



National Transportation Safety Board Aviation Accident Final Report

| | | | |
|-------------------------|--------------------------------------|------------------|------------|
| Location: | Montgomery, TX | Accident Number: | DEN05FA032 |
| Date & Time: | 12/07/2004, 1020 CST | Registration: | N141SW |
| Aircraft: | Beech A45 | Aircraft Damage: | Destroyed |
| Defining Event: | | Injuries: | 2 Fatal |
| Flight Conducted Under: | Part 91: General Aviation - Business | | |

Analysis

While maneuvering during an upset recovery training flight, the left wing separated from the airframe, which resulted in an uncontrolled descent and impact with terrain. A review of an on-board video revealed the instructor and student were performing training maneuvers which included steep turns, stalls, accelerated stalls, unusual attitudes and recoveries from these to a wings level attitude using several techniques. During the final maneuver, the instructor asked the student to lower the nose to "about a hundred and forty knots", and afterwards told the student to slowly pitch the nose upward "until we're pointed straight up." The airplane was seen climbing vertically up and visual contact with the ground disappeared. The instructor then told the student to "pull the way we just did a minute ago and pull the airplane into a stall." A brief stall occurred, and then the airplane continued to pitch in the same direction, and its path resembled the remainder of an inside loop. As the ground reappeared into the view, the aircraft was inverted and descending. There was a slight roll to the left as the airplane was descending while its pitch attitude continued in the same trend toward a vertical nose down attitude. While in a steep nose down attitude (no sky visible in the view), the instructor told the student to "pull it into a stall right now." At that moment, the recording ended. The main wreckage came to rest on the side of a hard surface gravel road, and the left wing, left horizontal stabilizer, inboard section of left elevator, aft canopy frame, and a portion of the left wing skin were located in a wooded area approximately 0.4 miles southwest of the main wreckage. The true history of the airframe could not be substantiated. All applicable Federal Aviation Administration Airworthiness Directives had been complied with at the time of the accident. Examination of the wing and carry-through structure revealed the structure failed as the result of extensive and widespread fatigue cracking in the -31 and -33

channels and the -3 and -85 webs. The cracks in the channels were in hidden areas and probably could not have been directly detected without extensive disassembly of the structure. However, the cracks in the webs would have been easily detected, and the crack in the forward web apparently was detected, based on the stop-drilled hole and the notes in the maintenance records. The materials of the structure were in compliance with required specifications. However, the workmanship was poor as indicated by the trapped debris and damaged holes. This may have been acceptable standards of workmanship at the time of manufacture, but have since been recognized as having a large negative impact on fatigue life of the structures. The fractured hole in the rear spar was recently inspected with no indication of cracks. It is highly unlikely that the cracks initiated and grew to the current sizes in less than 40 hours of flight time since the inspection. The localized damage and enlargement of the hole could have reduced the effectiveness of the inspection. The fatigue cracking in the carry-through, the rear wing spar, and the horizontal stabilizer indicate that the fatigue life of the entire aircraft structure has been expended. It is strongly suspected that these conditions may exist in other T-34 airframes.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

the in-flight separation of the left wing as a result of extensive fatigue cracking throughout the wing carry-through structure.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: MANEUVERING

Findings

1. (C) FUSELAGE, ATTACHMENT - FAILURE, TOTAL
2. (C) FUSELAGE, ATTACHMENT - FATIGUE
3. WING, SPAR - FAILURE, TOTAL
4. WING, SPAR - FATIGUE
5. HORIZONTAL STABILIZER ATTACHMENT - FAILURE, TOTAL
6. HORIZONTAL STABILIZER ATTACHMENT - FATIGUE

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: DESCENT - UNCONTROLLED

Findings

7. AIRCRAFT CONTROL - NOT POSSIBLE - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings

8. TERRAIN CONDITION - ROADWAY/HIGHWAY

Factual Information

HISTORY OF FLIGHT

On December 7, 2004, at 1020 central standard time, a Beech A45 single-engine airplane, N141SW, registered to PRVNY PLUK, LLC, of Houston, Texas, and operated by Texas Air Aces Inc., d.b.a. Aviation Safety Training, of Spring, Texas, was destroyed when it impacted terrain following an in-flight separation of the left wing and subsequent loss of control near Montgomery, Texas. The airline transport pilot (pilot-in-command/safety pilot) and pilot-rated passenger (client) were both fatally injured. Visual metrological conditions prevailed, and no flight plan was filed for the 14 Code of Federal Regulations Part 91 demonstration flight. The flight originated from the David Wayne Hooks Municipal Airport (DWH), near Houston, Texas, approximately 0945.

The client attended Aviation Safety Training for a two-day Advanced Maneuvering Program (AMP). The program included ground school and flight training that focused on unusual attitudes and upset recovery. The client completed the ground school portion of the training the day prior to the accident. The accident flight was the first of two flights for the flight portion of the program. The accident flight was a single aircraft

flight; according to the operator, typically the AMP training consisted of two aircraft training simultaneously in the practice area.

