National Transportation Safety Board
Aviation Accident Final Report

Location:	Ft. Lauderdale, FL	**Accident Number:**	NYC07FA234
Date & Time:	09/21/2007, 1328 EDT	**Registration:**	N123MD
Aircraft:	BEECH H-18	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Serious
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

The airplane's right engine experienced a complete loss of power immediately after takeoff and the airplane began to slow. The airplane reached an altitude of approximately 91 feet above ground level and then entered an uncontrolled descent consistent with the onset of a velocity minimum control (Vmc) roll to the right. No evidence of any preimpact failures or malfunctions with either the engine or airframe was discovered, and evidence at the scene indicated that the landing gear had been retracted and the right engine propeller feathered. Examination of the cockpit revealed the right engine fuel selector was positioned between the "60 GAL RIGHT AUX" detent and the "RIGHT ENG OFF" detent. Examination of the fuel system between the selector and the right engine indicated that it was in this position prior to impact. Also, placards next to the fuel selectors stated, "WARNING POSITION SELECTORS IN DETENTS ONLY. NO FUEL FLOW TO ENGINES BETWEEN DETENTS." The pilot loaded the majority of the cargo and performed the weight and balance calculations. Examination of the fuselage revealed that all six cargo bins were full. The investigation also discovered that the furthest aft bin contained 265 pounds of cargo even though placarded for a maximum of 75 pounds. All other bins were loaded considerably below their maximum weight limits. Weight and balance calculations revealed the information listed on the weight and balance form produced by the pilot was erroneous and that the actual center of gravity (CG) of the airplane was rear of the aft CG limit, which would have created instability in the handling characteristics of the airplane, especially after a loss of engine power. In addition, the aft-of-limit CG would have increased the airspeed needed to prevent the airplane from entering a Vmc roll. Performance calculations indicate that with the right engine having lost power immediately after takeoff, the airplane would most likely not have been able to continue the departure on one operating engine.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A total loss of engine power due to fuel starvation as a result of the pilot's failure to place the fuel selector for the right engine in the proper position. Contributing to the accident was the improper loading of the cargo.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. 1 ENGINE
2. FLUID,FUEL - STARVATION
3. (C) FUEL TANK SELECTOR POSITION - IMPROPER - PILOT IN COMMAND

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
4. (F) LOADING OF CARGO - IMPROPER - PILOT IN COMMAND

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

Findings
5. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On September 21, 2007, at 1328 eastern daylight time, a Beech H-18, N123MD, operated by Monarch Air Group, LLC, was destroyed when it impacted terrain during a forced landing after takeoff from Fort Lauderdale Executive Airport (KFXE), Fort Lauderdale, Florida. The certificated airline transport pilot was seriously injured. Visual meteorological conditions prevailed for the cargo flight, destined for Pindling International Airport (MYNN), Nassau, Bahamas. A visual flight rules flight plan was filed for the flight conducted under 14 Code of Federal Regulations Part 135.

According to witness statements, the airplane departed runway 8, and the pilot reported that he could not maintain altitude. The plane was then observed to drift to the south (right) of the extended runway centerline, at an approximate altitude of 150 feet above ground level (agl), and the tail appeared to be "wagging" side to side.

As the airplane approached Interstate 95 (I-95), it then appeared to enter an uncoordinated turn, and the tail of the airplane appeared to skid to the left. The right wing then dropped and the airplane rolled "rapidly" to its right at 50 to 75 feet agl. The nose pitched up and the plane appeared to "hang for a second" with the right side of the fuselage facing the direction of travel, "slightly nose up." A "puff" of smoke was observed as the right wingtip disappeared out of view, the nose then pitched down and the plane disappeared behind trees located along the edge of I-95. About 20 seconds later, smoke was observed rising from the area.

PERSONNEL INFORMATION

According to pilot and Federal Aviation Administration (FAA) records, the pilot held an airline transport pilot certificate with multiple ratings, including airplane multi-engine land. He reported 3,700 total hours of flight experience, with 450 hours in the accident airplane make and model. His most recent FAA first-class medical certificate was issued on May 7, 2007.

AIRCRAFT INFORMATION

According to FAA and maintenance records, the airplane was manufactured in 1964. The airplane's most recent 100 hour inspection was completed on March 26, 2007, and at the time of the inspection, it had accumulated 13,066 total hours of operation.

METEOROLOGICAL INFORMATION

The reported weather at FXE, 11 minutes after the accident, included: wind 120 degrees at 8 knots, visibility 10 miles, thunderstorms and light rain showers, few clouds at 3,700 feet, temperature 30 degrees Celsius, dew point 23 degrees Celsius, and an altimeter setting of 29.94 inches of mercury.

