



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Winchester, TN	<b>Accident Number:</b>	ERA15LA190
<b>Date &amp; Time:</b>	04/18/2015, 1452 CDT	<b>Registration:</b>	N9680M
<b>Aircraft:</b>	MOONEY M20C	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Aircraft loading event	<b>Injuries:</b>	2 Serious, 3 Minor
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Personal		

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## Analysis

The private pilot attempted to take off in a four-seat airplane with five adults onboard. A witness reported that the airplane lifted off about halfway down the 5,002-ft-long runway and momentarily climbed, then "suddenly dropped" and impacted terrain at the end of the runway. Review of weight and balance information indicated that the airplane was loaded at least 290 lbs above its maximum gross weight of 2,575 lbs. Had the airplane been loaded within limits, it could have taken off and cleared a 50-ft obstacle within a distance about 1,700 ft. Examination of the wreckage did not reveal evidence of any preimpact mechanical malfunctions. It is likely that the airplane's performance was significantly reduced given its gross weight, and that the pilot exceeded the critical angle of attack during the initial climb, which resulted in an aerodynamic stall.

## Probable Cause and Findings

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

The pilot's inadequate weight and balance and performance planning, including his decision to take off with more passengers than permitted, and his exceedance of the airplane's critical angle of attack during the initial climb, which resulted in an aerodynamic stall and impact with terrain.

## Findings

<b>Aircraft</b>	Maximum weight - Capability exceeded (Cause) Angle of attack - Not attained/maintained (Cause)
<b>Personnel issues</b>	Decision making/judgment - Pilot (Cause) Weight/balance calculations - Pilot (Cause)

## Factual Information

On April 18, 2015, about 1452 central daylight time, a Mooney M20C, N9680M, impacted terrain shortly after takeoff from runway 18 at the Winchester Municipal Airport (BFG), Winchester, Tennessee. The private pilot and two passengers received minor injuries, two passengers received serious injuries. The airplane sustained substantial damage to both wings and fuselage. Visual meteorological conditions prevailed and no flight plan was filed for the local flight. The airplane was privately owned and operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. The flight was originating at the time of the accident.

The pilot reported that after takeoff, the airplane's engine "lost power" and "put it down in a field across from the end of the runway" to avoid power lines. The pilot also stated that there were five people onboard the airplane. The airplane had four seats, and a baggage area located behind the rear seats.

A witness, who worked at the airport, stated that she watched the airplane lift off about halfway down the 5,002-ft-long runway and it did not seem to have the proper lift. The airplane seemed to gain altitude then sink as it made a slight left turn at the end of the runway. The airplane then suddenly dropped out of sight.

Examination of the wreckage at the scene by a Federal Aviation Administration (FAA) inspector revealed that the airplane impacted a grass field about a 1/4 mile south of the runway and came to rest on the edge of a roadway. Both propeller blades exhibited leading edge gouging and chordwise scratches. One blade exhibited aft "s" bending; the other was bent forward about mid span. Recovery personnel drained about 30 gallons of fuel from the airplane at the scene.

A postaccident examination of the engine was conducted by an FAA inspector at a secure facility. Engine crankshaft continuity was confirmed on all cylinders, valves, and accessory gears. Continuity of the valvetrain was verified through a thumb compression test. The spark plugs were removed and inspected; each displayed a light gray color. The carburetor bowl was examined and was found to be free of debris. The bowl contained fuel and about 1/2 teaspoon of water.

The 1435 recorded weather observation at BGF included wind 170 at 5 knots, visibility 10 miles with few clouds at 8000 feet, temperature 79 degrees F, dew point 57 degrees F; barometric altimeter 29.93 inches of mercury.

Review of records revealed that the airplane's basic empty weight was 1,620.8 lbs., with a maximum gross takeoff weight of 2,575 lbs., resulting in a useful load of 954.2 lbs. According to drivers' license records, the five occupants weighed a total of 1,065 lbs., which added to the weight of the fuel (180 lbs.) resulted in a gross weight that was 290.8 lbs. above the airplane's maximum gross weight, not accounting for any baggage. Review of a takeoff performance chart for the airplane revealed that for the given altitude and temperature, the airplane required

about 1,700 feet to takeoff and clear a 50-ft obstacle; however, that data assumed the airplane weighed 2,575 lbs.

