National Transportation Safety Board
Aviation Accident Final Report

Location:	LONE ROCK, WI	**Accident Number:**	CHI93FA158
Date & Time:	05/04/1993, 0140 CDT	**Registration:**	N80CB
Aircraft:	BEECH E-18S	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

THE PILOT OF A TWIN-ENGINE CARGO AIRPLANE SHUT DOWN THE LEFT ENGINE AND FEATHERED THE PROPELLER DUE TO A LOSS OF ENGINE OIL. THE FAA ARTCC HANDLING THE FLIGHT VECTORED THE AIRPLANE TOWARD A VOR. DUE TO THE AIRPLANE'S ALTITUDE AND DISTANCE FROM THE CENTER'S RADAR, THE PILOT OF THE AIRPLANE HAD TO PERFORM A FULL INSTRUMENT APPROACH PROCEDURE. THE AIRPLANE MAINTAINED ITS ENROUTE ASSIGNED ALTITUDE UNTIL PASSING THE VOR OUTBOUND. NTAP READOUTS SHOW THE AIRPLANE DESCENDING THROUGHOUT THE PROCEDURE TURN AND INBOUND LEG OF THE APPROACH. THE AIRPLANE'S LAST RADAR CONTACT WAS 300 FEET BELOW THE INBOUND ALTITUDE FOR THE APPROACH WHILE OUTSIDE THE FINAL APPROACH FIX. THE AIRPLANE COLLIDED WITH TREES AND TERRAIN APPROXIMATELY 2 1/4 MILES FROM THE AIRPORT. THE VOR IS 5.5 MILES FROM THE AIRPORT. THE ON-SCENE INVESTIGATION REVEALED THE LEFT ENGINE'S PROPELLER HAD BEEN FEATHERED, ITS NUMBER NINE CYLINDER MOUNTING STUDS ON THE ENGINE'S CASE WERE CRUSHED DOWNWARD OR WERE BROKEN OFF AT THE CASE'S SURFACE, AND THE LANDING GEAR HAD BEEN EXTENDED.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: was a pre-mature extension of the landing gear by the pilot which resulted in the inability of the pilot to maintain the minimum descent altitude. Factors related to the accident were the loose cylinder and loss of oil.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CRUISE - NORMAL

Findings
1. 1 ENGINE
2. (F) ENGINE ASSEMBLY,CYLINDER - LOOSE
3. (F) FLUID,OIL - LOSS,PARTIAL

Occurrence #2: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings
4. OBJECT - TREE(S)
5. PRECAUTIONARY LANDING - ATTEMPTED - PILOT IN COMMAND
6. (C) GEAR EXTENSION - PREMATURE - PILOT IN COMMAND
7. (C) MINIMUM DESCENT ALTITUDE - NOT POSSIBLE - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings
8. TERRAIN CONDITION - HIGH TERRAIN

Factual Information

HISTORY OF FLIGHT

On May 4, 1993, at 0140 central daylight time (CDT), a Beech E-18S, N80CB, operated by Viking Express, Incorporated, of Aurora, Illinois, and piloted by an airline transport rated pilot, was destroyed during a collision with trees and terrain while flying the inbound course of a VOR approach at the Tri-Counties Airport, Lone Rock, Wisconsin. Instrument meteorological conditions prevailed at the time of the accident. The 14 CFR Part 135 flight was operating on an instrument flight plan. The pilot received fatal injuries. The flight originated from Aurora, Illinois, at 0035 CDT.

N80CB was part of a two-airplane cargo flight, flying between Aurora, Illinois, and Minneapolis, Minnesota. N80CB had been assigned an altitude of 6,000 feet mean sea level and confirmed reaching that altitude approximately 24 minutes after contacting air traffic control. During the flight, the pilot of N80CB radioed the pilot of the second airplane informing him that N80CB was losing oil from its left engine. According to the Federal Aviation Administration's (FAA) Chicago, Illinois', Air Route Traffic Control Center (ARTCC), the pilot of N80CB contacted the controller at 0119 CDT. During the following conversation the pilot requested routing from the airplane's present position to the nearest airport with an instrument approach.

N80CB's pilot was advised he had two airports near him: Tri- County Regional Airport (Tri-County Airport), Lone Rock, Wisconsin, and Iowa County Airport, Mineral Point, Wisconsin. These airports were located 20 miles north and 5 miles southwest respectively of N80CB's position. After being informed of the nearest airports, the pilot advised ARTCC "...I'm gonna have an engine failure pretty quick." The pilot asked ARTCC the length of Tri-County Airport's runway. ARTCC advised the pilot to standby. At this time, an unidentified voice stated: "Come up on freak Jim." Approximately five seconds later ARTCC asked the pilot: "Ah did you copy that sir?" The pilot responded, "No." The pilot then stated, "Head me towards it right ah right now if you could can you give me a heading?"