AIRPORT INFORMATION

FXE had two runways, oriented in a 13/31 and 08/26 configuration. Runway 8 was asphalt, grooved, and in good condition. The total length of the runway was 6,001 feet, and its width was 100 feet.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site revealed that the airplane had impacted the northeast corner

of a building with the right wing tip and a portion of the wing was torn away. The airplane then struck a railroad right of way, skipped off of the rails, impacted a chain link fence, and then an inclined swale adjacent to the southbound lane of I-95.

Examination of the main wreckage revealed a wreckage path heading of 157 degrees magnetic. The majority of the fuselage came to rest on a heading of 069 degrees magnetic. The nose section and nose gear wheel well had separated from the fuselage. The left wing had separated from its attach fittings, and was found adjacent to the fuselage. The right wing had also separated from its attach fittings, and was discovered forward of the main wreckage. The majority of the fuselage was found lying on its right side. The cockpit roof and sidewalls were separated from the cockpit floor, and the instrument panel was separated from its mounting location.

Examination of the cockpit revealed that both the left and right electric fuel boost pumps were off, and the throttle control levers were in the full-throttle position. The mixture control levers were in the full-rich position, the propeller control levers were midrange, the landing gear handle was in the retracted position, and the wing flap handle was in the off position.

Examination of the engines revealed that both had separated from their mounts. The left engine's propeller blades exhibited leading edge gouging and chordwise scratching, however, the right engine's propeller blades did not. Further examination of the right engine also revealed that the propeller blades were in the "feathered" position, and only one side of the spinner was crushed. No evidence of any preimpact malfunctions of either engine was discovered. Examination of the right engine's fuel strainer, engine driven fuel pump, and carburetor float bowl revealed that they were devoid of fuel.

Examination of the fuel system revealed that fuel was present in the wing tanks. The left auxiliary wing tank was full and the left main wing tank was half full. The right auxiliary wing tank had been breached, and the right main wing tank was full. Approximately 245 gallons of 100LL aviation gasoline was recovered from the airplane. A fuel sample of the recovered fuel revealed no evidence of contamination.

No evidence of any preimpact malfunctions of the fuel system was discovered; however, the right engine fuel selector was found positioned between the "60 GAL RIGHT AUX" detent and the "RIGHT ENG OFF" detent. When the right engine fuel selector valve was examined, it was discovered that the fuel selector valve position agreed with the position of the right engine fuel selector and that fuel was present in the fuel lines which led from the right main wing tank, and from the right auxiliary wing tank, to the fuel selector valve. No fuel was discovered in the outlet port or the fuel line, which led from the fuel selector valve to the right engine.

TESTS AND RESEARCH

Pilot Statements

According to the pilot, he did not have the electric boost pumps on for takeoff. He had climbed to 250 to 300 feet in altitude and then the airplane started to yaw to the right. He added full power and then declared an emergency. He looked for a place to land and aimed for an area on the other side of Interstate 95. The airplane was descending at 250 feet per minute and "he could not have been in a worse spot to lose his engine" and "he had a 1/2 second to react."

He advised that the company pilots would plan round trip fuel. He would normally monitor the fueling but did not on the day of the accident. He would always visually check the inboard

(Main) fuel tank caps but not the outboard (Auxiliary) fuel tank caps. The flight to MYNN would normally take 1 hour and 15 minutes and they would flight plan for 42 gallons per hour fuel burn.

The pilot would always assist in loading the airplane. On the day of the accident he and the hangar supervisor loaded the airplane, the pilot did the weight and balance calculations himself, and "knew what was in each bin position." He could not remember who secured the cargo straps.

Hangar Supervisor Statements

According to the hangar supervisor, he would normally assist in the loading of the entire airplane but in this particular instance, the pilot had arrived at the airplane before he did and had "80 to 90 percent" of the airplane already loaded. He offered to load the last few items in the rear two bins while the pilot "wrote down" the exact weights for the items that he had placed in the bins.

After loading the last few items, the pilot then asked him to calculate the total weight in each bin and derive a number for the entire airplane load using the numbers the pilot gave him.

He also advised that he attached the right cargo strap but did not secure the left cargo strap as the pilot was the one who closed up the airplane while he was busy entering the cargo weight numbers the pilot provided into the computer.

Airplane Loading

Examination of the interior of the fuselage revealed that the airplane was full of cargo from aft of the pilot compartment to the rear bulkhead of the cabin. Both the left side and right side cargo hold down straps were installed, but only the right side strap had been secured.

Further examination revealed that the interior was subdivided with vertical paint stripes into 7 sections (A through G) to assist in loading. Section "A" was the pilot's compartment, and Sections B through G were designated for the carriage of cargo and were referred to as "Bins." Additionally, each bin was placarded for the maximum weight that could be carried in that bin.

During offloading and weighing of the cargo it was discovered, that Bin G (the furthest aft bin) contained 265 pounds of cargo. The bin was placarded however, for 75 pounds maximum weight.

