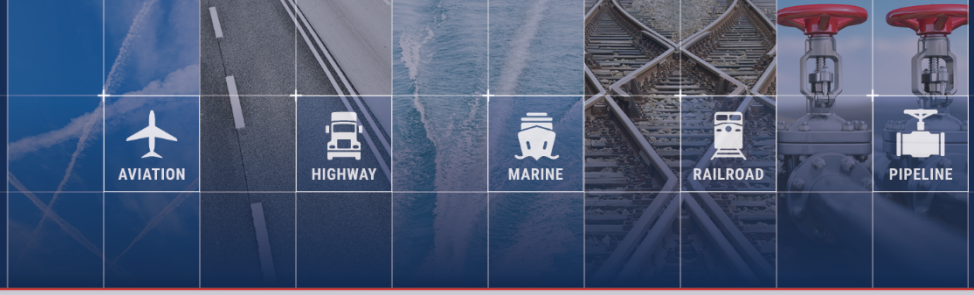

Aviation Investigation Final Report

Location:	SEDONA, Arizona	**Accident Number:**	LAX03FA135
Date & Time:	April 13, 2003, 12:30 Local	**Registration:**	N323D
Aircraft:	Beech A36	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The airplane lifted off near the end of the runway, snagged the airport boundary fence, crossed a canyon, and then collided with terrain. Runway 21 was 5,132 feet long, 75 feet wide, and the airport elevation was 4,827 feet. The density altitude was calculated at 6,435 feet. Witnesses noted that the airplane did not seem to accelerate and was rolling very slowly as it passed the midfield point. The engine did not sound like it was producing much power, yet the engine tones stayed steady and the engine sounded smooth. Several of the witnesses noted that the flaps were partially down. The witnesses thought that the pilot would abort the takeoff; however, the airplane continued down the runway and was still on the ground about 80 percent of the way down the runway. Then the pilot rotated it to a takeoff attitude, and broke ground with an extremely nose high attitude. The airplane only attained an altitude of several feet. The landing gear caught the upper strands of the airport boundary fence. The airplane then collided with the far side of a canyon that bordered the airport. The operator had a form that they used for weight and balance and performance. They required pilots to complete the form prior to each flight. The form provided spaces for pilots to record pertinent data, and log computed parameters. Those parameters included takeoff weight, density altitude, runway length, rotation speed, takeoff distance, takeoff distance over a 50-foot obstacle, rate of climb, and landing distance. Calculations for the given takeoff conditions indicated that the airplane should have had a ground roll of 1,900 feet, and would clear a 50-foot obstacle at 2,100 feet. The airplane had an altitude compensating fuel pump installed. The pump would automatically lean or enrich the engine's fuel mixture as the airplane changed altitude. The before takeoff checklist in Section IV of the Pilot Operating Handbook instructed the pilot to takeoff with the mixture in the full rich position. Other instructors from the operator who had flown with the accident instructor indicated that contrary to the instructions in the POH, they all leaned the engine prior to takeoff from high density altitude airports. The spark plugs indicated operation with an excessively lean mixture. Investigators noted no other anomalies with the airframe or engine that would have precluded normal operation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: a partial loss of engine power due to the certified flight instructor's failure to comply with the pilot operating handbook requirements for the mixture setting during takeoff. Also causal was the instructor's inadequate supervision of the flight, failure to monitor the airplane's performance, and failure to initiate an aborted takeoff in a timely way.

Findings

Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - NONMECHANICAL
Phase of Operation: TAKEOFF - ROLL/RUN

Findings
1. (C) PROCEDURES/DIRECTIVES - NOT COMPLIED WITH - PILOT IN COMMAND(CFI)
2. (C) MIXTURE - IMPROPER USE OF - PILOT IN COMMAND(CFI)

Occurrence #2: OVERRUN
Phase of Operation: TAKEOFF - ROLL/RUN

Findings
3. AIRCRAFT PERFORMANCE - DETERIORATED
4. (C) SUPERVISION - INADEQUATE - PILOT IN COMMAND(CFI)
5. (C) ABORTED TAKEOFF - NOT PERFORMED - PILOT IN COMMAND(CFI)

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: TAKEOFF

Findings
6. OBJECT - FENCE

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: TAKEOFF

Findings
7. TERRAIN CONDITION - DIRT BANK/RISING EMBANKMENT

Factual Information

HISTORY OF FLIGHT

On April 13, 2003, about 1230 mountain standard time, a Beech A36, N323D, collided with a fence and then terrain during takeoff from runway 21 at Sedona, Arizona. Mesa Pilot Development, Inc., was operating the airplane under the provisions of 14 CFR Part 91. The certified flight instructor (CFI) pilot, the private pilot undergoing instruction (PUI), and one passenger sustained fatal injuries; the airplane was destroyed. The instructional cross-country flight was en route to Williams Gateway Airport, Phoenix, Arizona. Visual meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan had been filed. The primary wreckage was at 34 degrees 50.63 minutes north latitude and 111 degrees 47.69 minutes west longitude.

Several witnesses observed the takeoff roll. They all noted that the airplane did not seem to accelerate and was rolling very slowly as it passed the midfield point. Several of the witnesses noted that the flaps were partially down. The witnesses thought that the pilot would abort the takeoff. However, the airplane continued down the runway and was still on the ground about 80 percent of the way down the runway. Then the pilot rotated it to a takeoff attitude. Several witnesses thought that it retained that attitude, and if it left he ground at all, it only attained an altitude of several feet.

Several of the witnesses that heard the engine reported that it did not sound like it was producing much power. The engine tones stayed steady and the engine sounded smooth. It did not cough, sputter, or backfire, and none of them observed smoke or any indications of a problem.

Another witness on the opposite side of the airport heard clanking and banging that sounded like a thresher machine. It was definitely not smooth or sound like engines that he had previously heard. It caught his attention and he looked toward the runway. He saw the top of a tail and fuselage. He estimated that the airplane was going about 70 miles per hour. He did not hear the engine wind down and wondered why it was trying to take off. He lost sight of the airplane behind trees and did not see it rotate. He thought that it was within 1,000 feet of the end of the runway. About 5 to 10 seconds later he heard a bang, and about 10 seconds later he heard another bang.

One witness was a CFI, and an airplane mechanic with 30 years experience in general aviation. He first saw the airplane about 1/3 of the way down the runway. From the moment he saw it, he thought that something was not right. He was concerned that it was not accelerating to flying speed. The engine sounded quite different from airplanes that he had heard over his career. It sounded like it was turning very slowly, much slower than takeoff revolutions per

minute (rpm). He thought that the propeller was set to cruise power rather than full rpm. It sounded like it was turning about 2,300 rpm. It sounded smooth; it did not backfire, surge, miss, or chug. It sounded the same from the time that he first saw it until it went out of sight. Other airplanes that he had observed take off had been airborne by this point. The accident airplane kept going and going. It went past the halfway point and was not accelerating. The witness kept saying, "shut down, shut down." It broke ground about 2/3 to 3/4 of the way down the runway, maybe beyond 3/4. He left his chair to watch the airplane. He noted that the nose came up and the airplane continued down the runway about 200 yards with the nose wheel off the ground and the main gear on the ground. It might have gotten airborne about 1 or 2 feet. The airplane broke ground with an extremely nose high attitude. He lost sight of it behind a parked airplane. He thought that the stall horn had to be going off.

PERSONNEL INFORMATION

The operator submitted a written report.

CFI

A review of Federal Aviation Administration (FAA) airman records revealed that the CFI held a commercial pilot certificate with ratings for airplane single engine land, multiengine land, and instrument airplane. She held a certified flight instructor certificate with ratings for airplane single engine land and instrument airplane.

The CFI held a first-class medical certificate issued on May 9, 2001. It had no limitations or waivers.

The operator reported that the CFI had a total flight time of 652 hours. She had 136 hours in the last 90 days, and 32 in the last 30 days. She had 50 hours in this make and model.

PUI

The operator reported that the PUI had a private pilot certificate with a rating for airplane single engine land. He had a total flight time of 174 hours. He had 34 hours in the last 90 days, and 14 in the last 30 days. He had 37 hours in this make and model, and was preparing for his instrument check ride.

AIRCRAFT INFORMATION

The airplane was a Beech A36, serial number E2613. The operator reported a total airframe time of 2,249 hours. The airplane was on a manufacturer's inspection program, and the last 100-hour inspection occurred on March 12, 2003. The tachometer read 1,748.2 and the Hobbs hour meter read 270.2 at the daily inspection prior to departure for Sedona.

The engine was a Teledyne Continental Motors IO-550-B(6) engine, serial number 296594R. Time since overhaul on the engine at the last inspection was 514 hours.

The operator indicated that the last fueling of the airplane occurred on April 12 with the addition of 36 gallons of aviation fuel. The airplane flew 0.8 hours on one flight prior to the accident flight.

METEOROLOGICAL INFORMTION

The Sedona airport administration office reported the weather conditions: skies clear; winds from 170 degrees at 11 knots gusting to 24 knots; temperature 68 degrees Fahrenheit; altimeter 30.05 inches of mercury.

AIRPORT INFORMATION

The Airport/ Facility Directory, Southwest U. S., indicated runway 21 was 5,132 feet long and 75 feet wide. The runway surface was asphalt, and the airport elevation was 4,827 feet.

WRECKAGE AND IMPACT INFORMATION

The National Transportation Safety Board investigator-in-charge (IIC) and investigators from the FAA, Beech, and Teledyne Continental Motors (TCM) examined the wreckage at the accident site on April 14, and at the facilities of Air Transport, Phoenix, on April 15. Safety Board software determined that the airplane came to rest approximately 1,032 feet on a magnetic bearing of 213 degrees from the airport.

Sedona airport is on a plateau that is surrounded by rocky canyons about 500 feet deep that are sparsely covered by cedar trees and bushes. The airport boundary fence was a 6-foot-high chain link fence with angled barbed wire strands another foot high. The fence ran along the edge of a canyon that began at the end of the runway. The fence was about 150 feet from the end of the runway. It sustained mechanical damage about 100 feet right of the extended centerline. The top part of the fence was deformed and pieces of barbed wire and fence posts were on the ground on the side of the fence away from the runway.

The main wreckage was on the opposite side of the canyon from the airport boundary. It was several hundred feet lower than the airport boundary fence.

The first identified point of contact (FIPC) was a cedar tree with broken limbs. Another cedar tree, about 10 feet right of the FIPC as one looked toward the main wreckage, also had broken limbs. Near the base of this tree were clear Plexiglass fragments similar in shape to the wing tip recognition lights' covers. The debris path was along a magnetic bearing of 185 degrees.

Thirty-three feet from the FIPC was the right main landing gear. Pieces of propeller, identified as prop piece 2 and prop piece 1, were 36 and 38 feet from the FIPC, respectfully.

The principle impact crater (PIC) was 46 feet from the FIPC. A scorched area about 6 feet in diameter surrounded the PIC. The left elevator counterweight separated and was just past the scorched area. It was not scorched and had scrapes along its edge and a dent along its front edge.

The main wreckage came to rest 85 feet from the FIPC. The main wreckage pointed along a magnetic bearing of 190 degrees. The separated left main landing gear was at the trailing edge of the left elevator. The left main gear had pieces of wire around it that were similar to the airport boundary fence. Fire consumed the cabin area. A scorched area extended from wing tip to wing tip, and from the nose of the engine to mid empennage. The tail area was outside of the scorched area and did not sustain thermal damage. About 6 feet of the outboard left wing bent up about 30 degrees.

About 10 feet right of the right elevator was the propeller. The propeller was outside of the scorched area and it did not exhibit thermal damage. A piece of propeller, identified as prop piece 3, was between the propeller and the main wreckage.

The engine separated from the airframe and rotated to a magnetic bearing of 235 degrees. The left side of the engine was downslope and sustained more thermal damage than the right side.

MEDICAL AND PATHOLOGICAL INFORMATION

The Yavapai County Coroner completed an autopsy on both pilots. The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing of specimens of the pilots.

Analysis of the specimens of the PUI contained no findings for carbon monoxide, cyanide, volatiles, or tested drugs.

TESTS AND RESEARCH

Wreckage Examination

Investigators established control continuity for all control surfaces. The airframe manufacturer's representative determined that the landing gear was in the down position. The representative measured the flap actuator at 4.4 inches. He reported that this corresponded to the 15 degrees flaps down position. The left aileron trim actuator measured 1.78 inches. He reported that this equated to 4.75 degrees tab up position. The elevator trim measured 1.4 inches. He determined that this equated to 5 degrees tab down.

Investigators removed the engine, which sustained thermal damage on its left side. The engine lay canted to the left at the accident site. Investigators slung it from a hoist, and

removed the top spark plugs. All spark plugs were clean with no mechanical deformation. All spark plugs exhibited a slightly oval shape and had similar gaps. The spark plug electrodes for cylinder nos. 1 and 3 were very light gray. Cylinder no. 5 was light gray. The bottom spark plugs for cylinders 1, 3, and 5 were also very light gray. The top plugs for cylinder nos. 2, 4, and 6, which were on the left side of the engine, had light soot deposits, while the bottom plugs for nos. 2, 4, and 6 were oily. According to the Champion Aviation Check-A-Plug AV-27 Chart, light gray colorization corresponded to lean operation.

Investigators manually rotated the engine. The engine rotated freely and the valves moved approximately the same amount of lift in firing order. The gears in the accessory case turned freely. Investigators obtained thumb compression on all cylinders in firing order.

Investigators manually rotated the magnetos. The left magneto was partially melted and could not be tested. The right magneto produced spark at all posts.

The vacuum pump drive gear remained unbroken, and the vacuum pump turned freely.

The oil filter material was brittle, but contained no debris.

The screens in the fuel distribution valve and fuel-metering unit were clean. The fuel nozzles were open and the injector lines were open.

The three-bladed propeller, which separated from the engine, was about 30 feet from the engine. All of the propeller's attachment bolts were stripped. The tips of all three blades separated. Blades 2 and 3 exhibited leading edge gouges, chordwise striations, and curled toward the low pitch (high rpm) position. The tip for blade 1 split at midchord, and bent forward 90 degrees. Three pieces of propeller blades were recovered. Prop piece 1 was several inches long and curled about 180 degrees. Its fracture surface mated with the fracture surface of blade 2. Prop piece 2 was about 2 inches long and curled about 180 degrees. It had gouges on the back that were similar to the gouges on blade 2. Prop piece 3 was about 12 inches long and its fracture surfaces appeared to match propeller blade 3. Blade 3 bent forward, about 60 degrees, from the end of the shank to the tip. It had leading edge gouges and scrapes, the trailing edge buckled, and it fractured along an angular plane.

Fuel Pump Examination

A Safety Board investigator observed the teardown and examination of the altitude compensating fuel pump. After technicians cleaned the pump, they performed a satisfactory leak check. They placed it in a test stand. The aneroid reduced the fuel flow rate as they reduced the atmospheric pressure input.

Pilot Operating Handbook (POH)

The operator had two Beech A36 airplanes in its fleet. The accident airplane had an altitude

compensating fuel pump installed. The second airplane did not have the altitude compensating fuel pump installed. Section VII of the POH indicated that the compensating pump automatically leaned or richened the engine's fuel mixture as the airplane changed altitude. Without the compensating fuel pump, the pilot would have to manually adjust the mixture as the airplane changed altitude.

The before takeoff checklist in Section IV (Normal Procedures) instructed the pilot of an airplane with the compensating fuel pump to position the mixture to the full rich position. Those without the compensating pump were to adjust the mixture manually prior to takeoff as required by field elevation. The takeoff checklist in this section instructed the pilot to make a final check of manifold pressure, fuel flow, rpm, and oil pressure at the start of the takeoff run.

The manufacturer determined from the POH that, at maximum certified gross weight with the given atmospheric condition, the airplane should have had a ground roll of 1,900 feet, and would clear a 50-foot obstacle at 2,100 feet.

Test Flight

The FAA accident coordinator supervised examination of the takeoff performance in another of the operator's airplanes in Gallup, New Mexico. The conditions approximated the same density altitude as the accident flight. This airplane also had the altitude compensating fuel pump installed. He observed several takeoffs. The test pilot took off using a full rich mixture setting, and also did takeoffs after leaning the mixture. The coordinator did not observe any appreciable difference in the takeoff roll or climb. The engine attained expected power settings and climb performance. They tried to simulate the power conditions that the witnesses reported. The closest configuration was with reduced manifold pressure (MP) and revolutions per minute (rpm). They reduced power to 23 inches MP and 2,300 rpm. They were not able to attain flying speed with full flaps. However, they did attain flying speed with 10-degree flaps about 500 feet further down the runway than they calculated.

Operator

The operator had a form that they used for performance calculations including weight and balance. They required pilots to complete the form prior to each flight. The form provided spaces for pilots to record pertinent data, and log computed parameters. Those parameters included takeoff weight, density altitude, runway length, rotation speed, takeoff distance, takeoff distance over a 50-foot obstacle, rate of climb, and landing distance.

The IIC interviewed other instructors from the operator who had flown with the accident instructor. The instructors all had similar practices. They indicated that they leaned engines in both airplanes prior to takeoff from high density altitude airports. One instructor and the CFI used similar leaning techniques. She would go to full power in the run up area and lean 40 degrees rich of peak prior to taking the runway. Another instructor said that she and the CFI were very thorough, and diligently followed company rules regarding takeoff and performance

data on the company form. She said company procedures require a 60-knot callout, and the instructor responds, "crosscheck."

ADDITIONAL INFORMATION

The IIC released the wreckage to the owner's representative.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	34,Female
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	May 1, 2001
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	August 1, 2002
Flight Time:	652 hours (Total, all aircraft), 50 hours (Total, this make and model), 553 hours (Pilot In Command, all aircraft), 136 hours (Last 90 days, all aircraft), 33 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Student pilot Information

Certificate:	Private	**Age:**	18,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	November 1, 2001
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 1, 2002
Flight Time:	174 hours (Total, all aircraft), 37 hours (Total, this make and model), 142 hours (Pilot In Command, all aircraft), 34 hours (Last 90 days, all aircraft), 14 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N323D
Model/Series:	A36	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	E2613
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	March 12, 2003 100 hour	**Certified Max Gross Wt.:**	3650 lbs
Time Since Last Inspection:	79.6 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2249.1 Hrs at time of accident	**Engine Manufacturer:**	Teledyne Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550-B(6)
Registered Owner:	Mesa Pilot Development, Inc.	**Rated Power:**	310 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:	FLG,7011 ft msl	**Distance from Accident Site:**	18 Nautical Miles
Observation Time:	11:56 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	18 knots / 24 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.13 inches Hg	**Temperature/Dew Point:**	14°C / -4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SEDONA, AZ (SEZ)	**Type of Flight Plan Filed:**	IFR
Destination:	Phoenix, AZ (IWA)	**Type of Clearance:**	None
Departure Time:	12:30 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Sedona SEZ	**Runway Surface Type:**	Asphalt
Airport Elevation:	4827 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	21	**IFR Approach:**	None
Runway Length/Width:	5132 ft / 75 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	34.841388,-111.7975

Administrative Information

Investigator In Charge (IIC):	Plagens, Howard
Additional Participating Persons:	BRUCE BESSETTE; Federal Aviation Administration ; Scottsdale, AZ Timothy D Rainey; Raytheon Beech; Wichita, KS John Kent; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	October 3, 2006
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=56837