The airplane was equipped with an on-board video/audio recording system. According to the operator, the videotapes are used for the purpose of post-flight debriefings. A review of the videotape revealed the video view was from a tail-mounted camera, which looked forward toward the canopy, and the view extended laterally to both wingtips. The camera view remained the same throughout the recording. The recording contained approximately 35:27 (minutes:seconds) of continuously recorded video and audio. All times of the recording in the History of Flight section of the factual report are elapsed times from the beginning of the recording unless otherwise specified. The elapsed time format is in hours, minutes, and seconds (HHMM:SS).

The recording began with the airplane on the ground at DWH in a parking area with the engine running. The safety pilot, seated in the rear seat, requested and received clearance and taxi instructions to runway 35L. The airplane approached the departure end of the runway, stopped on the taxiway, and the safety pilot performed pre-flight run-up procedures. After a position and hold clearance, the airplane was cleared for takeoff and began the takeoff roll. Shortly after the takeoff roll began, the safety pilot gave control of the airplane to the client, informed him that the takeoff would be his, and the safety pilot would maintain control of the engine power.

The airplane took off and generally maintained runway heading for the next 12 minutes of video. The airplane climbed in steps; first to 2,800 feet and then to 3,800 feet in order to remain clear of Class B airspace. Approximately 0015:00, the airplane reached the vicinity of Lake Conroe at 3,800 feet. At 0016:17, a climb to 6,000 feet was initiated. After reaching 6,000 feet, the safety pilot and client began performing the AMP training maneuvers. The safety pilot described each maneuver beforehand, as well as during each maneuver. The training maneuvers included steep turns, stalls, accelerated stalls, unusual attitudes and recoveries from these to a wings level attitude using several techniques. The maneuvers performed demonstrated the airplane's response to 'rudder only' recovery techniques at low and high angles of attack, 'rudder combined with aileron' recoveries also at low and high angles of attack, and demonstrations of positive dynamic and static stability of the airplane.

At 0034:50, the safety pilot asked the client to lower the nose to "about a hundred and forty knots," and afterwards told the client to slowly pitch the nose upward "until we're pointed straight up." The airplane was seen climbing vertically up and visual contact with the ground disappeared. The safety pilot then told the client to "pull the way we just did a minute ago and pull the airplane into a stall." A brief stall occurred, and then the airplane continued to pitch in the same direction, and its path resembled the remainder of an inside loop. As the ground reappeared into the view, the aircraft was inverted and descending. There was a slight roll to the left as the airplane was descending while its pitch attitude continued in the same trend toward a vertical nose down attitude. While in a steep nose down attitude (no sky visible in the view), the safety pilot told the client to "pull it into a stall right now." At that moment (0035:26), the recording appeared to end.

According to witness statements, at the time of the accident, the witnesses were working approximately 1/2 mile from the accident site. Witnesses heard a "bang" and noticed an

airplane in a near vertical attitude. The witnesses then observed a wing and several other small components separate from the airplane. After the wing separation, the airplane spiraled nose down toward the ground. Subsequently, the airplane impacted a hard surface gravel road. The witnesses secured the area until the local authorities arrived.

PERSONNEL INFORMATION

The pilot-in-command, designated as the safety pilot, occupied the rear seat. The pilot held an airline transport pilot certificate with an airplane multi-engine land rating. The pilot also held a commercial pilot certificate with an airplane single-engine land rating. The pilot was issued a second-class medical certificate on October 4, 2004, with a limitation for corrective lenses. According to the pilot's insurance records dated November 16, 2004, the pilot had accumulated 5,280 total flight hours and 792 total hours in the make and model of the accident airplane, of which 20 hours were in the previous 90 days. The records revealed the pilot was an ex-military fighter pilot. According to the operator, the pilot had been employed with them since October 2001, and had been the operator's chief pilot since December 2003.

The pilot-rated passenger, designated as the client, occupied the front seat. The pilot held an airline transport pilot certificate with an airplane multi-engine land rating. The pilot also held a commercial pilot certificate with an airplane single-engine land rating. The pilot was issued a first-class medical certificate on October 24, 2004, with no restrictions or limitations. According to an October 2003 medical certificate application, the pilot reported a total of 14,700 hours.

AIRCRAFT INFORMATION

The A-45 (military designation T-34A, B45) airplane is a single-engine, tandem-seat trainer manufactured by Beech Aircraft Corporation. The airplane was designed to meet the requirements of a primary military trainer and, at the same time, prepare the student pilot for the transition to heavier, higher-performance airplanes. The overall dimensions of the airplane are a wingspan of 32.8 feet, a length of 25.9 feet and a height of 9.6 feet. The normal gross weight of the airplane is 2,950 pounds. The airplane utilizes three landing gear in a retractable tricycle configuration. The entire T-34 A and B production was sold to U.S. military customers or exported to foreign military customers. The airplane was delivered with a Continental O-470-13 engine rated at 225 horsepower. The accident airplane had a Continental IO-550-B9F engine rated at 300 horsepower.

