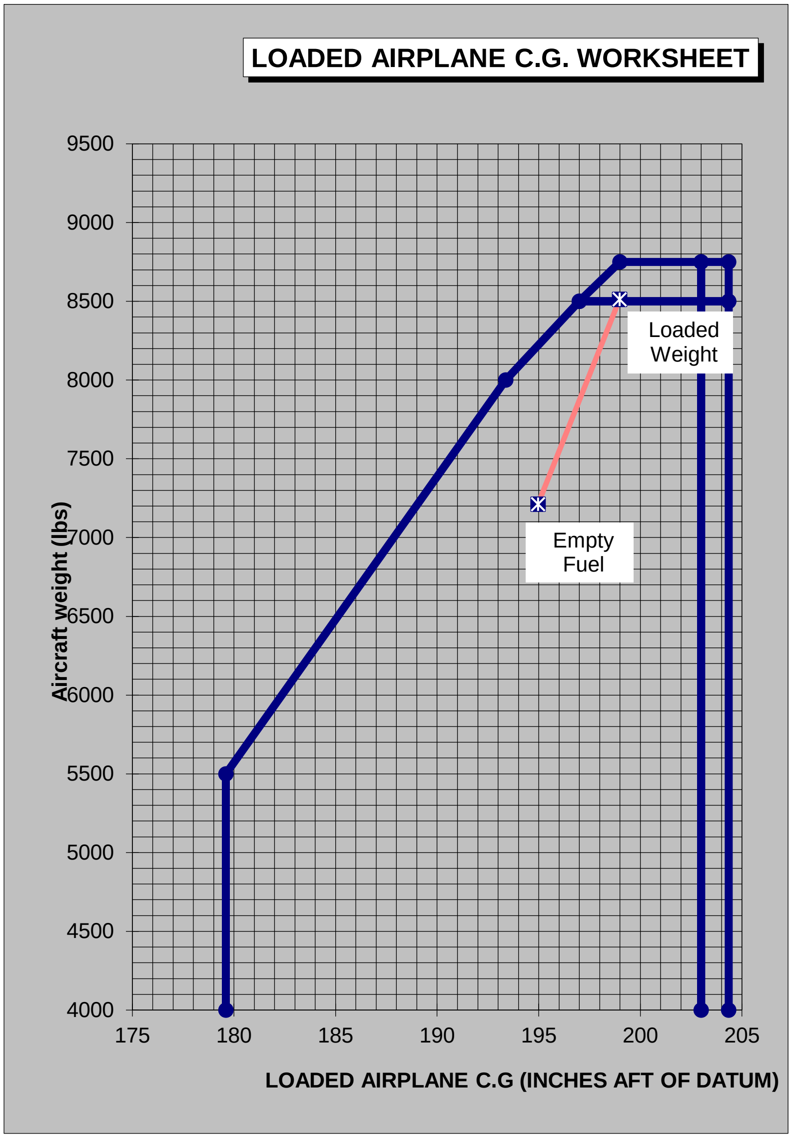
Loaded Aircraft				
	wt.	**arm**	**mom/1000**	
Empty wt.	5000.60	188.00	940.11	
				194
Fuel Main	1300.00	xxx	287.60	**gallons**
Pilot 1	160.00	135.50	21.68	
Co-pilot 2	0.00	135.50	0.00	
Zone 1	500.00	172.00	86.00	
Zone 2	500.00	217.80	108.90	
Zone 3	300.00	264.40	79.32	
Zone 4	300.00	294.50	88.35	
Zone 5	125.00	319.50	39.94	
Zone 6	100.00	344.00	34.40	
Pod Zone A	0.00	132.40	0.00	
Pod Zone B	40.00	182.10	7.28	
Pod Zone C	0.00	233.40	0.00	
Pod Zone D	0.00	287.60	0.00	
TKS Fluid	186.00	199.48	37.10	
Total Wt.	**8511.60**	**198.97**	**1693.58**	**-238 lbs.**

PLOT DATA

Envelope		Actual Data		
mom/1000	wt.	mom	weight	
180	4000	199.0	8511.6	Loaded a/c
180	5500	195.0	7211.6	empty fuel
193	8000			
197	8500			
204	8500			
204	8500			
197	8500			
199	8750			
203	8750			
203	4000			
203	8750			
204	8750			
204	4000			

Note 1: Shaded areas require manual input
Note 2: A & b tags must be positioned manually

Table 2: CE-208B center of gravity chart



6.0 Airport Information

Burley Municipal Airport (BYI) was located about one mile northeast of Burley, Idaho at an airport elevation of 4,153.5 feet. The airport did not have an ATC Control Tower (uncontrolled) and ATC approach and departure control services were provided by Twin Falls, Idaho approach control (TWF). The airport did not have ground de-icing capabilities for aircraft.

The airport was serviced by two runway surface, designated runways 02/20 and 06/24. The accident flight was cleared for the RNAV (GPS) Runway 20 approach.

Runway 20 was 4,092 feet long and 80 feet wide with an asphalt surface. It had a 305-foot-long displaced threshold, runway end identifier lights (REIL) lighting system[40] and medium intensity runway lights (MIRL)[41] that were pilot-controlled on the common traffic advisory frequency (CTAF). The runway did not have a visual approach slope indicator (VASI)[42] or a precision approach path indicator (PAPI).[43]

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[40] According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), a REIL was a pair of synchronized flashing lights, located laterally on each side of the runway threshold, providing rapid and positive identification of the approach end of a runway.

[41] According to the FAA Aeronautical Information Manual (AIM), runway edge lights are used to outline the edges of runways during periods of darkness or restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing. According to the BYI airport manager, the accident pilot did not turn on the runway lights (MIRL) on the day of the accident (See Attachment 2 – Witness Statements).

[42] According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), a VASI was visual aid of lights arranged to provide descent guidance information during the approach to the runway. A pilot on the correct glideslope will see red lights over white lights.

[43] According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), Precision approach path indicator (PAPI) was system of lights similar to the VASI but consisting of one row of lights in two- or four-light systems. A pilot on the correct glideslope will see two white lights and two red lights. According to the BYI airport manager, the runway used to have a VASI but it was decommissioned by the FAA eight years ago (See Attachment 2 – Witness Statements).

6.1 Burley, Idaho Charts

6.1.1 FAA Sectional Chart

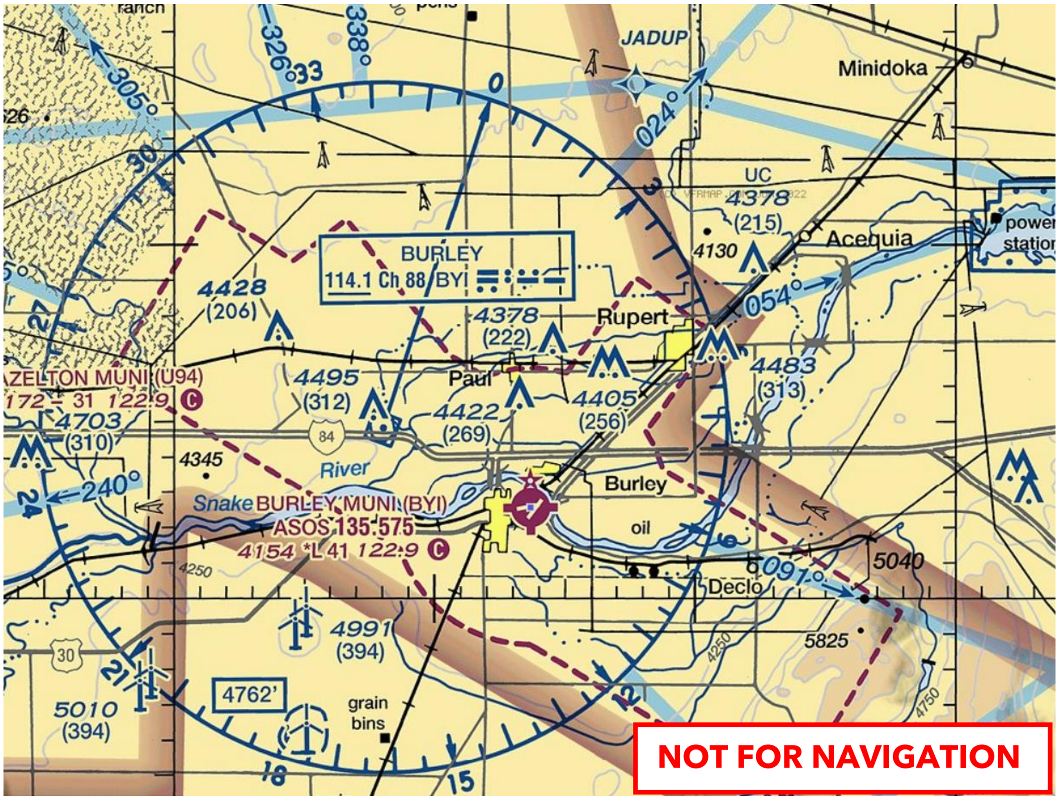
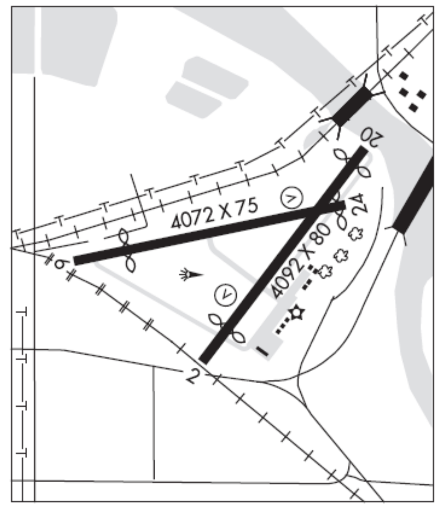