ARTCC gave the pilot Tri-County Airport data and instrument approach information. ARTCC advised the pilot that weather for the airport was not available. The pilot requested a radar vector to the VOR's final approach course. He was informed by ARTCC that the controller's radar screen did not have the VOR approach depicted. The ARTCC controller told the pilot he couldn't "...vector (him) around to the north side of the VOR... after (that) you'll don't have to do the full procedure turn if you'd like that sir." The pilot stated, "... that's my only choice I guess."

ARTCC cleared N80CB to 3,300 feet, "... at your discretion." The pilot confirmed the clearance and assigned heading of 350 degrees. Approximately one minute after clearing N80CB to 3,300 feet, ARTCC advised the pilot, "Ah roger and the airport now is just ah (unintelligible) at your discretion maintain three thousand three hundred as you start your descent ah you you'll be right over the airport you might be able to get it in sight." N80CB's pilot acknowledged ARTCC's statement and was advised he was "... a mile south of the airport." The pilot asked ARTCC to repeat the statement and was advised: "...you're about five and half miles south of the VOR at this time and the airport is ah just off to your ah left side now and a quarter mile." Approximately four minutes later, ARTCC cleared N80CB for the VOR-A approach. The pilot of N80CB did not acknowledge ARTCC's clearance.

While the pilot was talking with ARTCC he also spoke to the pilot of the second company airplane. According to the written statement of the second airplane's pilot, N80CB's pilot advised him "...that he was losing oil out of the engine and his oil pressure was dropping. He said that he was losing the engine and was going to talk to Center." This pilot stated he advised N80CB's pilot to divert to Lone Rock, Wisconsin, rather than Madison, Wisconsin. He said he advised the pilot to do this because Lone Rock was closer and, "At this point both engines were still running and the failing engine would only run until it ran out of oil."

The pilot of the second airplane stated N80CB's pilot advised him that he was shutting the left engine down due to an overspeeding propeller while flying the outbound leg of the VOR approach. According to the written statement, N80CB's pilot advised he was 100 feet low approximately three miles outside the VOR during the inbound portion of the approach. N80CB's pilot then stated he was about 1 1/2 miles inside the VOR and had to overboost the engine to hold airspeed and altitude. After reminding the pilot to use a radio frequency appropriate for the airport, the pilot was no longer in contact with N80CB's pilot.

The FAA ARTCC's National Track Analysis Program (NTAP) data showed N80CB maintained the assigned altitude of 6,000 feet within plus or minus 100 feet until it was approaching the Lone Rock VOR. As the airplane approached the Lone Rock VOR, its altitude was 5,300 feet MSL. Approximately two minutes later N80CB's altitude was 3,700 feet as it began its procedure turn outbound. At a point where it began its procedure turn inbound, N80CB's altitude was 2,800 feet; 100 feet below the established VOR crossing altitude. One minute and twenty seconds later, N80CB's altitude was 2,600 feet while it was northeast of the VOR.

PERSONNEL INFORMATION

Company records show the pilot began his employment on December 18, 1992, as pilot-in-command of a Piper PA-23-250. A review of the pilot's logbook concerning Beech 18 multi-engine training and pilot-in-command entries reveal two single-engine training activities. The logbook entries involving the Beech 18 show no instructor signature in the remark's section where the flight time is listed as "dual". On March 26, 1993, the pilot began flying the Beech 18 as pilot-in-command.

Company training records show the pilot had one session of Beech 18 training dated March 26, 1993. The record reflects 2.5 hours of flight training and 8.0 hours of ground training. The record is signed by the check airman who is also the company's owner. This is the only formal training record associated with the pilot and Beech 18 that was found in the company's pilot training records. The company owner said that the training folder contained all the records applicable to the pilot.

A review of FAA Form 8410.3, dated March 26, 1993, shows the pilot satisfactorily demonstrated all of the maneuvers listed on the form, except an NDB/ADF approach and use of auto-pilot which the pilot did not perform. The form shows a flight time of 2.1 hours and is signed by the same person signing the training record.