According to Federal Aviation Administration (FAA) registration records, the accident airplane was loaned to the Dyes Air Force Base (AFB), Texas, Aero Club on September 29, 1958, at a reported time of 1,901.09 hours. On October 15, 1958, the airplane was issued a FAA Standard Airworthiness Certificate and entered civilian use as a Dyes AFB Aero Club asset. It was released from the United States Air Force (USAF) in January 1965 and was transferred to the Civil Air Patrol. The certificate of ownership (dated February 25, 1965) at the time of transfer lists the USAF Serial Number as 53-4113 with no Manufacturer Serial Number (S/N) listed. According to FAA Aircraft Specification No. 5A3, T-34A, USAF S/N 53-4113, was manufactured by the Canadian Car and Foundry Company as manufacturer's S/N 34-82. The Federal Aviation Agency

(precursor to the FAA) Application for Aircraft Registration, also dated February 25, 1965, lists the S/N as 53-4113 with a hand written notation "G-13" above the type written number. According to Raytheon records, airplane S/N G-13 was manufactured as USAF S/N 52-7632A. In a June 1965 letter from Dyes AFB to the FAA, the USAF reported that airplane USAF S/N 52-7632A, N7830B, had crashed in July 1959 and was "turned over to salvage for reclamation and disposition." The Civil Air Patrol sold the airplane to a private individual in January 1972 as S/N G 13AF53 4113A. It was sold once more with this serial number before being sold in July 1974 as S/N G-13. In October and again in December 1977, the airplane was sold as S/N 6-13AF53-4113 and in February 1978 as S/N 53-4113A. The records indicate that the N-number was changed from N7979A to N20M in February 1978. On November 13, 1981, N20M was involved in an accident in which the airplane received substantial damage (See NTSB accident CHI82FEM02). The Deregistration of United States Civil Aircraft form lists airplane S/N G-13 as "totally destroyed or scrapped" on September 28, 1982. Prior to the airplane being deregistered, in March 1982, the airplane was again sold, this time as S/N G-13. From this point on, the airplane was sold five times as S/N G-13. The records indicate that on May 12, 1990, the airplane was ditched at sea by the owner. The insurance company recovered the airplane and treated it as a total loss. The Deregistration of United States Civil Aircraft form lists airplane S/N G-13 as "totally destroyed or scrapped" on June 26, 1990. Subsequently, in July 1990, the airplane was sold to Nogle & Black Aviation. According to Nogle & Black, the data plate was removed from the ditched hull (S/N G-13) and it and the airworthiness certificate were used to build a new airplane with new surplus and/or used serviceable parts. On February 1, 1991, a FAA Standard Airworthiness Certificate was issued to an airplane identified as registration N141SW and S/N G-13. This airplane was sold to Sky Warriors in December 1990 and then to PRVNY PLUK, LLC in April 2003.

This accident was the third fatal wing separation on a T-34 airplane during civilian operation. In April 1999, a Beech T-34A, N140SW, collided with the ground following the in-flight separation of the right wing near Rydal, Georgia (see NTSB accident ATL99FA072) during a laser combat simulation (dogfight) flight conducted by Sky Warriors. In November 2003, a Beech T-34A, N44KK, impacted the ground following the in-flight separation of the right wing near Montgomery, Texas (see NTSB accident FTW04FA025) during a simulated air combat demonstration conducted at the end of an AMP training flight by Texas Air Aces. The current accident airplane, N141SW, was the 'adversary' airplane in both of the previous accidents.

In August 2001, in response to the 1999 accident, the FAA issued Airworthiness Directive (AD) 2001-13-18, which limited the flight envelope of all T-34 airplanes until they had performed a detailed inspection of the wing spars in accordance with Raytheon Service Bulletin (SB) 57-3329. The FAA also approved four Alternate Means of Compliance (AMOC) to the AD. As a result of the November 2003 accident, the FAA revised AD 2001-13-18 because they "determined that those AMOCs do not address all critical areas in the wing spar assemblies and should no longer be valid." AD 2001-13-18R1 became effective on March 15, 2004 and eliminated the AMOC approvals thus requiring the T-34 owners perform the Raytheon SB inspections. Subsequent to the revised AD, the four original AMOC holders developed additional inspections to provide an equivalent level of safety in order to get all four AMOCs re-approved for compliance

with AD 2001-13-18R1. A review of the airframe logbook revealed the accident airplane complied with AD 2001-13-18R1 through the use of an AMOC on August 3, 2004.

In November 1962, the FAA issued AD 62-24-01, which requires that both horizontal stabilizers be removed from the airplane and inspected for cracks on the front and rear spars between the butt rib and the inboard end using the dye penetrant method. The inspection is to be repeated every 500 hours. According to the logbook, this inspection was last completed on January 4, 1999, at an airplane total time of 9035.5 hours.