Figure 4: FAA sectional chart showing BYI airport.

6.1.2 FAA BYI Airport Information

BURLEY MUNI (BYI)(KBYI) 1 NE UTC–7(–6DT) N42°32.56´ W113°46.29´ **SALT LAKE CITY**
4154 B NOTAM FILE BYI **L–11C**
RWY 02–20: H4092X80 (ASPH) S–43, D–60 MIRL 0.3% up SW **IAP**
RWY 02: VASI(V4L)—GA 3.5° TCH 46´. Thld dsplcd 626´. Road.
RWY 20: REIL. Thld dsplcd 305´. Stack.
RWY 06–24: H4072X75 (ASPH) S–23 MIRL
RWY 06: Thld dsplcd 796´. Railroad.
RWY 24: VASI(V2R)—GA 3.0° TCH 52´. Thld dsplcd 115´. Pole.
SERVICE: S4 **FUEL** 100LL, JET A **OX** 4 **LGT** ACTVT MIRL Rwy 02–20 and Rwy 06–24—CTAF (3 clicks to turn on). VASI Rwy 02 and Rwy 24 opr consly.
AIRPORT REMARKS: Attended May–Oct 1500–0000Z‡, Nov–Apr Mon–Fri 1500–0000Z‡, Nov–Apr wkends on call only 208–678–7118. For fuel sales ctc FBO. Nr on the FBO door. Birds invof all rwys, especially AER 20 and AER 24. AG activity on and invof all rwys Apr–Oct. Marked helipad on ramp in front of FBO bldg.
AIRPORT MANAGER: 208-678-0372
WEATHER DATA SOURCES: ASOS 135.575 (208) 677–3604.
COMMUNICATIONS: CTAF 122.9
CONNOR RCO 122.05 (BOISE RADIO)
Ⓡ **TWIN FALLS APP/DEP CON** 126.7 (1300–0400Z‡)
Ⓡ **SALT LAKE CENTER APP/DEP CON** 118.05 (0400–1300Z‡)
CLEARANCE DELIVERY PHONE: For CD ctc Twin Falls Apch at 208-734-7160, when Apch clsd ctc Salt Lake ARTCC at 801-320-2568.
AIRSPACE: CLASS E.
RADIO AIDS TO NAVIGATION: NOTAM FILE BYI.
(L) (L) **VORW/DME** 114.1 BYI Chan 88 N42°34.81´ W113°51.95´ 100° 4.8 NM to fld. 4226/18E.
DME unusable:
125°–135° byd 35NM blo 15,000´



NOT FOR NAVIGATION

NW, 24 MAR 2022 to 19 MAY 2022

Figure 5: FAA Airport Facilities Directory information for BYI.

6.1.3 BYI RNAV (GPS) Runway 20 Approach Chart

The accident occurred while the pilot was conducting a nonprecision RNAV (GPS) Runway 20 approach to BYI. According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), a nonprecision approach was a standard instrument approach procedure in which only horizontal guidance is provided.

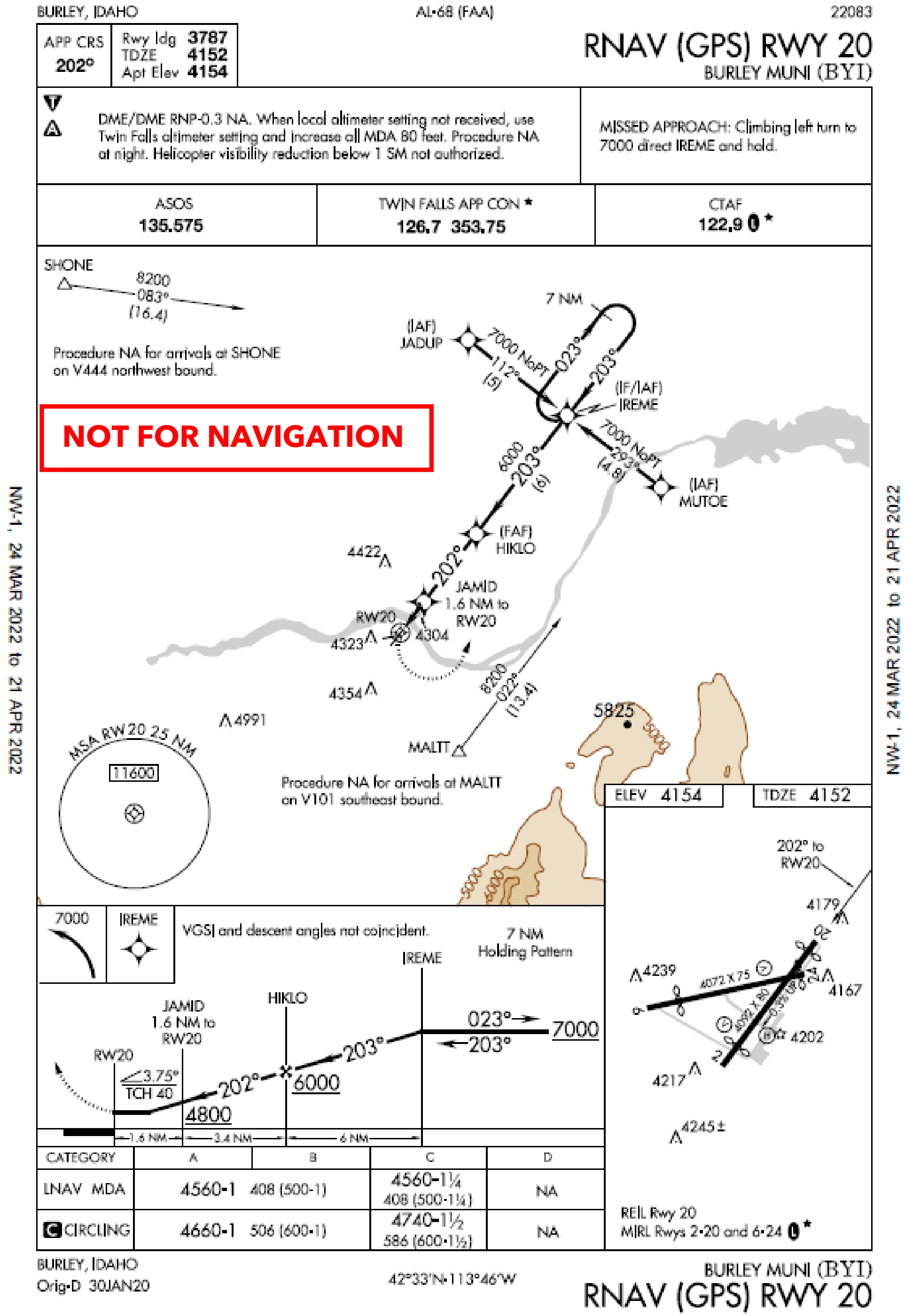


Figure 6: BYI RNAV (GPS) Runway 20 Approach Chart.[44]

The approach chart indicated that runway 20 had a visual glide slope indicator (VGSI) such as a VASI or PAPI by the note "VGSI and descent angles not coincident."

[44] Source: FAA.