The pilot's logbook record shows two entries for March 26, 1993. The first entry shows a flight time of 2.1 hours, the remarks section states: "...(check) ride 135 w/Bob Burwell (3 lndgs)." The second entry shows a cross country trip of 5.5 hours, of which 3.5 hours were at night. The company's "Pilot Duty Log" shows the pilot had a duty time of 8.5 hours, from 2200 to 0630 CDT, on March 26, 1993.

During 14 duty days before the accident the pilot averaged approximately 7.1 hours duty time

per day. The last logbook entry shows the pilot flew a 5.4 hour trip on May 2, 1993. Approximately five hours were flown in instrument meteorological conditions.

AIRCRAFT INFORMATION

N80CB was a Beech model E-18S that had been modified by an FAA approved supplemental type certificate (STC) number SA572WE on December 18, 1973. The STC was a product of the Hamilton Aircraft Company, Incorporated, of Tucson, Arizona. The addition of the STC allowed N80CB's gross takeoff weight (GTOW) to increase to 10,100 pounds rather than the original certificated weight of 9,600 pounds.

Based upon the Type Certificate (TC) data sheets, the Beech model E18S was allowed to attain higher gross takeoff weights depending upon installed equipment. The TC data approved January 19, 1959, states the maximum gross takeoff weight for the E-18S could be 9,700 pounds. N80CB's airframe logbook, dated July 9, 1971, shows it had a 9,600 pound gross takeoff weight before the addition of the STC.

A review of N80CB's engine logbooks show that freshly overhauled engines were installed on the airframe on January 18, 1993. At the time of the overhaul the right engine had a total time of 12,400 hours and the left engine had 10,757 hours total time. Before the accident flight's departure, company records show that both engines had accumulated 368.9 hours since their overhaul. The logbooks for both engines show they had undergone event number five of the FAA approved inspection program on April 2, 1993.

According to the event five work sheets dated April 2, 1993, the left engine's number eight cylinder base nuts were loose. The discrepancy sheet describing the maintenance problem had the statement, "Tightened nuts" next to the discrepancy description. The shop and radio maintenance write up sheet showed one maintenance write up for the month of May, 1993. The write up was dated May 1, 1993, stated: "Left engine has what looks like 2 grounding straps loose at very bottom of cowling between bottom two cylinders." This entry was made by the pilot of the accident airplane according to the pilot duty log for May, 1993.

METEOROLOGICAL INFORMATION

Dane County Airport, Madison, Wisconsin, reported weather at the time of the accident to be: Measured ceiling of 900 feet overcast, visibility of 2 1/2 miles with fog, light drizzle, wind 140 degrees at nine knots , and an altimeter setting of 29.79. The Dane County Airport is located approximately 38 miles east- southeast of the Tri-County Regional Airport. The Sauk County Sheriff's Deputy Sheriff stated the weather at the time of the accident was heavy fog and light rain near the accident site.

AIDS TO NAVIGATION

Tri-County Airport is served by a circling VOR-A instrument approach. Tri-County Airport VOR facility is located 5.5 miles from the airport. The final approach fix altitude for the VOR-A approach into the Tri-County Airport is 2,900 feet; the minimum descent altitude is 1,680 feet above mean sea level when using the Dane County Airport altimeter setting.

AERODROME INFORMATION

The Tri-County Airport is situated approximately one mile south of a series of hills, one of which N80CB impacted. The terrain the airport is situated upon is level and positioned between two areas of hilly terrain. Hilly terrain begins approximately 3 1/2 miles south of the

airport. A slough is located about 2 1/4 miles southwest of the airport.

According to a State of Wisconsin Division of Highways Geological Survey Map the airport's terrain elevation varies between 715 and 719 feet. N80CB collided with a hillside at an approximate altitude of 1,100 feet.

WRECKAGE AND IMPACT INFORMATION

N80CB collided with a hillside approximately 2 1/4 miles north- northeast of the Tri-County Airport. The wreckage path measured about 400 feet long and was oriented on an approximate 290 degree magnetic heading. Based upon measurements between three trees struck by N80CB, the approximate descent path of N80CB was 14 degrees. The left wingtip and red navigation light lens were found at the beginning of the wreckage trail. An area within an approximate 90 degree arc measuring about 100 feet of the tree first struck by N80CB the following airframe components were observed: Lefthand rudder, lefthand vertical stabilizer, and pieces of aluminum varying in size. The wreckage trail was consistent in direction and contained pieces of N80CB along it.

The left engine, left main landing gear assembly, and wing center section were located next to the remains of the forward fuselage at the end of the wreckage trail. The landing gear selector was found in the down position. Throttle quadrant witness marks produced by the left and right throttle lever arms showed a retarded left throttle and a full forward right throttle. Both propeller and mixture controls were in the full forward position. The fuel selector was found in the 76 gallon right fuel tank position.