All other applicable Airworthiness Directives had been complied with according to the logbook.

The airframe logbook supplied to the investigation began on December 24, 1990, with a total airplane time of 4947.5 hours and a Hobbs time of 0 hours. The 4,947.5 hours of total airplane time could not be substantiated. The installation of a new Hobbs meter reading 0 hours was substantiated. The first entry details major maintenance on the airplane including the installation of a new engine and the gun camera system that occurred after the airplane was ditched. Between the November 2003 accident and August 3, 2004, the airplane was operated for 0.2 hours. After August 3, 2004, it was operated for 36.2 hours prior to the accident. At the time of the accident, the airplane had accumulated 9316.3 hours (total airframe time).

According to the logbook, on August 3, 2004, the airplane underwent an annual inspection, a 100-hour inspection and major maintenance that included replacing the elevators and overhauling the propeller and governor. The entry in the logbook also states "Doublers were installed on the front carry through structure bulkhead web in accordance with T-34 structural repair manual figures B24 and B25, by Vern Gibson. Found installation to be acceptable." According to Vern Gibson, he discovered the cracking on the carry through web, stop drilled the cracks, installed the doublers in accordance with the figures, and repainted the area with zinc chromate. The referenced figures are from the Structural Repair Instructions for the Navy Model T-34B Aircraft, NAVAIR 01-90KDB-503. Examination of the wreckage revealed that the splice plates in Figure B25 were not installed on the accident airplane. The figures do not appear in the Beechcraft Mentor, Model B-45, Structural Repair Manual and are not FAA approved or accepted data. As part of the AMOC compliance with the AD, the lower, rear bathtub fittings and the two fastener holes in the right and left aft trunnion fittings were inspected for cracks with no faults found.

The collection of FAA Form 337, Major Repairs and Alterations, were reviewed. In February 1985 the airplane was "repaired following accident." During this repair, both wing spars were replaced, the left leading edge was replaced, both wings, ailerons and flaps were re-skinned, the forward fuselage was rebuilt, and the elevators, horizontal stabilizers, and vertical stabilizer were re-skinned. No record of the mentioned accident could be located in the NTSB or FAA databases. In April 1987, the airplane was repaired due to a nose landing gear collapse. The lower, forward area of the airplane was rebuilt, the propeller was overhauled and the nose landing gear doors were replaced. There are two 337s from January 1991 that list the installation of a new engine and the installation of the gun camera system. There is also a detailed work order and bill from Nogle & Black Aviation that includes the engine and gun camera installations along with a rebuild of the entire airplane. This date corresponds to the time when the airplane was

rebuilt following the ditching. In June 1996, both wing forward spars were replaced with used serviceable spars and the box sections were repaired. In March 1997, the right wing top skin was replaced, the rear spar was repaired and the flap and aileron were re-skinned. The rudder was reworked in August 2003 and both elevators were reworked in April 2004.

METEOROLOGICAL INFORMATION

At 0953, the Montgomery County Airport (CXO) automated surface observing system, located approximately 10 nautical miles east of the accident site, reported the wind from 340 degrees at 8 knots, 10 statute miles visibility, sky clear, temperature 16 degrees Celsius, dew point 8 degrees Celsius, and an altimeter setting of 30.06 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The main wreckage came to rest on the side of a hard surface gravel road at 30 degrees 30.553 minutes north latitude and 95 degrees 38.591 minutes west longitude, at an elevation of 330 feet msl. The main wreckage consisted of the engine, fuselage, right wing, vertical stabilizer, and right horizontal stabilizer, and was located in a crater approximately 6 feet in depth. Several fragmented pieces of the airplane were located within a 100-foot diameter of the main wreckage. No evidence of in-flight or post-impact fire was noted. The left wing, left horizontal stabilizer, inboard section of left elevator, aft canopy frame, and a portion of the left wing skin were located in a wooded area approximately 0.4 miles southwest of the main wreckage. The outboard section of the left elevator and left elevator counterweight were not located.

Examination of the main wreckage revealed the fuselage, including the front and rear cockpit areas, was crushed and fragmented. Both seats and instrument panels were destroyed. Both occupants were wearing a parachute, neither of which had been activated. The forward and aft cockpit control systems were fragmented and destroyed. Flight control continuity was established to the right aileron, elevator and rudder. The right wing was destroyed, and displayed crush damaged, leading edge aft, along the entire length of the wing. The right flap was found in the retracted position. The right main landing gear was found in the retracted position and the nose landing gear position was not determined. The elevator trim position was determined to be 5 degrees trailing edge down. The main wreckage and separated components were transported to the facilities of Air Salvage of Dallas (ASOD), near Lancaster, Texas, for further examination.