Moving forward from Bin G, All of the other bins were loaded below their maximum placarded limitations.

Bin F contained 260 pounds of cargo (placarded for 350 pounds), Bin E contained 150.5 pounds of cargo (placarded for 350 pounds), Bin D contained 294.5 pounds of cargo (placarded for 950 pounds), Bin C contained 178 pounds (placarded for 950 pounds), and Bin B contained 647.5 pounds (placarded for 950 pounds).

Weight and Balance Form

A review of the accident flight's Weight and Balance Form, revealed that the maximum allowable operating weight for the airplane was 10,100 pounds and that the maximum allowable aft center of gravity (CG) limit was 120.5 inches aft of the datum. The form also listed the maximum weight limitations for each bin.

Examination of the pilot's weight entries revealed that the entries were below the specified bin limitations but did not agree with the weight of the cargo, which had been recovered from each bin.

According to the pilot's entries, the airplane's actual weight was 9,581 pounds and it was at the aft CG limit of 120.5 inches.

Post accident weight and balance calculations utilizing three different scenarios were performed by the FAA. The first scenario utilized the actual recovered cargo weights, the second scenario shifted the weight forward, and the third scenario utilized the pilot's weight and balance calculations and weight of the fuel recovered at the accident site. Results from these calculations revealed, that the airplane's takeoff weight was at 10,057 to 10,089.5 pounds and the actual CG was rear of the aft limit by 1.2 to 6.1 inches.

Security Camera and Airport Witnesses

Photographic evidence recovered from an airport security camera revealed that the accident airplane after takeoff remained at or below the height of airport's hangars for the duration of the flight and according to a pilot and a ramp agent, who observed the departure, as the airplane reached the departure end of the runway, the right propeller came to a complete stop.

Global Positioning System Data

During examination of the wreckage, a Global Positioning System (GPS) receiver was discovered. Information downloaded from the unit revealed that a tracklog for the accident flight had been recorded. Based on GPS groundspeed and altitude, the accident airplane lifted off at approximately 1327:12, with approximately 3,300 feet of runway remaining. The airplane accelerated for approximately 10 seconds, to a top groundspeed of 109 mph before beginning to decelerate. At this time the airplane was at 29 feet GPS altitude (approximately 20 feet agl) with approximately 2,000 feet of runway remaining including the overrun. The airplane then climbed to a maximum GPS altitude of 100 feet and slowed to 93 mph groundspeed while deviating to the right of runway heading. The final tracklog point was located near the railroad tracks just west of I-95. The last recorded GPS groundspeed was 95 mph and the last recorded GPS altitude was 27 feet.

Airplane Operating Information

During examination of the wreckage, it was discovered that placards were installed next to the fuel selectors, which stated, "WARNING POSITION SELECTORS IN DETENTS ONLY. NO FUEL FLOW TO ENGINES BETWEEN DETENTS." The airplane manufacturer's flight handbook and the operator's "Normal Checklist" for the airplane also required that the fuel selectors be "on MAIN tanks," as part of the pre-start check and that prior to takeoff, that the electric boost pumps be selected "ON."

According to the Beech H18 Flight Handbook, the lowest airspeed at which a pilot could maintain a safe margin of control with one engine inoperative and the other engine operating at full power was 94 mph.

According to the operator's training manual and "Emergency Checklist" for the airplane if an engine failure occurred at or before liftoff, that the takeoff should be aborted and if an engine failure occurred after liftoff, that directional control should be maintained and the airplane accelerated to the single engine best rate of climb speed of 120 mph.

ADDITIONAL INFORMATION

Aircraft Weight and Balance Handbook

According to the FAA's Aircraft Weight and Balance Handbook (FAA-H-8083-1A), there are many factors that lead to efficient and safe operation of aircraft. Among these vital factors is proper weight and balance control.

The weight and balance system commonly employed among aircraft consists of three equally important elements: the weighing of the aircraft, the maintaining of the weight and balance records, and the proper loading of the aircraft. An inaccuracy in any one of these elements nullifies the purpose of the whole system. The final loading calculations will be meaningless if either the aircraft has been improperly weighed or the records contain an error.

Improper loading cuts down the efficiency of an aircraft from the standpoint of altitude, maneuverability, rate of climb, and speed. It may even be the cause of failure to complete the flight, or for that matter, failure to start the flight. Because of abnormal stresses placed upon the structure of an improperly loaded aircraft, or because of changed flying characteristics of the aircraft, loss of life and destruction of valuable equipment may result. The responsibility for proper weight and balance control begins with the engineers and designers, and extends to the aircraft mechanics that maintain the aircraft and the pilots who operate them.

The ideal location of the center of gravity (CG) was very carefully determined by the designers, and the maximum deviation allowed from this specific location was calculated.

