National Transportation Safety Board
Aviation Accident Final Report

Location:	Santa Teresa, NM	**Accident Number:**	CEN18LA383
Date & Time:	08/31/2018, 1700 MDT	**Registration:**	N747DA
Aircraft:	Piper PA46	**Aircraft Damage:**	Substantial
Defining Event:	Runway excursion	**Injuries:**	6 None
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The pilot and five passengers were departing the airport on an international cross-country flight. The pilot attempted an intersection takeoff in high density altitude conditions over the airplane's maximum gross weight. The airplane would not become airborne, so the pilot back taxied and attempted to take off on the full length of another runway. The airplane lifted off but was not climbing, so the pilot lowered the nose and the airplane hit the runway hard. The airplane veered right and exited the runway surface, which resulted in substantial damage to the wings. The pilot reported that there were no mechanical malfunctions or failures with the airplane or engine that would have precluded normal operation and that he attempted the takeoff in an overweight airplane at a high density altitude. Calculations showed that the airplane's maximum gross takeoff weight was exceeded by at least 300 lbs, and the density altitude was about 6,900 ft.

Probable Cause and Findings

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

The pilot's decision to attempt to take off in an overweight airplane in high density altitude conditions, which resulted in the airplane's inability to climb, an aborted takeoff, and a subsequent runway excursion.

Findings

Aircraft	Maximum weight - Capability exceeded (Cause)
Personnel issues	Decision making/judgment - Pilot (Cause)
Environmental issues	High density altitude - Effect on operation (Cause)

Factual Information

On August 31, 2018, about 1700 mountain daylight time, a Piper PA46-350P airplane, N747DA, registered to a private individual, sustained substantial damage during an aborted takeoff from the Dona Ana International Jetport (DNA), Santa Teresa, New Mexico. All 6 occupants, the private pilot and 5 passengers, were not injured. Visual meteorological conditions prevailed and a flight plan was not filed. The personal cross country flight was conducted under the provisions of Title 14 *Federal Code of Regulations* Part 91. The flight's intended destination was Chihuahua, Mexico.

After refueling and loading the passengers and baggage, the pilot taxied to the intersection of taxiway Delta and runway 10 at DNA. With 10° of flaps and full throttle, the pilot began the takeoff on runway 10 from the intersection. The airplane did not lift off, so the pilot stopped the takeoff and back taxied to the end of the reciprocal runway (runway 28). The pilot reported that the wind was calm. With 20° of flaps and full throttle, the pilot started to takeoff, using the full length of runway 28. Approaching 60-70 knots, the airplane started to liftoff, but was not climbing. The pilot then lowered the nose toward the runway. The airplane hit the runway hard, veered to the right, and exited the runway. After the airplane came to a stop in the grass, all occupants exited. During the excursion, the left main landing gear collapsed. The top of the left wing was punctured and the right wing's leading edge was buckled and dented along the span of the front spar.

The pilot reported on the National Transportation Safety Board Accident Report Form 6120 that he took off overweight and at a high density altitude. The pilot also indicated on the form that there were no mechanical anomalies with the airplane that would have precluded normal operations. Data from the aircraft's weight and balance sheet (dated June 8, 2008), fuel logs, and estimated pilot/passenger weights were used to calculate the airplane's takeoff weight at the time of the accident. The calculations estimated the takeoff weight to be about 4,675 lbs., without baggage. Fixed Base Operator personnel reported that a large amount of baggage was loaded onto the airplane before takeoff; however, the weight of this baggage was not known. The maximum takeoff weight for the airplane was 4,358 lbs. the density altitude was approximately 6,900 ft.

History of Flight

Prior to flight	Aircraft loading event
Takeoff	Runway excursion (Defining event)

Pilot Information

Certificate:	Private	**Age:**	56, Male
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without Waivers/Limitations	**Last FAA Medical Exam:**	05/26/2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	04/12/2014
Flight Time:	(Estimated) 1500 hours (Total, all aircraft), 700 hours (Total, this make and model), 30 hours (Last 90 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N747DA
Model/Series:	PA46 350P	**Aircraft Category:**	Airplane
Year of Manufacture:	2008	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	4636445
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	07/26/2017, Annual	**Certified Max Gross Wt.:**	4299 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	1277 Hours as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	TIO-540-AE2A
Registered Owner:	On file	**Rated Power:**	350 hp
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:	DNA, 4112 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	1656 MST	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.9 inches Hg	**Temperature/Dew Point:**	30°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Santa Teresa, NM (DNA)	**Type of Flight Plan Filed:**	None
Destination:	Chihuahua, FN	**Type of Clearance:**	None
Departure Time:	1700 MDT	**Type of Airspace:**	Class E

Airport Information

Airport:	Dona Ana County Int Jetport (DNA)	**Runway Surface Type:**	Asphalt
Airport Elevation:	4112 ft	**Runway Surface Condition:**	Dry
Runway Used:	28	**IFR Approach:**	None
Runway Length/Width:	9550 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	5 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	6 None	**Latitude, Longitude:**	31.880556, -106.703333 (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 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.

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.ntsb.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.ntsb.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

Investigator In Charge (IIC):	Alexander Lemishko	**Report Date:**	06/03/2020
Additional Participating Persons:	Raymond Romero; FAA FSDO; Albuquerque, NM		
Publish Date:	06/03/2020		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=98326		