On December 10, 2005, at the facilities of ASOD, a detailed examination of the left wing and left horizontal stabilizer was conducted under the supervision of the NTSB. Examination of the left wing revealed the forward carry through structure was fractured about station (STA) 17 and the rear spar fractured about STA 28. The entire wing leading edge remained attached to the forward spar of the wing. The flap remained attached to the wing with some creasing damage centered at about STA 82. The aileron and trim tab also remained attached to the wing with some minor damage to the outboard end with embedded tree debris (this portion of the wing was leaning against a tree when it was found). The landing gear and inboard gear door remained attached to the wing. The outboard landing gear door remained attached to

the landing gear strut. There was some crushing damage to the forward inboard corner of the leading edge of the wing. A small section of fuselage skin remained attached to the carry through structure at the wing attach point.

The upper forward surface of the wing had some abrasion damage between STA 48 and STA 66. A 2-by 3-foot section of the inboard, upper skin adjacent to the rear spar was separated and found near the left wing. The recovered piece of wing skin included the wing walk area. The flap actuator cable and aileron cables tore through the upper skin during the separation. There was some buckling damage to the upper surface between STA 48 and STA 80 oriented about 45 degrees to the longitudinal axis of the airplane.

The fuselage side upper wing fitting and upper cap channel fractured at about STA 15. The forward leg of the upper cap channel was bent aft about 30 degrees. The aft leg of the upper channel was bent aft about 5 degrees. There was some mechanical damage to the fracture surfaces of the upper fitting and channel. Where undamaged, the upper fracture surfaces had an angled, dull, grainy appearance consistent with overload. The upper surface of the fitting and channel were deformed upwards around the fastener holes. There was an extra hole in the upper surface of the upper cap channel that did not have a rivet installed. There was also a crack running from this hole to the next aft, inboard hole that pulled out.

The forward spar lower cap was made up of three nested channels that attach around the fuselage side wing fitting to transfer the loads from the wing to the carry through structure. The lower, upper channel was fractured at about STA 17, and the entire surface had an angled, dull, grainy appearance. The entire lower middle channel forward leg has a flat, dark, shiny appearance consistent with fatigue fracture. The aft leg of the lower middle channel had small flat, dark, shiny areas adjacent to the rivet holes while the remaining portions had an angled, dull, grainy appearance. The forward and aft legs of the lower, lower channel had small, flat, dark, shiny areas adjacent to the rivet holes while the remainder had an angled dull, grainy appearance.

The aft spar fractured near STA 28. The aft, upper L-angle and upper spar cap remained intact. The wing upper bathtub fitting pulled out and fractured leaving the aft leg of the T between the upper cap and aft, upper L-angle. The fracture surface of the fitting had an angled, dull, grainy appearance. The web fractured between rivet holes. The lower bathtub fitting fractured at about STA 28 with an angled, dull, grainy appearance. A small area of the fitting adjacent to the upper rivet had a flat fracture face. The lower spar cap was intact. The aft spar also fractured at STA 66 through the outboard hole in the aft main landing gear trunnion fitting. This fitting had a removable fastener installed per the AD 2001-13-18R1 inspections. The lower spar cap had some small, flat, dark, shiny areas adjacent to the fastener. The lower flap fairing was fractured at STA 66 also.

The remaining carry through and fuselage structure sustained crushing damage from the ground impact. Most of the mating fracture surfaces were obscured and/or mechanically damaged.

The horizontal stabilizer fractured at the attach points. The inboard trailing edge of the stabilizer was bent upwards about 30 degrees. The leading edge exhibited about 12 inches of upward impact damage about 48 inches from the root. The upper skin was

dented about 41 inches outboard of the root. The lower skin had 3 wrinkles oriented about 45 degrees from the longitudinal axis of the airplane. The two outboard hinges were intact and had part of the elevator structure still attached. The forward and aft spars separated at the outboard attach bolts. The upper and lower cap straps on both spars did not fracture and were deformed upwards. The front spar fracture surfaces had small flat, dark, shiny areas adjacent to the fastener holes. The fracture surface adjacent to the lower edge of the lower fastener hole on the aft spar had a small area with a flat, dark, shiny appearance. The remainder of the fracture surfaces exhibited a dull, grainy appearance.

The inboard 48 inches of the left elevator was recovered separate from the main wreckage near the horizontal stabilizer. The two outboard hinges were pulled from the elevator structure. The outboard end of the recovered elevator section was deformed upwards and the trim tab remained attached to the elevator. The trim tab actuator rod was fractured at the forward end of the elevator.

PATHOLOGICAL INFORMATION

On December 9, 2004, an autopsy was performed on the pilot-in-command by the Montgomery County Forensic Pathologist, Conroe, Texas. Toxicological tests were performed by the FAA Civil Aeromedical Institute, Oklahoma City, Oklahoma. The toxicological tests were negative for all screened substances.

TEST AND RESEARCH

On January 12-14, 2005, at the NTSB Materials Laboratory, Washington, DC, portions of the forward wing spar carry through structure near the left wing attachment, two sections of the left wing spar (one at the inboard end of the wing and the second from the area around the wing station (WS) 66), and the inboard region of the left horizontal stabilizer including the mating fractures of the forward and aft spars were examined.

