Aviation Investigation Final Report

Location:	Mobile, Arizona	**Accident Number:**	MIA02FA098
Date & Time:	May 22, 2002, 14:42 Local	**Registration:**	N866AF
Aircraft:	Grob G120A	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Flight test		

Analysis

During the airplane's first flight after assembly, an eyewitness on the ground stated he observed it cross his field of vision, right to left, at a very low altitude and at very high rate of speed. The attitude of the airplane went progressively from 90 degrees of bank to wings level and nose down until it collided with the terrain in a flat attitude. He saw a perceptible nose rising, but it was too late to avoid impact with the desert floor. No discrepancies could be found with the airframe or engine, post crash.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the pilot to maintain altitude clearance with the terrain.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: MANEUVERING

Findings
1. (C) ALTITUDE/CLEARANCE - NOT MAINTAINED - PILOT IN COMMAND

Factual Information

HISTORY OF FLIGHT

On May 22, 2002, about 1442 mountain standard time, a Grob G120A, N866AF, registered to Airline Training Center Arizona, Inc., operating as a Title 14 CFR Part 91 maintenance test flight, crashed while maneuvering in the vicinity of Mobile, Arizona. Visual meteorological conditions prevailed, and no flight plan was filed. The aircraft was destroyed, and the airline transport rated flight instructor, the sole occupant, sustained fatal injuries. The flight departed Phoenix-Goodyear Municipal Airport, Goodyear, Arizona, at 1404.

According to a statement by another training center instructor who was communicating on base radio about a landing gear indication problem with training aircraft N1569P during the time period 1420 to 1430, N866AF's pilot overheard and said he would lend assistance. After a quick descent from 7,000 feet msl, loosely joining on N1569P at 2,500 feet msl, and simultaneously stating his observations about landing gear and gear door positions on base radio frequency to base operations and to N1569P, N866AF detached at about 1430. Upon detaching, the pilot stated he was climbing back up to 7,000 feet msl, to resume his test flight.

According to an eyewitness on the ground, at about 1440, he observed the aircraft traveling east to west, north of his position and south of the Lufthansa training airport at Mobile, at an extremely high rate of speed and low to the ground. The left wing was straight down and the right wing was straight up. He next observed the nose angle toward the ground, the wings roll level with the horizon, and simultaneously, the nose began to angle upward as the aircraft impacted the ground. He stated he thought there were two trainers in the landing pattern for the Mobile training airport at the time.

PERSONNEL INFORMATION

The pilot held a Federal Aviation Administration, (FAA) airline transport pilot certificate for airplane multiengine land and a flight instructor certificate with ratings for airplane single engine, multiengine, and instrument airplane. His most recent FAA second-class medical certificate was issued on December 3, 2001, with the limitation, "holder shall wear corrective lenses while exercising the privileges of his FAA certificate". The pilot successfully completed a biennial flight review in December, 2000. The pilot was employed by Airline Training Center Arizona as an instructor pilot on June 18, 1990, and was furloughed on September 30, 1993. He was rehired on January 4, 1999, and upgraded to the Flight Standards department on February 17, 2001. The pilot's immediate supervisor stated that, "[the pilot] was known as a conscientious and thorough check pilot."

On the day of the accident, the pilot reported for duty at 0530, and his only flight that day was

the accident flight. On the day prior to the accident, the pilot reported for duty at 0530 and flew two flights, a Grob instructional flight with one student for 2:05 hours and a Bonanza instructional flight with one student for 2:25 hours. Two days prior to the accident, the pilot reported for duty at 0830 and flew two instructional flights, a Bonanza with one student for 1:45 hours and a Grob flight with one student for 1:30 hours. Three days prior to the accident was a weekend day and the pilot had a day off. Nothing unusual was reported on any of the training flights prior to the accident flight.

According to the pilot's wife, a 72-hour history of the pilot's personal life indicated no stressful conditions that could have influenced pilot performance. Family member interactions appeared to be centered around construction of their horse ranch and barn with his father-in-law's help, a long range mutual plan that was finally becoming a reality, and planning for his niece's graduation with his two daughters.