As previously mentioned, runway 20 did not have any VGSI system. In addition, the approach chart did not depict any visual descent point (VDP).[45]

Prior to the accident, the FAA had published Notice to Air Mission (NOTAM) flight data center (FDC) 2/5029 that included the following information:

> *DELETE NOTE: VGSI AND DESCENT ANGLES NOT COINCIDENT (VGSI ANGLE 3.00/TCH 37).*

According to Foreflight records, the online weather briefing received by the pilot at 0506:35 for BYI included FDC NOTAM 2/5029. Further, the pilot requested and received the BYI RNAV (GPS) Runway 20 approach chart from Foreflight at 0750:02 while enroute to BYI.

A vertical descent angle (VDA) of 3.75º was depicted on the chart. According to the FAA Instrument Flying Handbook (FAA-H-8083-15B) the VDA found on nonprecision approach charts provides the pilot with information required to establish a stabilized approach descent from the FAF or stepdown fix to the threshold crossing height (TCH). Pilots can use the published angle and estimated or actual groundspeed to find a target rate of descent using the rate of descent table in the back of the Terminal Procedures Publication (TPP).[46]

According to the FAA Instrument Procedures Handbook (FAA-H-8083-16B), the VDA provides the pilot with advisory information not previously available on nonprecision approaches. It provides a means for the pilot to establish a stabilized descent from the FAF or step-down fix to the MDA. Stabilized descent is a key factor in the reduction of controlled flight into terrain (CFIT) incidents.

The Instrument Procedures Handbook further stated that pilots should be aware that the published angle is for information only – it is strictly advisory in nature. There is no implicit additional obstacle protection below the MDA. The Handbook stated that pilots must still respect any published stepdown fixes and the published MDA unless the visual cues stated in 14 *CFR* 91.175 are present, and they can visually acquire and avoid both lit and unlit obstacles once below the MDA. The presence of a VDA does

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[45] According to the FAA Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B), a visual descent point (VDP) was defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the runway environment is clearly visible to the pilot.

[46] United States Terminal Procedures Publication (TPP) are booklets published in regional format by the National Aeronautical Charting Office (NACO) that include departure procedures, standard terminal arrivals (STARs), instrument approach procedures (IAPs), and other information pertinent to instrument flight rules (IFR) flight. The NACO is an organization within the FAA whose mission is to promote safe and efficient air travel by producing and disseminating aeronautical navigation charts and data to both public and private customers.

not guarantee obstacle protection in the visual segment and does not change any of the requirements for flying a nonprecision approach.

Title 14 *CFR* 91.175(c) Operation below DA/DH[47] or MDA stated the following:

Except as provided in § 91.176 of this chapter, where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, below the authorized MDA or continue an approach below the authorized DA/DH unless -

(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing;

(2) The flight visibility is not less than the visibility prescribed in the standard instrument approach being used; and

(3) Except for a Category II or Category III approach where any necessary visual reference requirements are specified by the Administrator, at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

(i) The approach light system, except that the pilot may not descend below 100 feet above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bars are also distinctly visible and identifiable.
(ii) The threshold.
(iii) The threshold markings.
(iv) The threshold lights.
(v) The runway end identifier lights.
(vi) The visual glideslope indicator.
(vii) The touchdown zone or touchdown zone markings.
(viii) The touchdown zone lights.
(ix) The runway or runway markings.
(x) The runway lights.

Pilots may use the published angle and estimated/actual groundspeed to find a target rate of descent from the rate of descent table published in the back of the U.S. Terminal Procedures Publication. This rate of descent can be flown with the Vertical

[47] Decision Altitude/Decision Height.

Velocity Indicator (VVI) in order to use the VDA as an aid to fly a stabilized descent. No special equipment was required.

Table 3: Terminal Procedures Publication rate of descent chart[48]

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INSTRUMENT TAKEOFF OR APPROACH PROCEDURE CHARTS
RATE OF CLIMB/DESCENT TABLE
(ft per min)

A rate of climb/descent table is provided for use in planning and executing climbs or descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, altitude combination can be programmed which will result in a stable glide rate and altitude favorable for executing a landing if minimums exists upon breakout. Care should always be exercised so that minimum descent altitude and missed approach point are not exceeded.

ft/NM	%	GROUND SPEED (knots)											ANGLE
		60	90	120	150	180	210	240	270	300	330	360	
152	2.50	150	230	300	380	460	530	610	680	760	840	910	1.43
200	3.29	200	300	400	500	600	700	800	900	1000	1100	1200	1.89
210	3.46	210	320	420	530	630	740	840	950	1050	1160	1260	1.98
220	3.62	220	330	440	550	660	770	880	990	1100	1210	1320	2.07
230	3.79	230	350	460	580	690	810	920	1040	1150	1270	1380	2.17
240	3.95	240	360	480	600	720	840	960	1080	1200	1320	1440	2.26
250	4.11	250	380	500	630	750	880	1000	1130	1250	1380	1500	2.36
260	4.28	260	390	520	650	780	910	1040	1170	1300	1430	1560	2.45
270	4.44	270	410	540	680	810	950	1080	1220	1350	1490	1620	2.54
280	4.61	280	420	560	700	840	980	1120	1260	1400	1540	1680	2.64
290	4.77	290	440	580	730	870	1020	1160	1310	1450	1600	1740	2.73
300	4.94	300	450	600	750	900	1050	1200	1350	1500	1650	1800	2.83
310	5.10	310	470	620	780	930	1090	1240	1400	1550	1710	1860	2.92
320	5.27	320	480	640	800	960	1120	1280	1440	1600	1760	1920	3.01
330	5.43	330	500	660	830	990	1160	1320	1490	1650	1820	1980	3.11
340	5.60	340	510	680	850	1020	1190	1360	1530	1700	1870	2040	3.20
350	5.76	350	530	700	880	1050	1230	1400	1580	1750	1930	2100	3.30
360	5.92	360	540	720	900	1080	1260	1440	1620	1800	1980	2160	3.39
370	6.09	370	560	740	930	1110	1300	1480	1670	1850	2040	2220	3.48
380	6.25	380	570	760	950	1140	1330	1520	1710	1900	2090	2280	3.58
390	6.42	390	590	780	980	1170	1370	1560	1760	1950	2150	2340	3.67
400	6.58	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	3.77
450	7.41	450	680	900	1130	1350	1580	1800	2030	2250	2480	2700	4.24
500	8.23	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	4.70
550	9.05	550	830	1100	1380	1650	1930	2200	2480	2750	3030	3300	5.17

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[48] Source: U.S. Terminal Procedures Publication Northwest (NW) Vol 1 of 1.

According to the Instrument Procedures Handbook, in rare cases the LNAV[49] minima may have a lower height above touchdown (HAT) than minima with a glide path, due to the location of the obstacles and the nonprecision missed approach point (MAP). This should serve as a clear indication to the pilot that obstacles exist below the MDA, which must be seen in order to ensure adequate clearance. In those cases, the glide path may be treated as a VDA and used to descend to the LNAV MDA, as long as all of the rules for a nonprecision approach are applied at the MDA.

According to the FAA Instrument Procedures Handbook (FAA-H-8083-16B), when there are obstacles in the visual area that could cause an aircraft to destabilize the approach between the MDA and touchdown, the IAP will not show a vertical descent angle in the profile view. The charts currently include the following statement: "Descent Angle NA" or "Descent Angle NA-Obstacles."

According to the FAA Instrument Procedures Handbook (Descent Rates and Glidepaths for Nonprecision Approaches Maximum Acceptable Descent Rates), operational experience and research have shown that a descent rate of greater than approximately 1,000 fpm[50] is unacceptable during the final stages of an approach (below 1,000 feet agl). This is due to a human perceptual limitation that is independent of the type of airplane or helicopter. Therefore, the operational practices and techniques must ensure that descent rates greater than 1,000 fpm are not permitted in either the instrument or visual portions of an approach and landing operation.

For short runways, arriving at the MDA at the MAP when the MAP is located at the threshold may require a missed approach for some aircraft. For non-precision approaches, a descent rate should be used that ensures the aircraft reaches the MDA at a distance from the threshold that allows landing in the touchdown zone (TDZ).[51] On many IAPs, this distance is annotated by a VDP. If no VDP is annotated, calculate a normal descent point to the TDZ. To determine the required rate of descent, subtract the TDZE from the FAF altitude and divide this by the time inbound. For example, if the FAF altitude is 2,000 feet msl, the TDZE is 400 feet msl and the time inbound is two minutes, an 800 fpm rate of descent should be used.