## History of Flight

Prior to flight	Aircraft loading event (Defining event)
Initial climb	Off-field or emergency landing
Landing	Collision with terr/obj (non-CFIT)

## Pilot Information

Certificate:	Private	Age:	31, Male
Airplane Rating(s):	Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Unknown
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 3 Without Waivers/Limitations	Last FAA Medical Exam:	07/16/2013
Occupational Pilot:	No	Last Flight Review or Equivalent:	10/25/2013
Flight Time:	63 hours (Total, all aircraft), 999999 hours (Total, this make and model)		

## Aircraft and Owner/Operator Information

Aircraft Make:	MOONEY	Registration:	N9680M
Model/Series:	M20C	Aircraft Category:	Airplane
Year of Manufacture:	1967	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	670016
Landing Gear Type:	Retractable - Tricycle	Seats:	4
Date/Type of Last Inspection:	01/25/2015, Annual	Certified Max Gross Wt.:	2575 lbs
Time Since Last Inspection:	9 Hours	Engines:	1 Reciprocating
Airframe Total Time:	3031 Hours as of last inspection	Engine Manufacturer:	Lycoming
ELT:	Installed	Engine Model/Series:	O-360
Registered Owner:	Pressley, Brent, DBA Smokey Mountain Aeroplanes	Rated Power:	180
Operator:	On file	Operating Certificate(s) Held:	None

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KBGF, 979 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	1935 CDT	Direction from Accident Site:	358°
Lowest Cloud Condition:	Few / 8000 ft agl	Visibility	10 Miles
Lowest Ceiling:		Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	170°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	29.93 inches Hg	Temperature/Dew Point:	26° C / 14° C
Precipitation and Obscuration:			
Departure Point:	Winchester, TN (BGF)	Type of Flight Plan Filed:	None
Destination:	Winchester, TN (BGF)	Type of Clearance:	None
Departure Time:	1452 CDT	Type of Airspace:	

## Airport Information

Airport:	WINCHESTER MUNI (BGF)	Runway Surface Type:	Asphalt
Airport Elevation:	979 ft	Runway Surface Condition:	Dry
Runway Used:	18	IFR Approach:	None
Runway Length/Width:	5002 ft / 75 ft	VFR Approach/Landing:	None

## Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:	2 Serious, 2 Minor	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Serious, 3 Minor	Latitude, Longitude:	35.167500, -86.065833 (est)

## Preventing Similar Accidents

Minding Weight, Maintaining Balance

### **Improper or Unperformed Calculations Can be Fatal**

#### **The problem**

Between 2008 and 2016, the probable causes of 136 general aviation (GA) accidents were related to pilots improperly conducting preflight performance calculations for weight and balance or not conducting them at all. One-third of these accidents resulted in pilot and/or passenger deaths.

If pilots do not perform preflight calculations to verify that their aircraft are within allowable weight and center of gravity (CG) limits, the aircraft could be operated in exceedance of their certificated takeoff gross weight and/or outside CG limits.

Overloading aircraft or operating outside of the CG limits can severely degrade an aircraft's performance characteristics and ultimately lead to an aerodynamic stall and/or loss of aircraft control, typically during takeoff or landing.

Not accounting for atmospheric conditions—such as wind, high temperature, and high-density altitude—on an aircraft's performance can exacerbate the effects of operating outside of weight and CG limits. Even if an aircraft is under or near its maximum gross takeoff limit, atmospheric conditions can degrade the aircraft's performance enough to prevent it from attaining or maintaining a climb.