AIRCRAFT INFORMATION

The German manufactured aircraft was the sixth Grob G-120A that had been delivered to the Airline Training Center Arizona, Inc. Upon its delivery to the training center by ship and overland container transport from the factory in Germany on March 29, 2002, while uncrating, it was discovered that the aircraft fuselage had shifted position on its shipping cradle, and was slightly damaged. The carbon fiber composite, (CFC) constructed airframe utilizes glass reinforced plastic, (GRP) for ailerons, flaps, rudder, and trim tabs. The top of the vertical stabilizer and the under wing trailing edge fillet area sustained scraping. Additionally, some lower fuselage drain tubes were bent, two propeller tips had dragged, (not bent), and the spinner was dented. After uncrating, the wings, rudder, and elevators were reinstalled, the fuselage scrapes were repaired, the drain tubes were replaced, the engine and propeller were inspected and their respective manufacturers were consulted for remedial disposition, the spinner was replaced, and some unrelated, minor post delivery modifications were accomplished. The work was accomplished and signed off by Grob Systems, the U.S. distributor, of Bluffton, Ohio, on April 29, 2002. A copy of the maintenance records and repairs accomplished on N866AF are an attachment to this report. Total time on the aircraft at the time was 5:32 flight hours, which represented 4 to 5 production test flights in Germany prior to partial disassembly, containerization, and shipment to the U.S. Following reassembly and system ground checks, the FAA certified the aircraft's airworthiness on May 22, 2002, shortly before the accident.

The accident occurred as the aircraft was being test flown for the first time since its reassembly. The first five G-120A's had been test flown by a Grob production test pilot who traveled to Phoenix from the factory in Germany. That pilot left Phoenix and returned to Germany on March 30, 2001. According to the Grob mechanic responsible for N866AF's reassembly, 21 gallons of 100 LL aviation fuel were pumped into each wing fuel tank for fuel tank quantity calibration purposes on April 29, 2002. The fuel had undergone contamination testing the day of the fuelling. The aircraft had not been fueled since the calibration fuel load, and following two short engine runs, it was estimated by the mechanic and operations

personnel that about 19 gallons per wing tank remained for the test flight. A report of the daily fuel sump check, as well as the quantity pumped into N866AF is an attachment to this report.

The aircraft is equipped with two Fischer-manufactured energy absorbing, "safety shell" pilot 's seats. Shock absorbers in the seat structure collapse progressively under high loading to protect the pilot. The seats are equipped with Schroth-manufactured 5-point pilot safety restraint harnesses.

The aircraft is equipped with a large, rearward sliding canopy using two lever-type operating handles mounted on a longitudinally oriented center bow, one an interior handle, and the other, an external handle. The interior handle's normal range of motion is from fully forward, (closed and fully locked position) to 90 degrees downward, (open position), but for emergency egress, the handle can be pulled further rearward for 170 degrees of aft travel, after first pulling a red safety locking handle. This action would jettison the canopy by releasing the attachment points on the guide rails. The canopy is not powered and must be manually moved closed or open. The red handle extends about 2.5 inches into the free space of the cockpit from its overhead mounted location.

METEOROLOGICAL INFORMATION

Visual meteorological conditions prevailed at the time of the accident. The Phoenix METAR for 1505 local time was; winds from 260 degrees at 3 knots, visibility 10 statute miles, cloud ceiling was broken at 25,000 feet msl, barometric pressure was 29.84 inHg, temperature was 81 degrees F, with a dew point temperature of 18 degrees F. The computed density altitude was 3,054 feet and the pressure altitude was 1,335 feet.

WRECKAGE AND IMPACT INFORMATION

The impact area was located in flat desert and scrub vegetated terrain on the 205 degree radial/31.5 NM from the Phoenix VOR at about 1,260 feet elevation. The wreckage location was 2.75 NM north-northwest of the city of Mobile, Arizona, at coordinates, North 33 degrees, 6.311 minutes by West 112 degrees, 16.496 minutes. Relative to the left hand landing pattern for runway 27 at the Mobile training airport, the wreckage was located equidistant between the departure end of runway 27 and the transition point that describes the end of the upwind turn and the beginning of the downwind leg for runway 27. The aircraft was not configured for landing, and examination of the wreckage path revealed, (1) the aircraft was not established in the landing pattern, and, (2) the speed of the aircraft was excessive for any airport traffic pattern work except, possibly, a high speed pass.