Title 14 *CFR* 91.175(e) Missed approach procedures, stated the following:

Each pilot operating an aircraft, except a military aircraft of the United States, shall immediately execute an appropriate missed approach procedure when either of the following conditions exist:

[49] Lateral Navigation.
[50] Feet per minute.
[51] According to the FAA AIM, the touchdown zone is the first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

(1) Whenever operating an aircraft pursuant to paragraph (c) of this section or § 91.176 of this part, and the requirements of that paragraph or section are not met at either of the following times:

(i) When the aircraft is being operated below MDA; or

(ii) Upon arrival at the missed approach point, including a DA/DH where a DA/DH is specified and its use is required, and at any time after that until touchdown.

(2) Whenever an identifiable part of the airport is not distinctly visible to the pilot during a circling maneuver at or above MDA, unless the inability to see an identifiable part of the airport results only from a normal bank of the aircraft during the circling approach.

According to the Instrument Procedures Handbook (FAA-H-8083-16B), once descent below the DA, DH, or MDA is begun, a missed approach must be executed if the required visibility is lost or the runway environment is no longer visible, unless the loss of sight of the runway is a result of normal banking of the aircraft during a circling approach. A missed approach is also required upon the execution of a rejected landing for any reason, such as men and equipment or animals on the runway, or if the approach becomes unstabilized and a normal landing cannot be performed.

According to the FAA, a stabilized approach was one in which the pilot establishes and maintains a constant angle glidepath towards a predetermined point on the landing runway. It is based on the pilot's judgment of certain visual clues and depends on the maintenance of a constant final descent airspeed and configuration.

6.1.4 Continuous Descent Final Approach

Guidance for all operators using the continuous descent final approach (CDFA) technique while conducting a nonprecision approach (NPA) procedure was found in Advisory Circular 120-108 (dated January 20, 2011). According to the Advisory Circular, CDFA is a technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway threshold or to a point where the flare maneuver should begin for the type of aircraft being flown. This definition harmonizes with the International Civil Aviation Organization (ICAO) and the European Aviation Safety Agency (EASA).

According to the FAA, controlled flight into terrain (CFIT) is a primary cause of worldwide commercial aviation fatal accidents. Unstabilized approaches are a key contributor to CFIT events.[52] Present NPAs are designed with and without stepdown fixes in the final approach segment. Stepdowns flown without a constant descent will require multiple thrust, pitch, and altitude adjustments inside the final approach fix (FAF). These adjustments increase pilot workload and potential errors during a critical phase of flight. NPAs designed without stepdown fixes in the final segment allow pilots to immediately descend to the MDA after crossing the FAF. In both cases, the aircraft remains at the MDA until descending for the runway or reaching the missed approach point (MAP). This practice, commonly referred to as "dive and drive," can result in extended level flight as low as 250 feet above the ground in instrument meteorological conditions (IMC) and shallow or steep final approaches.

The FAA recommends CDFA for NPAs (including an RNAV approach) published with a VDA or glideslope (GS). CDFA requires the use of a published VDA or barometric vertical guidance (GS) on the instrument approach procedure (IAP). Figure 8, Instrument Approach Procedure Legend, shows the legend for an IAP and defines the GS and VDA. RNAV approaches with LNAV/vertical navigation (VNAV) minima are published with a GS. Non-RNAV NPAs or RNAV approaches with LNAV-only minima are published with a VDA. According to Advisory Circular 120-108, in rare cases, the VDA or GS may be calculated from a stepdown fix altitude (see subparagraph 6d of Advisory Circular 120-108). Aircraft with flight management systems (FMS), barometric vertical navigation (baro-VNAV), wide area augmentation system (WAAS), or that are similarly equipped typically provide the published VDA or GS when the IAP is selected from the database. Aircraft equipped with Flight Path Angle (FPA) allow the pilot to enter an electronic descent angle based on the published GS or VDA. Pilots flying aircraft without either type of equipment must compute a required rate of descent.

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[52] On November 10, 2015, about 1453 eastern standard time, Execuflight flight 1526, a British Aerospace HS 125-700A (Hawker 700A), N237WR, departed controlled flight while on a nonprecision localizer approach to runway 25 at Akron Fulton International Airport (AKR) and impacted a four-unit apartment building in Akron, Ohio. The captain, first officer, and seven passengers died; no one on the ground was injured. The airplane was destroyed by impact forces and postcrash fire. The airplane was registered to Rais Group International NC LLC and operated by Execuflight under the provisions of 14 Code of Federal Regulations (*CFR*) Part 135 as an on-demand charter flight. Instrument meteorological conditions prevailed, and an instrument flight rules flight plan was filed. The flight departed from Dayton-Wright Brothers Airport, Dayton, Ohio, about 1413 and was destined for AKR. As a result, the NTB issued Safety Recommendation A-16-039 to the FAA, which stated: *Require 14 Code of Federal Regulations (CFR) Part 121, 135, and 91 subpart K operators and 14 CFR Part 142 training centers to train flight crews in the performance and use of the continuous descent final approach technique as their primary means for conducting nonprecision approaches.* As of April 6, 2017 the recommendation was classified Open – Acceptable Response.

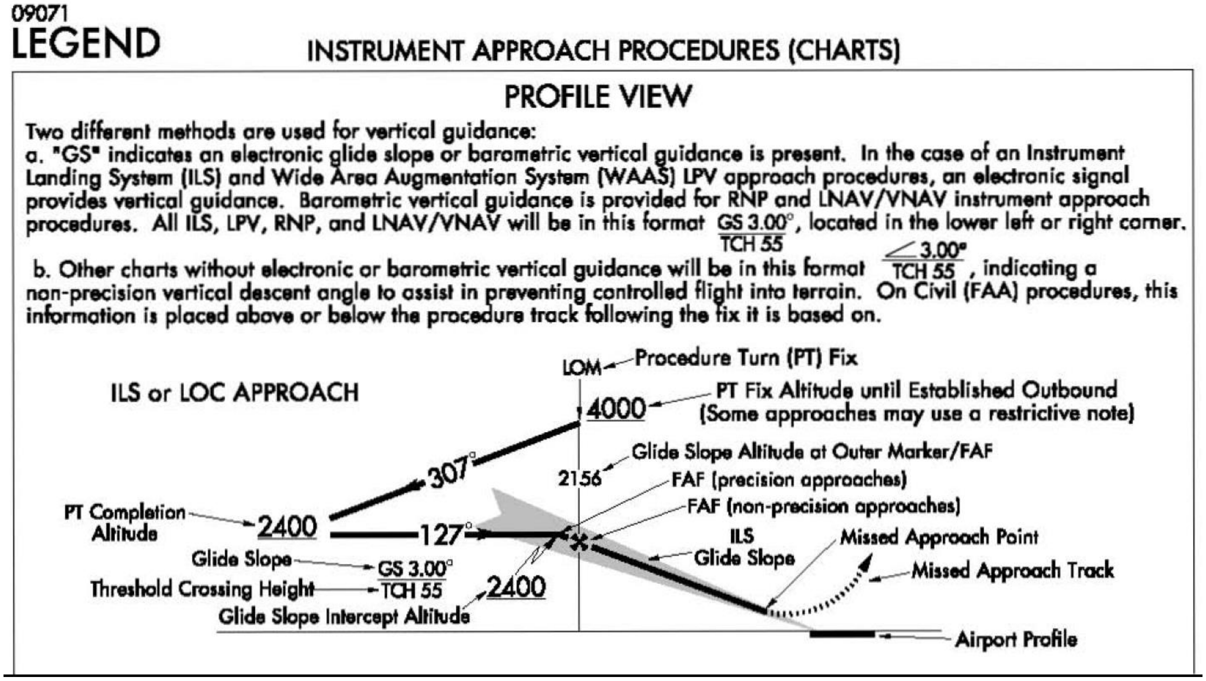

Figure 7: Instrument approach procedures legend.[53]

Both U.S. Government and private fight information publications offer the pilot a way to compute a rate of descent. (The climb/descent table, Figure 9, Rate of Descent Table, was provided in government publications.) Pilots can use this table to translate the published VDA or GS into the required rate of descent.