### **Related accidents**

The following examples from the National Transportation Safety Board's (NTSB) accident database show the diverse circumstances under which these types of accidents happen:

- An airline transport pilot was conducting a flight from a fishing lodge to a remote fishing location in a float-equipped de Havilland DHC-3T (Otter) airplane, which impacted tundra-covered terrain just after takeoff from a lake. Three passengers were killed, the pilot and four passengers sustained serious injuries, and two passengers sustained minor injuries. According to a witness, after liftoff, the airplane began to climb and then descended. The floats struck the water, then the airplane briefly became airborne again before crashing. The pilot reported that, before departure, the front and center fuel tanks were filled and that the aft fuel tank had "residual" fuel. He said that he "guesstimated" the airplane's weight and balance before departure (he did not weigh the cargo, obtain passenger weights, or document any weight and balance calculations). A postaccident weight and balance study using the passenger weights, weighed cargo, and fuel load showed that the airplane exceeded its maximum gross weight by about 508.6 lbs and that the CG was 4.08 inches aft of the aft CG limit. The pilot's failure to determine the airplane's actual preflight weight and CG led to the airplane being operated outside of its weight and CG limits, preventing it from attaining a proper airspeed and ultimately resulting in an aerodynamic stall. ([ANC15FA071](#))
- A Robinson R22 Beta II helicopter sustained substantial damage when it collided with rising terrain 10 miles west of its departure point. The private pilot sustained a serious injury, and the passenger sustained a minor injury. The pilot reported that, as he was flying the helicopter up a canyon and climbing in rising mountainous terrain, he noticed a substantial tailwind gust, followed by a decrease in airspeed below effective translational lift. The helicopter stopped climbing, and the pilot immediately made a left turn with the intention of reversing course and turning into the wind. However, the helicopter impacted rising terrain. The investigation determined that the helicopter was operating about 30 lbs above its maximum gross weight and that the calculated density altitude was about 9,600 ft. The pilot did not know that the helicopter's gross weight was greater than its maximum due to inadequate preflight planning. His subsequent decision to attempt to climb over rising terrain in high-density altitude conditions with a

tailwind resulted in the helicopter's inability to maintain a positive climb rate and subsequent impact with terrain. ([GAA15LA131](#))

- A Beech 100 ran off the departure end of the runway during takeoff, substantially damaging the airplane. The airline transport pilot, copilot, and eight passengers were not injured. During the takeoff roll, the airplane did not accelerate as quickly as the pilot expected. When the airplane reached the last third of the runway, the pilot pulled back on the control yoke to lift the airplane off the runway, but the stall warning horn sounded. He lowered the nose, but the airplane subsequently departed the runway and impacted terrain and obstacles. The pilot reported that he knew that the total weight of the eight passengers, their bags, and the fuel caused the airplane to be overweight, but he did not complete a weight and balance form or determine the expected takeoff performance before the flight. After the accident, the pilot determined that the airplane was 623 lbs over its maximum gross weight. The pilot's decision to depart knowing that the airplane was over its maximum gross takeoff weight was unsafe. Coupling that decision with the pilot's failure to determine the expected takeoff performance resulted in the airplane not accelerating as expected and its subsequent runway excursion. ([CEN17LA029](#))
- A flight instructor and student pilot were conducting an instructional flight in an Aeronca 11AC airplane when it impacted trees at the departure end of the runway, resulting in minor injuries to the student. The flight instructor reported that, during the takeoff climb from a grass runway, the "climb rate became stagnant." He added that he instructed the student to "lower the nose slightly," but the airplane still could not establish a "normal climb rate." After taking over the flight controls, the flight instructor turned the airplane toward a small gap in the tree line ahead, and the airplane subsequently impacted the trees. According to the flight instructor, the airplane departed "loaded at gross weight." The student reported that the flight instructor did not discuss the airplane's weight and balance with him before the flight. Postaccident weight and balance calculations revealed that the airplane was 139 lbs over its maximum gross weight, and the calculated density altitude was about 2,648 ft. The airplane's overweight condition, in combination with the takeoff in high-density altitude conditions from a turf runway, decreased the airplane's takeoff performance and resulted in the accident. ([GAA17CA347](#))