The 535-foot long wreckage path consisted of two distinguishable impact craters; (1) first terrain impact crater followed by a bounce of 336 feet, and, (2) a second impact crater followed by a slide in the desert sand of about 120 feet. The wreckage path centerline measured 272 degrees, magnetic, and the aircraft wreckage came to rest heading 300 degrees, magnetic. At some point during the crash sequence, the pilot was ejected, and was

found 31 feet beyond the aircraft wreckage, slightly left of wreckage centerline. The pilot's 5-point safety harness was found undamaged and unsecured with no evidence of forced opening. The canopy jettison safety locking handle was found detached, and was found lying amid cockpit debris. The canopy was found detached from its fuselage slide rails, still attached at its aft securing point, with most of the forward bow resting on the left wing root. The right canopy rail and about 3 inches of the right side canopy bow had split from the canopy assembly and was still oriented nearby the right fuselage slide rail. The empennage and aft fuselage, from about 24 inches aft of the wing butt area had separated and was lying next to the right side fuselage, inverted and oriented 90 degrees from the airframe's heading. Pieces of canopy glass formed a circular pattern from the first crater, outward and forward for about an 80 foot radius.

Gouges in the sand made by the flap hinges adjacent to and following the first crater revealed the aircraft was in a wings level attitude at impact. A detached tail skag, various antennae, and a nose gear door in the first crater revealed the aircraft impacted fairly level in the longitudinal axis, as well as the lateral axis. The three bladed propeller gouges and extreme propeller deformation revealed the aircraft impacted the ground at a high rate of forward airspeed and engine power. The propeller remained attached to the crankshaft flange, and the heavily deformed spinner remained attached to the hub. The blades displayed significant leading edge gouging, torsional twisting, chordwise striations, and trailing edge "s" bending. The complete rudder detached from the vertical stabilizer, and was found 100 feet from the first crater, left of centerline. Examination of the shape of the second crater, oil spewage pattern from a separated magneto, examination of the engine and mount, and twisting of through-firewall hosing and tubing revealed that the steel tube engine mount and the engine firewall broke loose with its four reinforced carbon fiber attach points and rotated about the aircraft's longitudinal axis counter clockwise about 360 degrees. The firewall, instrument panel, rudder pedals and their mounts, and cowling rotated likewise about 180 degrees, counter clockwise. A slight irregularity in the desert sand's appearance could be detected down the wreckage path from the second crater, and appeared to be a pattern of fuel spewage from the left tank. Examination of the airframe revealed that the previous shipping damage repair was not a factor in the accident.

The left wing fuel tank had been breached when the large, under-wing mounted pitot probe dug into the desert terrain and separated during the slide, tearing about a foot square of carbon fiber skin from the left wing's upper and lower leading edge. The left wing tank was found void of fuel, but the sides of the tank contained a mud mixture of sand and what smelled like 100 octane LL fuel at a level that corresponded to about 10 gallons of fuel. The fuel selector was found selected to the left tank. The inboard right wing remained substantially intact and the right wing fuel tank contained about 19 gallons of 100 octane LL fuel. The right wing tip was ripped diagonally from the leading edge tip to the trailing edge outer aileron hinge point, and remained attached only by electrical conduit for the wing tip light. The right wing fuel tested negatively for water content.

The pilot's crushable designed seat supports had compressed to its maximum downward

travel, indicating a minimum of 19 downward g's were sustained in the crash, according to the aircraft manufacturer. In addition to the maximum downward travel of the seat, the carbon-fiber seat pan was fractured in a downward direction. The panel mounted ship's clock was stopped at 1442. The g-meter's recording needles were stuck at plus 7.5 g's and minus 4 g's. The throttle was found full forward, the propeller control was one knob aft of full forward, and the mixture control was full forward. Dust on the left side airspeed indicator face exhibited a faint needle-width shadow that was oriented radially from the center of the face outward to the 235 KIAS mark. A pair of vision corrective glasses were found under the aircraft wreckage.

All aircraft parts and components were contained within the wreckage area. All control surfaces revealed evidence of normal attachment and operation, precrash. Following mating of fracture surfaces of the carbon fiber control tubes, control path continuity in the pitch axis was confirmed from a point under the cockpit floor to the elevators. Yaw axis control continuity was confirmed from a point under the cockpit floor to the rudder attachment points in the vertical stabilizer. Aileron control was confirmed from the cockpit to the aileron mixer mechanism, but postcrash damage prevented movement to the control surface. Both left and right ailerons were connected and operated correctly with respect to each side. Aileron servo tabs were still connected to the wing structure and actioned normally with respect to aileron movement. Rudder trim tab position was impossible to determine because the rudder had separated after the first ground impact. The elevator was also separated, but the cockpit control and indicator were near neutral.

According to the Lycoming investigator, visual examination of the Lycoming engine, AEIO-540-D4D5, serial No. L-28265-48A, revealed no evidence of preimpact catastrophic mechanical malfunction or fire. Mechanical continuity of the internal components of the engine was obtained while moving the propeller. The complete valve train within the rocker box areas appeared free of any precrash malfunctions. The cylinders were examined using a lighted bore scope. The combustion chambers revealed no damage, no evidence of foreign object damage, or of any valve-to-piston contact. The gas path, combustion signatures at the spark plugs, within the combustion chambers, and the exhaust system displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path. Severe ductile bending of the exhaust system components revealed those components were at high temperature and power at impact. Both magnetos produced spark from each tower when rotated. "There were no discrepancies or conditions observed during the engine examination that would have precluded the engine from operating."

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examination of the pilot was performed by Phillip E. Keen, M.D., Medical Examiner, Maricopa County, Arizona, on May 23, 2001. The cause of death was reported as deceleration injuries due to an aircraft crash. No autopsy findings that could be considered causal were noted. Postmortem toxicology testing on specimens obtained from the pilot was performed by Dennis V. Canfield, Ph.D., Manager, FAA Toxicology and Accident Research Laboratory, Oklahoma City, Oklahoma. Tests revealed that tetrahydrocannabinol carboxylic

acid, (marihuana) was detected in the blood, urine, and bile.

TEST AND RESEARCH

On May 25, 2001, a conference telephone call to Germany from Airline Training Center Arizona, (ATCA) was arranged so that the accident investigative parties could conduct a real-time conference with the Grob employee/pilot who had traveled to Phoenix to perform post shipment reassembly and conduct several post reassembly test flights on the first five Grob G-120A's. The Grob pilot stated that he did not refer to any formal printed test procedures, and did not complete a formal test report, as required for factory production testing. He did, however, state that he followed a basic test routine from memory that included; (1) a 5-minute climb, (2) stall warnings, (3) landing gear operation and warnings, (4) basic aerobatics, (5) inverted flight, (6) maximum flight speed or velocity/never exceed, (Vne) dive and flutter checks, and (7) a flight instrument static system check involving a high speed, low altitude pass. During the conversation, the pilot further stated from memory those training center flight personnel who flew co-pilot with him on the test flights. He stated he remembered flying with the accident pilot during the testing of the #4 aircraft, and that he had performed a high speed, low altitude pass over the Phoenix-Goodyear airport on that flight. Before the Grob pilot returned to Germany, on March 30, 2002, he stated to training center personnel that there was no requirement for a formal test pilot to conduct the post reassembly test flights.

ATCA management vigorously admonished the Grob pilot for the high speed, low pass. Numerous statements were submitted by different ATCA flight instructor personnel relating to the flight procedures used by the Grob pilot during the course of the Grob 120A test flights at Phoenix. The instructor's individual statements are attachments to this report, and are quoted, in part, here:

(1) "My recollection of the Vne dive test is as follows; We did not get to Vne for a long period of time. I recall him slowly adding power and us getting to within 3-4 knots of actual Vne. During the Vne dive test I must say I was very uncomfortable. The outside references were definitely beyond the vertical.

(2) "On March 28, 2002, at approximately 4:00 PM local time, I observed an ATCA Grob 120A make an extremely low altitude, high speed pass over the Phoenix-Goodyear Airport."

(3) " I don't recall the date of the flight I was on, but it was the last day of the test pilot here at ATCA. What stands out most in memory of the test flight was the Vne dive. It seemed to me that the altitude for recovery from the dive was very low, too low to have parachuted from the airplane. My suggestion is that the Vne dive should be performed at higher altitude."