Forward Spar Carry Through

The left side of the forward spar carry through structure was received by the material laboratory in two pieces, outboard and inboard (the outboard portion remained attached the left wing and was unbolted from the wing during the examination at ASOD; the inboard section remained attached to the fuselage and displayed heavy damaged and distortion by impact forces and was cut from the main wreckage at ASOD). The forward spar carry through structure is a riveted and bolted sheet metal assembly, which the main wing spars are attached. The carry through was vertically fractured, with fractures through multiple assembly pieces, about 5 to 6 inches inboard of the left side fuselage skin.

Visual and magnified examinations of the fractures uncovered indications of fatigue cracking in the multiple individual components that comprise the lower box structure of the carry through. The box structure at the fracture locations consists of four nested channel sections, -33 outer channel, -31 inner channel, -29 upper channel, and -15 cap, along with forward and aft webs. The fasteners joining the box structure together and to the lower wing attachment fitting were steel shank, hi-shear pins. Microscopic examinations of the outboard fracture faces uncovered four fatigue crack regions in the -33 outer channel and four additional regions in the -31 inner channel. At seven of the eight fatigue locations, the fatigue initiated at the most inboard fastener holes

connecting the lower wing fitting to the carry through structure. The eighth fatigue region located in the forward side of the inner channel initiated at the second inboard fastener hole. Additional inspections of the components of the inboard piece of the carry through uncovered an additional fatigue area in the -31 channel. This 9th fatigue region was on the lower side of the most inboard wing fitting hole opposite the fatigue region on the upper side of the inboard hole.

The fractured outboard portions of the channels were separated from the surrounding structure by removing the hi-shear pins. Detailed examinations including scanning electron microscopy (SEM) were performed on each of the fatigue regions to determine the location of initiation(s), the extent of fatigue progression, and other observations.

Each of the nine fatigue regions was characterized by a single fatigue origin located in or near the respective fastener hole. The fatigue origins were associated with several different mechanical features; including hole bore damage, sharp or damaged corners and surface dents. Each crack had an initial region of low stress propagation that varied from 0.1 to 0.27 inch in length. On six of the nine fatigue areas, the low stress propagation was immediately followed by ductile overstress through the remainder of the cracked ligament. At the three fatigue regions in the forward flange of the -31 channel, the low stress fatigue regions were followed by large areas of higher stress fatigue propagation. The combined lengths of low and high stress fatigue propagation completely separated the ligament above the forward hole of -31 channel and separated all but 0.1 inch of the portion of -31 channel below the second inboard fastener hole. The ninth fatigue region at the lower side of the inboard hole was composed of a 0.15 inch long low stress area followed by an additional 0.45 inch long segment of high stress propagation.

Following disassembly of the fractured channel sections from the outboard structure three additional vertically oriented cracks were found in the adjacent fastener holes of the -31 and -33 channels.

In addition to the channels, fatigue cracking was uncovered in both webs of the carry through structure adjacent to the wing attach fitting. Visual inspections found large regions of fatigue and preexisting cracking in both the forward -85 and aft -3 sheet metal webs. The preexisting cracks in each web were composed of two intersecting cracks: an angled crack in the portions of the web below the level of the channels and a vertical crack in the portions of the webs above the bottom of the channels. The vertical portions of the web cracks progressed through the webs inboard of the wing fitting. The angle cracks were at approximately 45 degrees (down and outboard) to the carry through and were mostly below the level of the wing attach fitting.

Shadow lines in the primer established that a portion of the angled crack on the aft face was partially covered by a doubler on the web. The shape, location, and rivet pattern of the doubler was consistent with the -105 doubler shown on the original Raytheon installation drawing. According to the Raytheon Aircraft representative, records indicated that the -105 doublers were not installed during production until after the manufacture of the accident airplane. Shadow lines were also apparent on the forward web. This doubler was attached to the web sheet by blind rivets. The installation drawing showed a -107 doubler at this location but it had a significantly different configuration and shape. The installed doubler partially overlaid the -33 channel and

the drilling for the doubler rivets penetrated into the channel. The doubler also completely covered the angled crack and most of the vertical crack.

Magnified examinations revealed through-the-thickness fatigue propagation from multiple origins all along the exposed web surfaces at the vertical cracks. The fatigue region in the forward web measured 1.9 inches in length, and the fatigue in the aft web measured approximately 2.2 inches. Both angled cracks showed fracture face rubbing and recontact damage consistent with preexisting cracks but no clear indications of slow growth fatigue progress. On the forward web the upper end of the angled crack was drilled consistent with "stop drilling" indicating that this portion of the crack existed prior to the application of the forward doubler.

Wear and chaffing patterns were noted on several components including the webs, cap (-15), and wing fitting. Details within the wear, including orientation of wear marks, indicated relative inboard/outboard movement of the components relative to mating components. Further, the markings indicated that the greatest relative movements were near the lower edge of the carry through structure.