The left propeller had separated from the engine at the crankshaft entry into the engine crankcase. The propeller was in the feathered position. One blade was twisted and had leading edge scars from the tip inward to the mid-span location. The second blade was bent aft approximately 10 degrees at the mid-span position. The outboard half of the left engine's firewall was oil soaked. Oil staining was observed on the nacelle's outboard side. The oil stain had an airflow pattern over the wing next to the nacelle. The left side of the cockpit roof was oil stained.

The right propeller was attached to the engine and had one blade tip curled approximately eight inches inward. The other blade was bent aft at the mid-span point at an approximate 40 degree angle. The right main landing gear assembly was found approximately 50 feet north of the fuselage center section.

An examination of the left engine revealed the number nine cylinder had separated during the collision sequence and was located near the second ground scar. The cylinder barrel case studs were the necked type. The ends of the studs were crushed downward. The bottom piston ring on this cylinder's piston was missing. The piston skirt was fractured and sections of it were missing. The piston moved freely on the wrist pin. The engine case area where the cylinder barrel is normally attached displayed fretting and galling on its surface. The number one cylinder barrel, next to the number nine cylinder, had discoloration on its surface. The discoloration was bluish black at the center with a gradual color change to a reddish brown.

No oil was found in the left engine. The engine's oil screen had three pieces of a silver colored metallic material in it. The three pieces measured 1/32 inch square. No other contaminants were found in the screen. The camshaft ring inner bearing surface was scored along its track. The wet vacuum pump drain fitting had separated from its mounting. A red plastic buildup plug was found at the base of the fitting. The cylinder barrel case mounting nuts on cylinder

numbers one and eight were loose, two mounting nuts on cylinder number six were loose.

The wing flap jack screw was found in the retracted position. The tail wheel slide tube showed the tail wheel was in the extended position. The left main landing gear retract chain was broken but attached to the upper sprocket and collar. The collar was in the forward position. The right main landing gear drive chain was separated from the assemblies sprockets. The slide tubes for both landing gear assemblies showed that both were in the extended position at the time of ground collision.

The attitude and heading indicator's rotors and associated rotor cases displayed rotational scuffing.

Continuity was observed throughout the right engine when its crankshaft was rotated. No restriction within the engine was observed during the rotation. Both magnetos were separated from the accessory case. The oil screen was examined and no debris was found. The carburetor accelerator pump well contained a substance similar to the color and smell of 100 low lead aviation fuel.

MEDICAL AND PATHOLOGICAL INFORMATION

The autopsy was conducted by the University of Wisconsin Medical School, Madison, Wisconsin. The toxicology report from the Federal Aviation Administration's Civil Aeromedical Institute states that no carboxyhemoglobin or cyanide was detected in the blood samples. 10.00 (mg/dl) ethanol and 1.000 (mg/dl) acetaldehyde was detected in the brain fluid. The report notes: "The ethanol detected in this case is most likely from postmortem ethanol production." The report concludes by stating that no drugs were detected in the urine sample.

ADDITIONAL INFORMATION

Pilots who have flown with the accident pilot said he had a habit pattern of extending his airplane's landing gear as it passed over the final approach fix during an instrument approach.

A company pilot, who had flown with the accident pilot, stated the company's Beech 18 single-engine procedure was to extend the landing gear and flaps once a landing was assured. She said the normal two engine approach for landing was to extend the landing gear and flaps at the final approach fix. This pilot had flown with the accident pilot before his 14 CFR Part 135 pilot-in-command checkride. She stated the accident pilot was very procedurally oriented and flew the Beech 18 "...pretty much by the numbers."

Viking Express, Incorporated, training manual discusses the non-precision instrument approach and multi-engine airplane piloting techniques. The training manual section on non-precision approaches states, in part, "Upon passing the final approach fix, begin descent to MDA or step down fix, if applicable. Landing flaps may be delayed until landing is assured." A drawing, entitled BACK COURSE LOC/VOR/NDB INSTRUMENT APPROACH PROCEDURES has two notations upon it: 1) "For SEL & MEL, 1 & 2 Eng."., and 2) "GEAR DOWN-LDG CHECK (at the) VOR or FINAL FIX INBOUND."