## What can pilots do?

- **Know** your aircraft's limitations and the factors that can affect its performance.
- **Conduct** weight and balance calculations in accordance with the applicable aircraft flight manuals (AFM) to ensure that your aircraft is loaded within its weight and CG limits. The limitations section of each AFM or Pilot's Operating Handbook contains details about the maximum weight and CG limits for takeoff and landing.
- **Be prepared** and conduct takeoff and landing distance calculations as part of your preflight planning. Remember to account for fuel burn during flight, which will result in a CG shift and decrease in weight.
- **Be aware** of the atmospheric conditions that exist at the time throughout your flight and account for these factors in all your performance calculations.
- **Remember** that operating the aircraft above its maximum gross weight can result in a longer takeoff run due to the airplane's slower acceleration and the need for a higher

takeoff speed; shallower climb angles and reduced climb rates; reduced cruising speed; shorter range; higher stall speeds; and longer landing rolls.

- **Be aware** that operating an aircraft outside of its CG limits can degrade its handling qualities, resulting in reduced stability and/or reduced control authority, which increases the risk of a loss of control. Be vigilant on every flight.
- **Determine** the CG even if your aircraft is under its maximum gross weight. Even if an aircraft is within its allowable gross weight, it may be loaded outside of its CG limits.
- **Do not “guesstimate”** passenger and cargo weights. The margins of error are small, and even slightly underestimating these weights could kill or seriously injure you, a friend or colleague, or a family member.
- When using automated weight and balance application calculators, **ensure** that the basic empty weight and moment match the specific values for your aircraft. Sample weight and balance data should never be used as a substitute for actual numbers in the AFM.
- If any major modifications to your aircraft change its weight or CG, such as the installation of onboard equipment, **ensure** that this information is in the updated weight and balance forms contained in the AFM.
- **Remember** that aircraft performance can only be determined after the gross weight is computed. Professional flight crews do these computations routinely. You should strive for professionalism as well when you are planning your flights.

## **REMEMBER — Before Every Flight, Ensure That Your Aircraft Can Operate Safely**

### **Interested in more information?**

Education and training are essential to improving GA safety. The Federal Aviation Administration (FAA) Safety Team ([FAASTeam](#)) provides access to online training courses, seminars, and webinars as part of the FAA’s “WINGS—Pilot Proficiency Program.” The program includes targeted flight training designed to help pilots develop the knowledge and skills needed to achieve flight proficiency and to assess and mitigate the risks associated with the most common causes of accidents, including operating outside of weight and CG limits. The courses and resources listed below (among others), as well as seminar and webinar information, can be accessed from the FAASTeam website at [www.faasafety.gov](http://www.faasafety.gov) through an existing account or creation of a free FAASTeam account.)

- [Performance Limitations](#)
- [Helicopter - Weight & Balance, Performance](#)
- [Weight and Balance P-8740-05](#)

FAA-H-8083-1, “[Weight and Balance Handbook](#),” and FAA-H-8083-21A, “[Helicopter Flying Handbook](#)” both provide pilots with information on loading and operating aircraft and emphasize the importance of ensuring that the weight and CG are within the allowable limits. The handbooks also describe the negative effects of overloading an aircraft and operating an aircraft outside of CG limits. The handbooks provide exemplar loading computations for GA aircraft and corresponding loading graphs and tables of weight and moment indexes. Both handbooks can be accessed from the FAA’s website at [www.faa.gov](http://www.faa.gov).

A companion [video](#) to this safety alert can be accessed from the [Aviation Safety Alerts](#) link.

The NTSB's Aviation Information Resources web page, [www.nts.gov/air](http://www.nts.gov/air), provides convenient access to NTSB aviation safety products. This safety alert and others can be accessed from the Aviation Safety Alerts link at [www.nts.gov](http://www.nts.gov).

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

### Administrative Information

<b>Investigator In Charge (IIC):</b>	Douglass P Brazy	<b>Report Date:</b>	07/16/2018
<b>Additional Participating Persons:</b>	Doyle Ferguson; Federal Aviation Administration; Nashville, TN		
<b>Publish Date:</b>	07/16/2018		
<b>Note:</b>	The NTSB did not travel to the scene of this accident.		
<b>Investigation Docket:</b>	<a href="http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=91052">http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=91052</a>		

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](#).