The VDA or GS was calculated from the FAF/precise final approach fix (PFAF) altitude to the TCH. The optimum NPA descent angle (VDA or GS) is 3.0 degrees. Descent angles were found in the following range when the optimum VDA is not possible: 2.75°–3.77° (IAPs w/≤ Category (CAT) C minimums), 2.75°–3.50° (IAPs w/CAT D/E minimums). On approaches with stepdown fixes, the goal was to publish a VDA that keeps the Vertical Path (VPATH) above the stepdown fix altitude. However, in some cases, the VDA was calculated from the stepdown fix altitude to the TCH. In this situation, the VDA was published on the IAP following the associated stepdown fix. In most cases, the descent angle between the FAF altitude and the stepdown fix altitude is slightly shallower than the published VDA for the segment between the stepdown fix and the runway. Operators should determine how they would like their pilots to fly the approach.

Two examples of how pilots may fly the approach are:

- Descend from the FAF at the shallower rate in order to cross above the stepdown fix altitude and then transition to published VDA, or

[53] Source: FAA Advisory Circular 120-108.

• Begin a descent at a point past the FAF that will allow the aircraft to descend at the published VDA and still clear the stepdown fix altitude.

CLIMB/DESCENT TABLE 10042

INSTRUMENT TAKEOFF OR APPROACH PROCEDURE CHARTS
RATE OF CLIMB/DESCENT TABLE
(ft. per min)

A rate of climb/descent table is provided for use in planning and executing climbs or descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, altitude combination can be programmed which will result in a stable glide rate and altitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that minimum descent altitude and missed approach point are not exceeded.

CLIMB/ DESCENT ANGLE (degrees and tenths)	ft/NM	GROUND SPEED (knots)										
		60	90	120	150	180	210	240	270	300	330	360
2.0	210	210	320	425	530	635	743	850	955	1060	1165	1275
2.5	265	265	400	530	665	795	930	1060	1195	1325	1460	1590
VERTICAL PATH ANGLE 2.7	287	287	430	574	717	860	1003	1147	1290	1433	1576	1720
2.8	297	297	446	595	743	892	1041	1189	1338	1486	1635	1783
2.9	308	308	462	616	770	924	1078	1232	1386	1539	1693	1847
3.0	318	318	478	637	797	956	1115	1274	1433	1593	1752	1911
3.1	329	329	494	659	823	988	1152	1317	1481	1646	1810	1975
3.2	340	340	510	680	850	1020	1189	1359	1529	1699	1869	2039
3.3	350	350	526	701	876	1052	1227	1402	1577	1752	1927	2103
3.4	361	361	542	722	903	1083	1264	1444	1625	1805	1986	2166
3.5	370	370	555	745	930	1115	1300	1485	1670	1860	2045	2230
4.0	425	425	640	850	1065	1275	1490	1700	1915	2125	2340	2550
4.5	480	480	715	955	1195	1435	1675	1915	2150	2390	2630	2870
5.0	530	530	795	1065	1330	1595	1860	2125	2390	2660	2925	3190
5.5	585	585	880	1170	1465	1755	2050	2340	2635	2925	3220	3510
6.0	640	640	960	1275	1595	1915	2235	2555	2875	3195	3510	3830
6.5	690	690	1040	1385	1730	2075	2425	2770	3115	3460	3805	4155
7.0	745	745	1120	1490	1865	2240	2610	2985	3355	3730	4105	4475
7.5	800	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
8.0	855	855	1280	1710	2135	2560	2990	3415	3845	4270	4695	5125
8.5	910	910	1360	1815	2270	2725	3180	3630	4085	4540	4995	5450
9.0	960	960	1445	1925	2405	2885	3370	3850	4330	4810	5295	5775
9.5	1015	1015	1525	2035	2540	3050	3560	4065	4575	5085	5590	6100
10.0	1070	1070	1605	2145	2680	3215	3750	4285	4820	5355	5890	6430

Figure 8: Instrument approach rate of climb/descent table.[54]

According to Advisory Circular 120-108, during any approach, pilots should perform a continuous descent flight path that meets all altitude constraints.

Flying the published VDA or GS will have the aircraft intersect the plane established by the MDA at a point before the MAP. Approaching the MDA, the pilot

[54] Source: FAA Advisory Circular 120-108.

has two choices: continue the descent to land with required visual references, or execute a missed approach, not allowing the aircraft to descend below the MDA.

6.2 BYI Runway 20 Approach Obstacles

As previously mentioned, there were smokestacks on top of the Gem State Processing building located about ½ nautical miles from the threshold of runway 20 at BYI and along the approach path to the runway. A witness to the accident observed N928JP descend out of the clouds then immediately went into a steam cloud being produced by the set of six smokestacks.

Photo 2: Photo of the smokestacks on the Gem State Processing building. The red arrow indicates the stack that was struck by the accident airplane, and the yellow arrow indicates where the wreckage was located. The airplane was traveling right to left in the photo.[55]

For additional information on the obstacles associated with the approach to runway 20 at BYI, see Airport Group Chairman's Factual Report.

6.2.1 Exhaust Plume Hazards

The FAA AIM (dated June 17, 2021) provided pilot guidance on avoiding flight in the vicinity of exhaust plumes. Section 7-6-16 of the AIM stated the following in part:

[55] Source: NTSB Investigator-in-Charge.

Flight Hazards Exist Around Exhaust Plumes. Exhaust plumes are defined as visible or invisible emissions from power plants, industrial production facilities, or other industrial systems that release large amounts of vertically directed unstable gases (effluent). High temperature exhaust plumes can cause significant air disturbances such as turbulence and vertical shear. Other identified potential hazards include, but are not necessarily limited to: reduced visibility, oxygen depletion, engine particulate contamination, exposure to gaseous oxides, and/or icing. Results of encountering a plume may include airframe damage, aircraft upset, and/or engine damage/failure. These hazards are most critical during low altitude flight in calm and cold air, especially in and around approach and departure corridors or airport traffic areas.

Whether plumes are visible or invisible, the total extent of their turbulent affect is difficult to predict. Some studies do predict that the significant turbulent effects of an exhaust plume can extend to heights of over 1,000 feet above the height of the top of the stack or cooling tower. Any effects will be more pronounced in calm stable air where the plume is very hot and the surrounding area is still and cold. Fortunately, studies also predict that any amount of crosswind will help to dissipate the effects. However, the size of the tower or stack is not a good indicator of the predicted effect the plume may produce. The major effects are related to the heat or size of the plume effluent, the ambient air temperature, and the wind speed affecting the plume. Smaller aircraft can expect to feel an effect at a higher altitude than heavier aircraft.

When able, a pilot should steer clear of exhaust plumes by flying on the upwind side of smokestacks or cooling towers. When a plume is visible via smoke or a condensation cloud, remain clear and realize a plume may have both visible and invisible characteristics. Exhaust stacks without visible plumes may still be in full operation, and airspace in the vicinity should be treated with caution. As with mountain wave turbulence or clear air turbulence, an invisible plume may be encountered unexpectedly. [Cooling towers, power plant stacks, exhaust fans, and other similar structures are depicted in Figure 10.]

Pilots are encouraged to exercise caution when flying in the vicinity of exhaust plumes. Pilots are also encouraged to reference the Chart Supplement U.S. where amplifying notes may caution pilots and identify the location of structure(s) emitting exhaust plumes.

The best available information on this phenomenon must come from pilots via the PIREP reporting procedures. All pilots encountering hazardous plume conditions are urgently requested to report time, location, and intensity (light, moderate, severe, or extreme) of the element to the FAA facility with which *they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other PIREPs [pilot reports] and position reports.*[56]

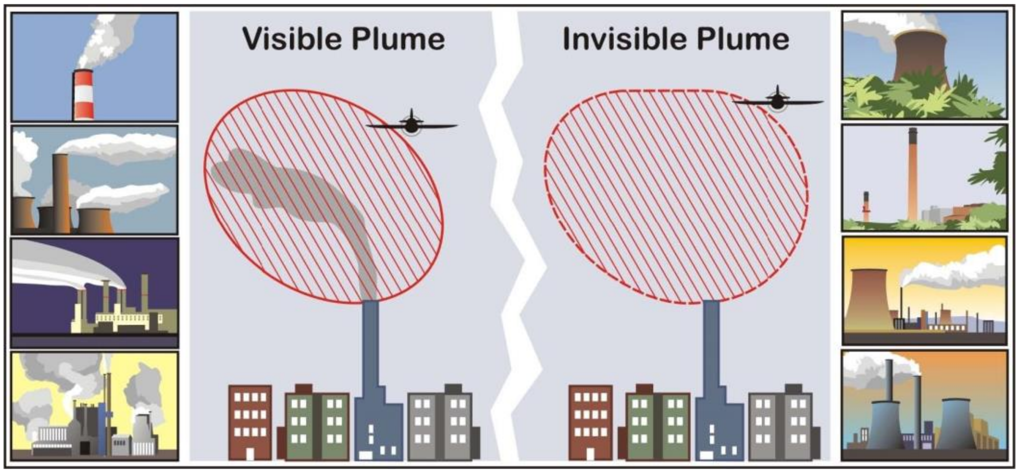

Figure 9: A graphic depicting cooling towers, power plant stacks, exhaust fans, and other similar structures.[57]

7.0 Company Information

Gem Air LLC was a Part 135 on-demand charter company that also conducted cargo air service based in Salmon, Idaho since 1982. It held an FAA Part 135 operating certificate (GAJA077E) that authorized it to conduct on-demand operations in common carriage pursuant to Title 14 *CFR* 119.21(a)(5) per the company Operations Specifications A001 issued May 9, 2003. It also was authorized to conduct commuter operations under 119.21(a)(4). The company's principal base of operations was located at Lemhi County Airport (SMN) in Salmon, Idaho.