The training manual also provided two perspective drawings related to single-engine approaches and landings, and an instrument approach circle to landing procedure. A notation on the single- engine approach and landing illustration states: "BASE LEG TO FINAL; START DESCENT WHEN RUNWAY IS MADE GEAR DOWN LANDING FLAPS & COMPLETE LDG. CK.". The circling approach illustration has two notations calling attention to single-engine

operations: 1) On the upwind leg, at MDA, "1 ENG. - CLEAN"., and 2) "BASE TO FINAL: ..... 1 ENG. GEAR DOWN & LDG FLAPS WHEN RUNWAY MADE".

Beech Aircraft Corporation was contacted regarding performance data related to the Beech 18's single-engine performance. Upon hearing that N80CB had been modified with an STC changing the gross takeoff weight to 10,100 pounds, the company representative stated the following: During 1966, and 1967, Beech Aircraft attempted to increase the gross weight of the Model 18. At 10,000 pounds the Model H-18, which out performs the Model E-18, could not meet the single-engine climb criteria per CAR 3 or FAR 23. He said that the FAA approved an STC allowing a gross weight increase to 10,100 pounds shortly after Beech ended its developmental flight tests associated with the 10,000-pound weight increase.

Research concerning the Beech 18's performance parameters with the gross weight increase STC revealed the following: The Federal Aviation Administration's Aircraft Certification Office (ACO), ANM-100L, in Los Angles, California, said that the approval test flight report (TIR-Type Inspection Report) could not be located when the STC's file was reviewed. This was confirmed by an official in the FAA's Washington, D.C., Headquarters Office of Accident Investigation, AAI-200.

According to the enroute climb performance data produced by the STC holder, the Beech 18 should have a single-engine rate of climb of 85 feet per minute at a standard temperature when at 6,000 feet. The performance data showed the airplane should have a single-engine rate of climb of 165 FPM when at 4,000 feet at the same conditions. N80CB's FAA Approved Flight Manual (AFM) performance section showed the standard airplane without the gross weight increase STC can attain an approximate 65 FPM single-engine rate of climb at 6,000 feet, and approximately 163 FPM at 4,000 feet.

The wreckage was released to Mr. Tom DiPiazza, Wisconsin River Aviation, Lone Rock, Wisconsin, on May 7, 1993.

Pilot Information

Certificate:	Airline Transport; Flight Instructor; Commercial	**Age:**	26, Male
Airplane Rating(s):	Multi-engine Land; Single-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; Glider	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	11/23/1992
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	4492 hours (Total, all aircraft), 310 hours (Total, this make and model), 4352 hours (Pilot In Command, all aircraft), 318 hours (Last 90 days, all aircraft), 112 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	BEECH	**Registration:**	N80CB
Model/Series:	E-18S E-18S	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	BA257
Landing Gear Type:	Retractable - Tailwheel	**Seats:**	9
Date/Type of Last Inspection:	04/02/1993, AAIP	**Certified Max Gross Wt.:**	10100 lbs
Time Since Last Inspection:	93 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	15027 Hours	**Engine Manufacturer:**	P&W
ELT:	Installed	**Engine Model/Series:**	R-985-14B
Registered Owner:	ROBERT R. BURWELL	**Rated Power:**	450 hp
Operator:	VIKING EXPRESS, INC.	**Operating Certificate(s) Held:**	On-demand Air Taxi (135)
Operator Does Business As:		**Operator Designator Code:**	CHRA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	**Condition of Light:**	Night/Dark
Observation Facility, Elevation:	MSN, 862 ft msl	**Distance from Accident Site:**	38 Nautical Miles
Observation Time:	0050 CDT	**Direction from Accident Site:**	100°
Lowest Cloud Condition:	Unknown / 900 ft agl	**Visibility**	3 Miles
Lowest Ceiling:	Overcast / 900 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	15°C / 14°C
Precipitation and Obscuration:			
Departure Point:	AURORA, IL (ARR)	**Type of Flight Plan Filed:**	IFR
Destination:	MINNEAPOLIS, MN (MSP)	**Type of Clearance:**	IFR
Departure Time:	0035 CDT	**Type of Airspace:**	Class G

Airport Information

Airport:	TRI-COUNTY REGIONAL (LNR)	**Runway Surface Type:**	
Airport Elevation:	717 ft	**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	VOR
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

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

Administrative Information

Investigator In Charge (IIC):	FRANK S GATTOLIN	**Report Date:**	07/25/1994
Additional Participating Persons:	CHUCK A EBERT; MILWAUKEE, WI CHET J CYBULSKI; MILWAUKEE, WI KENNETH STURKEY; WICHITA, KS		
Publish Date:			
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.ntsb.gov/pubdms/.		