(4) "While on a break between two 16 A-2 check rides with CRC's, (students) in IAZO, [Mobile airport], we observed a G-120 on a low pass with an airspeed of 170 to 180 knots at an altitude of lower than 10' AGL over the runway (09). As we observed the low pass, I ran outside and saw the aircraft pitching up and rolling with several G's into a left turn climbing out towards the

north. The onset of the traverse G's was very abrupt."

The Grob pilot submitted a written statement on December 10, 2002, in which he reiterated that he is not a test pilot, and that his job was to reassemble the aircraft after shipment from the factory and conduct a subsequent, routine maintenance test flights. He stated, "I made a low pass with GROB G120-A, N861AF, N862AF, N863AF, N864AF, and N865AF during post-reassembly-test-flights over and along the runway of the airport of Goodyear to perform a static check. In every case I have requested permission from the Goodyear tower, in every case I received clearance/approval from the tower. During the flight with N864AF with [the accident pilot], I did also perform the static test after clearance by the tower. After the flight, the [ATCA Flight Safety/Quality Manager] advised both me and the [accident pilot] that ATCA does not want such static checks performed during a high speed low pass. He believed that this was not necessary. I never flew 10' AGL over the runway at Mobile airport, whenever I flew over this runway, it was much higher." The Grob pilot additionally stated he recalled that the ATCA Director of Maintenance asked him for his opinion as to who should conduct subsequent test flights. He recommended a particular ATCA instructor pilot, but according to ATCA management, that pilot was unavailable at the time that N866AF became ready to test fly. The quoted portions of the Grob pilot's written statement were converted from number/column form to narrative form to fit this reports format, but the quotes are authentic, and no attempt was made to take his statements out of their intended context. The Grob pilot's statement is an attachment to this report.

The left side airspeed indicator was shipped to the NTSB Materials Laboratory, Washington, DC for examination. Results were inconclusive as to any permanent evidence indicating airspeed at the time of first terrain impact.

The Phoenix air traffic control radar, (tracon) searched their recorded tapes for radar returns for the time and location of the crash. N866AF had not asked for any air traffic services. Phoenix tracon reported the identification of two targets in the vicinity of the Mobile airport with transponders emanating a 1200 squawk, (VFR only squawk) but could not detect any fast moving target that abruptly terminated. The two training aircraft in the traffic pattern at the Mobile airport reported hearing no radio calls from the accident aircraft.

ADDITIONAL INFORMATION

The airspeed indicator face shipped to the NTSB Materials Laboratory for analysis was returned to ATCA on September 12, 2002. The pilot's operating handbook retained by the NTSB for reference was not returned to the academy per instructions from ATCA's Manager, Flight Safety/Quality.

Pilot Information

Certificate:	Airline transport; Flight instructor	**Age:**	42,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	December 3, 2001
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 1, 2001
Flight Time:	8170 hours (Total, all aircraft), 64 hours (Total, this make and model), 70 hours (Last 90 days, all aircraft), 27 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Grob	**Registration:**	N866AF
Model/Series:	G120A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Aerobatic; Utility	**Serial Number:**	85006
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	May 22, 2002 Continuous airworthiness	**Certified Max Gross Wt.:**	3175 lbs
Time Since Last Inspection:	0.5 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	AEIO-540-D4D5
Registered Owner:	Airline Training Center Arizona, Inc.	**Rated Power:**	260 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PHX,1135 ft msl	**Distance from Accident Site:**	31 Nautical Miles
Observation Time:	14:56 Local	**Direction from Accident Site:**	25°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.84 inches Hg	**Temperature/Dew Point:**	27°C / -8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Goodyear, AZ (GYR)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	14:04 Local	**Type of Airspace:**	Class C

Airport Information

Airport:	Mobile 1AZO	**Runway Surface Type:**	
Airport Elevation:	1261 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Unknown

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	33.108612,-112.280555

Administrative Information

Investigator In Charge (IIC):	Stone, Alan
Additional Participating Persons:	Gary G Martin; FSDO FAA; Phoenix, AZ George Bean; FSDO FAA; Phoenix, AZ Greg Schmidt; Airline Training Center Arizona, Inc.; Goodyear, AZ Heinz Micheler; Grob-Werke; Germany Mark Platt; Textron Lycoming Engines; Williamsport, PA
Original Publish Date:	April 18, 2003
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=54767