According to the Gem Air LLC director of operations (DO), the company operated half its flights as a freight operator (under contract with the United Parcel Service – UPS) and half as a tourist "backcountry operator." The company also operated for the United States Forest Service. They had twelve airplanes ranging from four Caravans (CE-208B), two Islanders, a Piper Seneca, a Cessna 206, Cessna 201, Cessna 172 and two Piper Navajo Chieftains (which were for sale at the time of the accident). Their pilot staffing varied seasonally. They had six pilots that operated year-round, and five seasonal pilots. Pilots were either salaried (like the accident pilot) or compensated at a daily rate (not per flight hour). The DO had taught the accident pilot's father how to fly and had known the accident pilot and her family for "a number of years."[58]

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[56] See ATC Group Chairman's Factual for ATC services and PIREPS reported at BYI.
[57] Source: FAA AIM.
[58] See Attachment 1 – Interview Transcripts.

The company did not have a safety management system (SMS) and did not have a flight data monitoring program (FDM). According to the DO, the CE-208B airplanes had a Garmin G1000 that operational data could be downloaded but the company did not perform that function. According to the chief pilot, a yearly audit of the G1000 data was used to see how pilots were operating on takeoff and cruise and following standard operating procedures (SOPs). He would also review the data if there was any known exceedance of limits.

The Gem Air LLC Flight Operations Manual stated the following:

> *Gem Air's safety program is an institutionalized system for involving all personnel in continuous hazard identification, analysis, prevention strategy implementation, communications and monitoring*.

The company also used a safety program drop box where employees could provide safety concerns or suggestions. According to the chief pilot, the company had a voluntary non-punitive hazard reporting system, and he was responsible for review of any hazard reports.

Gem Air LLC flight locating procedures were found in the Gem Air LLC Flight Operations Manual. For flight locating, the pilots took a picture of their flight data sheet and sent it to the Gem Air LLC office, which included their takeoff time and estimated time of arrival. According to the Gem Air LLC Flight Operations Manual, flight plans were filed in accordance with 14 *CFR* 135.79.

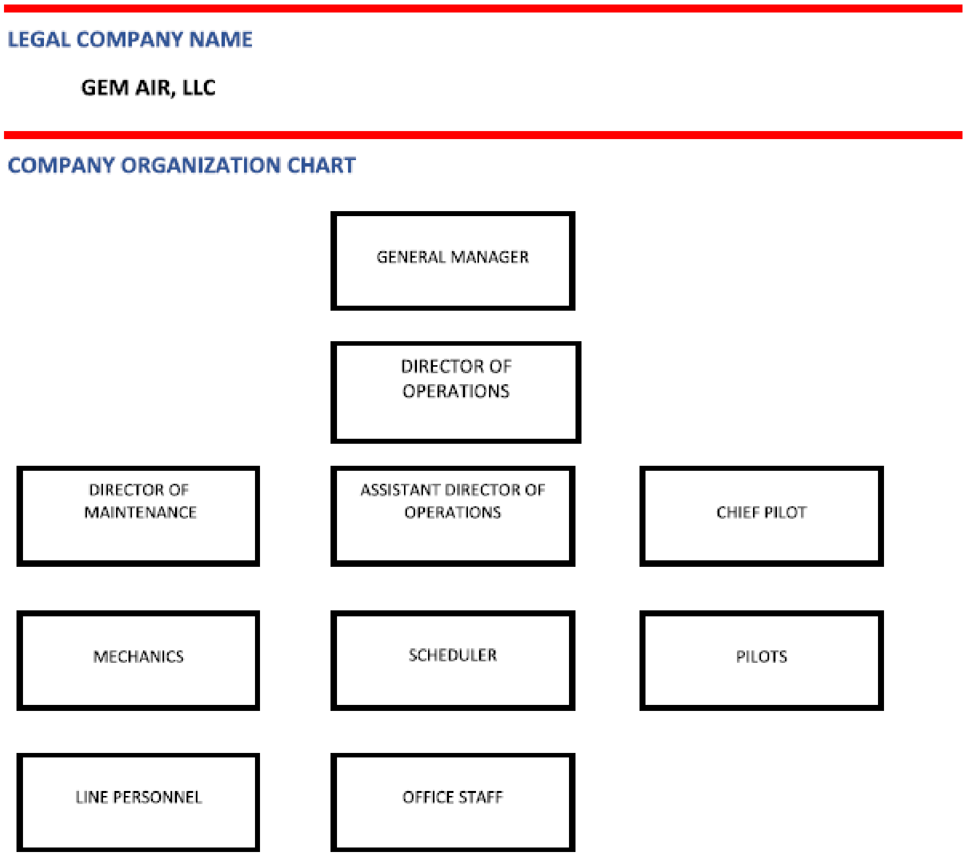

Figure 10: Gem Air LLC Organizational Chart.[59]

7.1 Operational Control

Title 14 *CFR* 135.77 stated the following:

Each certificate holder is responsible for operational control and shall list, in the manual required by § 135.21, the name and title of each person authorized by it to exercise operational control.

According to the Gem Air LLC Flight Operations Manual, the following individuals were authorized to exercise operational control:

Director of Operations
General Manager
Chief Pilot
Director of Maintenance
Assistant Director of Operations

[59] Source: Gem Air LLC Flight Operations Manual.

Scheduler

According to the Gem Air LLC Flight Operations Manual, operational control included, but was not limited to, the performance of the following:

(1) Ensuring that only those operations authorized by the OpsSecs were conducted
(2) Ensuring that only crewmembers trained and qualified in accordance with the applicable regulations were assigned to conduct flights.
(3) Ensuring crewmembers were in compliance with flight and duty time requirements when departing on a flight.
(4) Designating a PIC for each flight.
(5) Providing the PIC and other personnel who perform operational control functions with access to the necessary information for the safe conduct of the flight (such as weather, NOTAMs and airport analysis).
(6) Specifying the conditions under which a flight may be dispatched or released (weather minimums, flight planning, and airworthiness of aircraft, aircraft loading, and fuel requirements).
(7) Ensuring that each flight has complied with the conditions specified for release before it is allowed to depart.
(8) Ensuring that when the conditions specified for a flight's release cannot be met, the flight is either cancelled, delayed, re-routed, or diverted.
(9) Monitoring the progress of each flight and initiating timely actions when the flight cannot be completed as planned, including diverting or terminating a flight.

According to the Gem Air LLC DO, when asked by the NTSB who was responsible for operational control of the accident flight, he said "well, I guess you could say everyone was."[60]

7.2 Gem Air LLC Management

The Duties and Responsibilities of Gem Air LLC management and pilots were described in the GEM Air LLC Flight Operations Manual.

[60] See Attachment 1 – Interview Transcripts.

7.2.1 Director of Operations

The director of operations was a Vietnam war veteran who, along with his wife, started Gem Air LLC in 1982.

7.2.2 Chief Pilot

The chief pilot had been with Gem Air LLC since 2014. He was responsible for pilot hiring and training and maintenance of the company manuals. He was also a training captain and check airman. He had about 4,000 total flight hours and held an Airline Transport Pilot certificate. He was considered the safety manager at Gem Air LLC.

7.2.3 Assistant Director of Operations

The assistant director of operations had been with Gem Air LLC for just over one year. His primary aviation experience was 22 years flying missionary flights in Africa and was a former director of operations in Kenya for Mission Aviation Fellowship. He held a commercial pilot certificate and a mechanic certificate with an A&P rating.

7.2.4 Pilot in Command Responsibilities

Title 14 *CFR* 91.3 Responsibility and authority of the pilot in command stated the following in part:

> *(a) The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.*

The responsibilities for the pilot in command were listed in the GEM Air LLC Flight Operations Manual.[61]

8.0 Relevant Systems

8.1 Garmin 1000

According to the Cessna MODEL 208B G1000 POH, the Garmin system consists of three Garmin Display Units (GDUs), an audio panel, and an autopilot mode controller.

[61] See Attachment 6 - GEM Air PIC Responsibilities.

The three GDUs are configured as two Primary Flight Displays (PFDs) and one Multifunction Flight Display (MFD).

The PFDs, centered above the yokes in front of the pilot and copilot seats, showed the primary flight instruments and display any Crew Alert System (CAS) messages and alerts. During reversionary operation (MFD or PFD 1 failure) or when the DISPLAY BACKUP switch was selected, the Engine Indication System (EIS) was shown on the PFD.

The MFD, located between the two PFDs, depicts EIS information along the left side of the display and shows navigation, terrain, lightning and traffic data on the moving map. Flight management or display configuration information can be shown on the MFD in place of the moving map pages.

The Garmin audio panel was located between the pilot PFD and the MFD. It integrates all the communication and navigation digital audio signals, intercom system and marker beacon controls. A pushbutton switch labeled DISPLAY BACKUP allowed manual selection of reversionary mode for the PFDs and MFD.

The Garmin autopilot mode controller, located above the MFD, was the pilot interface with the autopilot system.

8.2 Panel Layout

To the left of the pilot PFD was a switch panel which has many of the switches necessary to operate the airplane systems. At lower left were a circuit breaker panel for the avionics systems, the left fresh air outlet and pull knob, test switches for prop overspeed, fire detection, and fuel selection warning systems, microphone and headset jacks, and an alternate static source valve.

Below the MFD were standby indicators for airspeed, attitude, altitude, and torque. Below these indicators were the parking brake, light dimming controls, inertial separator control, and cabin heat controls. Provisions were included for optional air conditioning controls and HF and ADF displays.

At the lower right was the map compartment, right fresh air outlet and pull knob, and microphone and headset jacks. At upper right was the hour meter and ELT remote switch. Mounted above the glare shield was a magnetic compass. For details concerning the instruments, switches, and controls on this panel, refer to this section for the description of the systems to which these items are related.

Figure 11: Typical CE-208B G1000 cockpit configuration.[62]

8.3 Control Pedestal

A control pedestal, extending from the center of the instrument panel to the floor, contains the EMERGENCY POWER Lever, power lever, PROP RPM Lever, FUEL CONDITION Lever, WING FLAP selector and position indicator, elevator, rudder and aileron trim controls with position indicators, the fuel shutoff valve control, cabin heat firewall shutoff valve control, a microphone, 12VDC power outlet, and an auxiliary audio input jack.

8.4 Engine Indication System

The G1000 Engine Indication System (EIS) provides graphical indicators and numeric values for engine, fuel, and electrical system parameters to the pilot. The EIS was shown in a vertical strip on the left side of the PFD during engine starts and on the MFD during normal operation. If either the MFD or PFD fails during flight, the EIS would be shown on the remaining display.

[62] Source: https://studylib.net/doc/25777452/caravan-g1000-instrument-panel.

The EIS consisted of two pages that were selected using the ENGINE softkey. The ENGINE page provided indicators for engine torque, engine ITT[63], gas generator RPM%, propeller RPM, oil pressure, oil temperature, fuel quantity, fuel flow, battery amps, bus voltage, and either Anti-Ice Fluid Remaining or Propeller Amps. When the ENGINE softkey was pressed, the SYSTEM softkey will appear adjacent to the ENGINE softkey. The SYSTEM page provides numerical values for parameters on the ENGINE page that are shown as indicators only. Torque, ITT, Ng%[64] and Np[65] RPM were displayed identically on the SYSTEM page. The SYSTEM page also provided numerical indication for fuel quantity, fuel totalizer (pounds remaining and pounds used), generator amps, standby alternator amps, battery amps, bus voltage, anti-ice remaining (gallons of fluid and hours remaining), and propeller amps.

The engine and airframe unit provided data to the EIS, which displays the data for the ENGINE page described below. Engine operation was monitored by torque, ITT, Ng%, propeller RPM, oil pressure, oil temperature, and fuel flow.

8.5 Pitot-Static System and Instruments

There were two independent pitot-static systems on the airplane. The left pitot-static system supplies ram air pressure to Air Data Computer #1 and to the standby airspeed indicator and supplies static pressure to Air Data Computer #1 and to the standby airspeed indicator, vertical speed indicator, and altimeter. The right pitot-static system provides ram air and static pressure to Air Data Computer #2. Each system was composed of a heated pitot-static tube mounted on the leading edge of the corresponding wing, a drain valve located on the sidewall beneath the instrument panel, and the associated plumbing necessary to connect the instruments and sources. In addition, the left system included a static pressure alternate source valve located on the lower left corner of the instrument panel.

The static pressure alternate source valve in the left system can be used if the static source was malfunctioning. This valve supplies static pressure from inside the cabin instead of from the pitot-static tube. If erroneous instrument readings were suspected due to water or ice in the pressure line going to the static pressure source, the alternate source valve should be pulled on. Pressures within the cabin will vary with vents open or closed.

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[63] Inter-Turbine Temperature.
[64] Rotation speed of the compressor section of the engine provide as a percentage of a design maximum.
[65] Propeller rpm.

8.5.1 Airspeed Indicators

The Garmin PFDs were the primary sources of airspeed information. Standby airspeed information was depicted by a mechanical indicator calibrated in knots, connected to the left pitot-static system.

The standby airspeed indicator was a true airspeed indicator and was equipped with a knob which worked in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator the pilot must, first rotate the knob until pressure altitude was aligned with outside air temperature in degrees centigrade. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude was obtained. Having set the knob to correct for altitude and temperature, read the true airspeed shown in the window by the indicator pointer.

8.5.2 Vertical Speed Indication

The vertical speed indication on the PFDs depicted airplane rate of climb or descent in feet per minute. The pointers were actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static sources.

8.5.3 Altimeter (Standby Instrument Panel)

Airplane altitude was depicted by a barometric type of altimeter. A knob near the lower left portion of the indicator provided adjustment of the instrument's barometric scale to the current altimeter setting.

9.0 TKS Anti-ice System

According to the Textron Aviation Maintenance Manual 1985 & On Model 208 Series (Revision 37 dated March 1, 2020), the TKS anti-ice system was a fluid anti-ice system to prevent ice formation on the leading edges of the wings, horizontal stabilizers, struts, vertical stabilizer, propeller, and the windshield. A monoethylene glycol/isopropyl alcohol/deionized water solution was used to anti-ice the airframe surfaces and windshield in flight. The solution was a freezing point depressant that was swept rearward over the surfaces and prevents ice buildup. The TKS system was divided into two subsystems; the airframe anti-ice and the windshield anti-ice system.

Both systems shared the anti-ice fluid tank which was located in the cargo pod of the airplane. The fluid tank assembly was attached to the belly of the aircraft in the second bay area of the cargo pod. The assembly was accessible through the cargo pod doors on the left side of the pod. Tank level was monitored with an indication on the MFD on the G1000.

Operation of the TKS anti-ice system was controlled by three switches on the left panel in the cockpit (Primary, Max Flow, Backup). There were three modes of operation; Normal, High, Maximum and Backup.