During disassembly, large quantities of drill turning and other debris were found trapped in the various joints between assembly members throughout the received assembly. In some instances, the trapped material was deeply embedded into the faying surfaces of the joint such as at the fatigue origin of the aft upper crack in the -33 channel.

Left Wing Rear Spar

The left wing rear spar was received in two sections. Magnified examination of the wing root section found fracture features and deformation patterns on the rear spar consistent with an upward bending overstress of the wing. The damage at WS 66 fractured the lower spar cap of the rear spar in the fore and aft direction at the outboard of two removable fasteners in the area.

Examinations of the fracture surfaces revealed darkened preexisting cracks in the two spar members on the forward side of the hole. Closer examinations after cleaning and removal of the bolt established that the cracks were fatigue initiating on the bore surfaces of the hole. The bore of the hole was damaged and enlarged on one side at the location of the cracks. The lower crack in the lower spar member was completely through the thickness of this member and measured about 0.06 inch long in the fore and aft direction. The upper crack measured about 0.02 inch long in the fore and aft direction.

Left Horizontal Stabilizer

The stabilizer had separated through the forward and aft spars at the outboard attachment holes to the empennage. Visual inspections uncovered evidence of preexisting cracking in the forward spar pieces but none in the aft spar.

The stabilizer's forward spar assembly was made up of two nested "C" sections, a -14 spar and a -22 doubler, with horizontal fasteners through the web portion of the spar. The fastener holes in the spar and doubler were machined for insertion of stepped steel bushings through which the attaching bolts pass.

Magnified examinations of the fracture surfaces after cleaning found multiple fatigue cracks in both spar members at the upper and lower holes. Eight fatigue cracks were identified in the spar and the doubler, the largest of which was in the spar at the lower hole.

Materials

Measured hardness and conductivity for all the sampled members was typical for the required materials.

ADDITIONAL INFORMATION

As previously stated, the airplane was equipped with video recording equipment, which was used for the purpose of post-flight debriefing. The recording equipment and videotape were recovered from the accident site and shipped to the NTSB Vehicle Recorder Division in Washington DC. The Vehicle Recorder Division received a VHS format video recorder, which was severely damaged and fragmented into pieces. Inside the recorder was a damaged VHS cassette which was also fragmented. The magnetic tape was found broken in several places, and several small tape fragments were found in the recorder mechanism. The tape sections were removed from the recorder, spliced together by matching the corresponding end-to-end breaks in the tape, cleaned, respooled onto new reels, and installed in a new cassette housing for playback.

The audio portion of the recording captured intra-cockpit communications between the safety pilot and client, from an intercom system. The intercom audio sounds as if it was configured for "hot mic" communications between the two pilots (the microphones are on continuously, as opposed to a Push-To-Talk or Voice-Activated configuration). Incoming and outgoing radio transmissions were also captured.

On March 16, 2005, a video recorder group convened at the NTSB laboratory in Washington, DC. The group created a partial transcript of the video and audio information, extracting and documenting any facts that could have been relevant to the accident investigation. The group reviewed a digitized copy of the entire recording and produced a transcript starting at 0016:11 elapsed time. All conversation that occurred from that time up until the end of the recording was transcribed. The group also transcribed the last 4 minutes of the video portion of the recording. The video descriptions occurred at points in the recording determined by the group to be key to understanding the accident sequence. The video and audio transcript can be found in the attachment to the "On Board Video Recording" factual report in the public docket.

As a result of this accident, the FAA issued Emergency AD 2004-25-51 on December 10, 2004, that essentially grounded all the remaining T-34 airplanes until an approved inspection and/or modification could be developed that would address the forward spar carry through structure. The FAA AD 2004-25-51 final rule was issued on December 21, 2004, to all operators of T-34 airplanes.

On March 7, 2005, the FAA issued Special Airworthiness Information Bulletin (SAIB) CE-05-36. The SAIB CE-05-36 alerts T-34 owners of an approved inspection program for airplanes that have not yet reached 3,800 hours total time in service (TIS). The FAA determined that airplanes with less than 3,800 hours total TIS that have complied with all previous AD requirements, may be returned to service. The airplanes may be operated until 3,800 hours total TIS has been reached. Airplanes with more than 3,800

hours total TIS must have an inspection and/or modification program completed that is approved specifically for AD 2004-25-51 by the FAA Wichita Aircraft Certification Office. The airplane wreckage was released to the owner's representative on October 3, 2005.