The pilot in command of the aircraft has the responsibility on every flight to know the maximum allowable weight of the aircraft and its CG limits. This allows the pilot to determine on the preflight inspection that the aircraft is loaded in such a way that the CG is within the allowable limits.

Balance control (location of the CG of an aircraft) is of primary importance to aircraft stability, which determines safety in flight. The CG is the point at which the total weight of the aircraft is assumed to be concentrated, and the CG must be located within specific limits for safe flight. Both lateral and longitudinal balance are important, but the prime concern is longitudinal balance; that is, the location of the CG along the longitudinal or lengthwise axis.

As long as the CG is maintained within the allowable limits for its weight, the airplane will have adequate longitudinal stability and control. If the CG is too far aft, it will be too near the center of lift and the airplane will be unstable, and difficult to recover from a stall. If the unstable airplane should ever enter a spin, the spin could become flat and recovery would be difficult or impossible.

Airplane Flying Handbook

According to the FAA's Airplane flying Handbook (FAA-H-8083-3A), the flight characteristics of the multiengine airplane will vary significantly with shifts of CG. At forward CGs, the airplane will be more stable, with a slightly higher stalling speed, a slightly slower cruising speed, and favorable stall characteristics. At aft CGs, the airplane will be less stable, with a slightly lower stalling speed, a slightly faster cruising speed, and less desirable stall characteristics. Forward CG limits are usually determined in certification by elevator/stabilator authority in the landing roundout. Aft CG limits are determined by the minimum acceptable longitudinal stability. For this reason, it is contrary to the airplane's operating limitations and the CFRs to exceed any weight and balance parameter.

Corrective Actions

On June 9, 2008, the operator advised the National Transportation Safety Board that in order to enhance safety they made the following changes:

- Added a graphic representation of the CG points on the CG envelope, to further enhance the interpretation of their weight and balance form.

- Reinforced during aircraft specific training that, the cabins of the Beech 18 are clearly marked defining each Bin and its maximum weight and that heavier items should be loaded up front, and that the weight should be gradually decreased as the bins in the rear are loaded. Established that the weight and balance form be used as a go/no go tool, and that pilots should not take off if any of the listed limitations are exceeded, and that cargo should be rearranged or removed to correct out of limit situations.

- Reinforced during pilot loading training to always secure the cargo netting and retention straps to insure loads do not shift in flight.

- Added detail to the weight and balance form, and now save the loading worksheets to crosscheck the entries transferred to the form. Limitations are now also highlighted on the loading worksheet to help in making loading decisions.

- Added a fuel signoff sheet as a fueling aid to confirm the fuel on board the airplane has been verified.

Pilot Information

Certificate:	Airline Transport; Flight Instructor; Commercial	**Age:**	34, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without Waivers/Limitations	**Last FAA Medical Exam:**	05/25/2007
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	04/30/2007
Flight Time:	3700 hours (Total, all aircraft), 450 hours (Total, this make and model), 2600 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	BEECH	**Registration:**	N123MD
Model/Series:	H-18	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	BA-701
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	03/26/2007, 100 Hour	**Certified Max Gross Wt.:**	10100 lbs
Time Since Last Inspection:	67 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	13066 Hours as of last inspection	**Engine Manufacturer:**	P & W
ELT:	Installed, not activated	**Engine Model/Series:**	R985-14B
Registered Owner:	Monarch Air Group	**Rated Power:**	450 hp
Operator:	Monarch Air Group	**Operating Certificate(s) Held:**	On-demand Air Taxi (135)
Operator Does Business As:		**Operator Designator Code:**	XQ0A

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	FXE, 13 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	1339 EDT	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Few / 3700 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.94 inches Hg	**Temperature/Dew Point:**	30°C / 23°C
Precipitation and Obscuration:	Light - In the Vicinity - Showers - Rain; In the Vicinity - Thunderstorms - Rain		
Departure Point:	Ft. Lauderdale, FL (FXE)	**Type of Flight Plan Filed:**	VFR
Destination:	Nassau (MYNN)	**Type of Clearance:**	VFR
Departure Time:	1327 EDT	**Type of Airspace:**	

Airport Information

Airport:	Fort Lauderdale Executive (KFXE)	**Runway Surface Type:**	Asphalt
Airport Elevation:	13 ft	**Runway Surface Condition:**	Dry
Runway Used:	08	**IFR Approach:**	None
Runway Length/Width:	6001 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	26.197222, -80.170556 (est)

Administrative Information

Investigator In Charge (IIC):	Todd G Gunther	**Report Date:**	08/13/2009
Additional Participating Persons:	Carlton L Kitchen; FAA/FSDO; Ft. Lauderdale, FL Paul S Slavin; Monarch Air Group, LLC; Fort Lauderdale, FL		
Publish Date:	09/28/2009		
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/.		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.