Photo 3: TKS cockpit switches.[66]

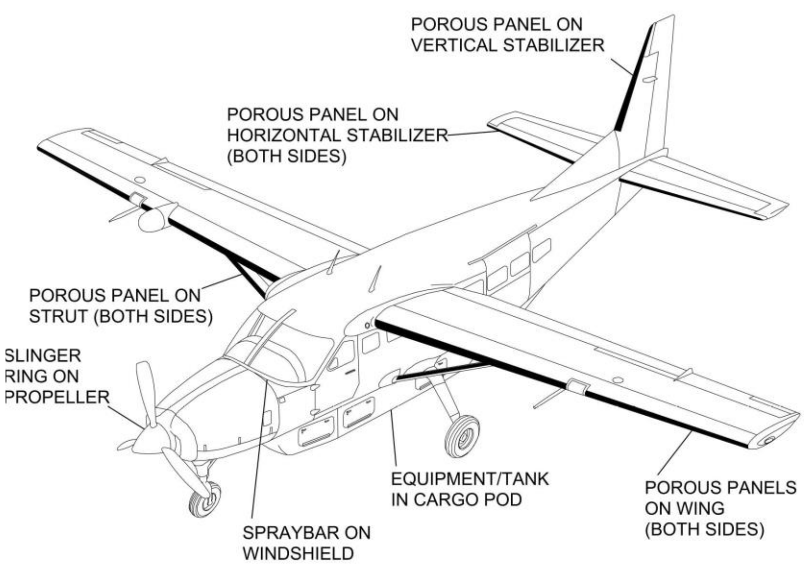

Figure 12: TKS Anti-ice System Components.[67]

[66] Source: NTSB Investigator-in-Charge.
[67] Source: Textron Aviation Maintenance Manual 1985 & On Model 208 Series (Revision 37 dated March 1, 2020.)

9.1 Airframe Anti-ice

Anti-ice fluid solution came out of the airframe anti-ice system through flush-fitting laser drilled titanium edge panels on the wings, stabilizers, and struts. The airframe anti-ice system applied anti-ice fluid to the wing leading edge, which had three panels on each wing, two panels on each strut, and one panel on each horizontal and vertical stabilizer leading edge. The system provided full coverage of the leading edge of the wings, lift struts, horizontal and vertical stabilizer, excluding the dorsal fin. The airframe system also included the propeller slinger application anti-ice system.

9.2 Windshield Anti-ice

The windshield anti-ice system applied anti-ice fluid through a spray bar to the pilot's windshield.

10.0 Relevant Procedures

CE-208B normal and emergency/abnormal procedures, checklists, and limitations were found in the FAA-approved Cessna MODEL 208B G1000 Pilot Operating Handbook. Company -specific CE-208B procedures were found in the Gem Air LLC Training Program – Flight Maneuvers Descriptions (dated June 11, 2016).

LANDING APPROACH:

Normal Approach, Flaps UP . . . . **100-115 KIAS**
Normal Approach, Flaps FULL . . . . **75-85 KIAS**
Short Field Approach, Flaps FULL . . . . **78 KIAS**

Figure 13: CE-208B landing approach speeds.[68]

FLAP LIMITATIONS

Approved Takeoff Range . . . . UP to 20°
Approved Landing Range . . . . UP to FULL
Approved Landing Range in Icing Conditions . . . . UP to 20°

Figure 14: CE-208B flap limitations.[69]

10.1 Nonprecision Approach

Gem Air LLC Cessna 208B Flight Maneuvers Descriptions Manual (dated June 11, 2016), provided the following guidance for a typical nonprecision approach in the CE-208B:

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[68] Source: Cessna MODEL 208B G1000 Pilot Operating Handbook.
[69] Source: Cessna MODEL 208B G1000 Pilot Operating Handbook.

NON-PRECISION APPROACH (TYPICAL)

A. "Descent/Arrival" checklist-COMPLETED. If you are not going to complete a "straight-in" approach then have a plan for how you will execute the circling approach. Study the airport diagram, check the winds, and visualize how you will maneuver the airplane for the circling pattern. If you are approaching an airport without current weather reports, even if the approach is straight-in, you may wish to plan on circling over the airport to check the winds and runway condition.

B. During or prior to completion of the procedure turn, or equivalent.

1. The "Before Landing" checklist should be completed.

2. Turn [sp] the radios for the approach.

3. Set the flight director for approach (if applicable).

4. Aircraft configuration:

AIRCRAFT	SPEED	POWER	FLAPS
C-208B	*120 KIAS*	*1100 lbs Torque*	*10° No Ice*

C. Final Approach Fix Inbound:

1. Time checked when passing the final approach fix. Be sure you have carefully examined the approach plate and know for certain what the FAF is. It may or may not be passage of the approach aid.

If the approach facility is on the field, or the missed approach point is not determined by timing (i.e. DME) you will not need to time the approach. Determine passage of the final fix either by a change of the TO/FROM indicator for VOR approaches; a complete swing of the ADF needle for NDB approaches; or the outer marker or DME for localizer approaches.

2. After passing the final approach fix inbound, begin descent to MDA or step down fix, if applicable. Descent should be approximately 1,000 fpm to insure that you are level at the next required altitude. Failure to make the descent to MDA in a timely manner may result in missing the opportunity to visually identify the airport in time to continue a normal descent to landing.

3. "Before Landing" checklist-COMPLETE

4. *Aircraft configuration after passing the final approach fix:*

AIRCRAFT	SPEED	POWER	FLAPS
C-208B	*120 KIAS*	*600 – 800 lbs Torque*	*10° No Ice*

D. *At the MDA, when time is expired or the missed approach point has been reached, if a landing cannot be completed, execute a missed approach:*

1. *Power: Maximum Allowable*
2. *Speed: Vy + 10 minimum*
3. *Flaps: UP, if selected to the approach setting, at Vy; otherwise, retract to the approach setting and stabilize the aircraft before retracting all the flaps. Sudden retraction of all flaps after selecting full down may result in the aircraft either being below the flaps up stall speed or may cause excessive sinking of the aircraft.*
4. *Aircraft configuration for the initial segment of the go-around:*

AIRCRAFT	SPEED	POWER	FLAPS
C-208B	*95 KIAS*	*Max Torque ITT or %Ng*	*Up*

E. *Landing Assured:*

1. *Flaps: DOWN (100%)*

F. *Cross threshold at the approach speed plus gust correction, if any.*

G. *Landing: Braking as required.*

According to an email to the NTSB from the Gem Air LLC chief pilot dated July 13, 2022, the chief pilot stated the following in part:

We do not teach pilots to follow the Garmin vertical path indication, but we do teach pilots to use it as advisory guidance. This is because on many of our NPAs the vertical path guidance ends at the FAF or at another fix.

However, we do teach pilots how to use the autopilot on NPAs in both VNAV and APR mode. If engaged, the autopilot in APR (approach) mode will follow the vertical path indication when available.

10.2 Gem Air IFR Procedures

On March 26, 2010 Gem Air LLC distributed a Procedure Document (Training) to pilots with a clarification of Company IFR Procedures.[70]

10.3 Icing Procedures

Procedures for an inadvertent encounter with icing conditions in the CE-208B were found in the FAA-approved Cessna MODEL 208B G1000 Pilot Operating Handbook. The procedures included the following steps in part:

> *If icing conditions are unavoidable, plan a landing at the nearest airport. With an extremely rapid buildup, select a suitable "off airport" landing site.*
>
> *With an accumulation of ¼ inch or more on the wing leading edges, be prepared for a significantly higher power requirement, approach speed and stall speed and longer landing roll.*
>
> *If necessary, set up a forward slip for visibility through the left portion of the windshield during the landing approach.*
>
> *Use a minimum approach speed of 105 KIAS, select the minimum flap setting required, and maintain extra airspeed consistent with available field length. With ice suspected on the airframe or operating at 4° C or less in visible moisture,* ***Do Not Extend Flaps Beyond 20° for Landing.*** [Bold type included in original document][71]

The FAA Airplane Flying Handbook (FAA-H-8083-3C), stated the following in part:

> *With less than full flaps, the airplane is in a higher pitch attitude. Thus, it requires less of a pitch change to establish the landing attitude and touchdown at a higher airspeed to ensure more positive control.*

The Airplane Flying Handbook further stated the following in part:

> *Flight at higher pitch attitudes requires greater reliance on the flight instruments for airplane control since outside references may be absent. Proficiency in attitude instrument flying, therefore, is essential . . .*

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[70] See Attachment 10 – Gem Air IFR Procedure Document.

[71] See Attachment 11 - CE-208B Icing Procedures.

F. LIST OF ATTACHMENTS

Attachment 1 – Interview Transcripts
Attachment 2 – Witness Statements and Emails
Attachment 3 – Pilot Information
Attachment 4 – Airplane Information
Attachment 5 – Weight and Balance Information
Attachment 6 – GEM Air LLC PIC Responsibilities
Attachment 7 – Pilot Training Records
Attachment 8 – Cessna MODEL 208B G1000 Pilot Operating Handbook (Excerpts)
Attachment 9 – Gem Air LLC CE-208 Procedures
Attachment 10 - Gem Air LLC IFR Procedure Document
Attachment 11 - CE-208B Icing Procedures
Attachment 12 - FAA AATD Observation

Submitted by:

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