Pilot Information

| | | | |
|---------------------------|--|-----------------------------------|----------------------------|
| Certificate: | Airline Transport | Age: | 51, Male |
| Airplane Rating(s): | Multi-engine Land; Single-engine Land | Seat Occupied: | Rear |
| Other Aircraft Rating(s): | None | Restraint Used: | Seatbelt, Shoulder harness |
| Instrument Rating(s): | Airplane | Second Pilot Present: | Yes |
| Instructor Rating(s): | None | Toxicology Performed: | Yes |
| Medical Certification: | Class 2 Valid Medical--w/ waivers/lim. | Last FAA Medical Exam: | 10/04/2004 |
| Occupational Pilot: | | Last Flight Review or Equivalent: | 10/01/2004 |
| Flight Time: | 5280 hours (Total, all aircraft), 95 hours (Total, this make and model), 5280 hours (Pilot In Command, all aircraft) | | |

Other Flight Crew Information

| | | | |
|---------------------------|--|-----------------------------------|----------------------------|
| Certificate: | Airline Transport | Age: | 38, Male |
| Airplane Rating(s): | Multi-engine Land; Single-engine Land | Seat Occupied: | Front |
| Other Aircraft Rating(s): | None | Restraint Used: | Seatbelt, Shoulder harness |
| Instrument Rating(s): | Airplane | Second Pilot Present: | Yes |
| Instructor Rating(s): | None | Toxicology Performed: | Yes |
| Medical Certification: | Class 1 Valid Medical--no waivers/lim. | Last FAA Medical Exam: | 10/29/2004 |
| Occupational Pilot: | Yes | Last Flight Review or Equivalent: | |
| Flight Time: | 13800 hours (Total, all aircraft) | | |

Aircraft and Owner/Operator Information

| | | | |
|-------------------------------|----------------------------------|--------------------------------|----------------------|
| Aircraft Make: | Beech | Registration: | N141SW |
| Model/Series: | A45 | Aircraft Category: | Airplane |
| Year of Manufacture: | | Amateur Built: | No |
| Airworthiness Certificate: | Aerobatic | Serial Number: | G-13 |
| Landing Gear Type: | Retractable - Tricycle | Seats: | 2 |
| Date/Type of Last Inspection: | 08/03/2004, 100 Hour | Certified Max Gross Wt.: | 2900 lbs |
| Time Since Last Inspection: | 36.2 Hours | Engines: | 1 Reciprocating |
| Airframe Total Time: | 9316.3 Hours at time of accident | Engine Manufacturer: | Teledyne Continental |
| ELT: | Installed, not activated | Engine Model/Series: | IO-550-B9F |
| Registered Owner: | PRVNY PLUK, LLC | Rated Power: | 300 hp |
| Operator: | Texas Air Aces | Operating Certificate(s) Held: | None |
| Operator Does Business As: | Aviation Safety Training | Operator Designator Code: | |

Meteorological Information and Flight Plan

| | | | |
|----------------------------------|----------------------------------|--------------------------------------|-------------------|
| Conditions at Accident Site: | Visual Conditions | Condition of Light: | Day |
| Observation Facility, Elevation: | CXO, 245 ft msl | Distance from Accident Site: | 10 Nautical Miles |
| Observation Time: | 0953 CST | Direction from Accident Site: | 280° |
| Lowest Cloud Condition: | Clear | Visibility | 10 Miles |
| Lowest Ceiling: | None | Visibility (RVR): | |
| Wind Speed/Gusts: | 8 knots / | Turbulence Type Forecast/Actual: | / |
| Wind Direction: | 340° | Turbulence Severity Forecast/Actual: | / |
| Altimeter Setting: | 30.06 inches Hg | Temperature/Dew Point: | 16°C / 8°C |
| Precipitation and Obscuration: | No Obscuration; No Precipitation | | |
| Departure Point: | Montgomery, TX (DWH) | Type of Flight Plan Filed: | None |
| Destination: | | Type of Clearance: | None |
| Departure Time: | 0945 CST | Type of Airspace: | Class G |

Wreckage and Impact Information

| | | | |
|---------------------|---------|----------------------|-----------------------|
| Crew Injuries: | 2 Fatal | Aircraft Damage: | Destroyed |
| Passenger Injuries: | N/A | Aircraft Fire: | None |
| Ground Injuries: | N/A | Aircraft Explosion: | None |
| Total Injuries: | 2 Fatal | Latitude, Longitude: | 30.509722, -95.648611 |

Administrative Information

| | | | |
|--|--|----------------------|------------|
| Investigator In Charge (IIC): | Aaron M Sauer | Adopted Date: | 02/28/2006 |
| Additional Participating Persons: | TR Proven; Federal Aviation Administration AAI-100; Washington, DC Paul Nguyen; Federal Aviation Administration ACE-118W; Wichita, KS Marv Nuss; Federal Aviation Administration ACE-110; Kansas City, MO Paul E Yoos; Raytheon Aircraft Company; Wichita, KS John Kent; Teledyne Continental Motors, Inc.; Seagoville, TX Ed Johnson; Aviation Safety Training; Spring, TX Victor Juarez; T-34 Association; San Antonio, TX | | |
| Publish Date: | 10/27/2015 | | |
| Note: | The NTSB traveled to the scene of this accident. | | |
| Investigation Docket: | NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ . | | |