

On July 23, 2015, about 1045 eastern daylight time, a North American Navion, N91418, was substantially damaged when it impacted trees and a pond shortly after takeoff from Eagles Nest Airport (W13), near Waynesboro, Virginia. The private pilot sustained minor injuries and the passenger sustained serious injuries. Visual meteorological conditions prevailed, and a flight plan was filed for the personal flight to Sullivan County International Airport (MSV), Monticello, New York. The flight was operated under the provisions of 14 Code of Federal Regulations Part 91.

The pilot stated he and his wife were planning a several week vacation. He loaded the back seat and cargo area with baggage and purchased 26.7 gallons of fuel from the local fixed base operator, topping off both wing fuel tanks and the fuselage-mounted auxiliary fuel tank with a total of 60 gallons. He stated that he had never completely filled the auxiliary tank before, but had been flying with about 10 gallons in the tank for a while and felt that the effect would be "negligible."

The engine run-up and taxi were normal. The airplane departed runway 24, a 2,004-foot-long, 50-foot-wide, paved runway at a field elevation of 1,436 feet. The pilot did not notice any issues until the initial rotation and climb. The pilot reported that normally the airplane would lift up on its own and "float" up. He rotated the airplane at 65 mph and took off, but, during the rotation, the airplane did not climb nor did the airspeed increase. The pilot leveled the airplane briefly to achieve 70 mph, and then increased pitch, but it did not climb and the airspeed started to decay. He added that the 85 mph is normal for climbout. The passenger stated that, "the takeoff at first was fine, but then [I] noticed it was a little sluggish off the ground."

The airport manager witnessed the loading of baggage, the fueling and the takeoff. He reported that, "... it seemed like a lot of luggage for that type of aircraft." The manager continued to watch the takeoff and reported that it "appeared to take longer than normal" and that, "it really shot up" to a nose high pitch and climbed to about fifteen feet in the air, before settling back down to 4 to 5 feet above the runway. The wings wobbled back and forth as it flew down the length of the runway before it hit trees and disappeared. Another witness near the accident site described the engine as sounding very strong during the takeoff roll, but when the airplane rotated, it appeared to lose lift and could not climb out of ground effect.

The airplane departed the runway area, struck a narrow line of brush and sapling trees, and came to rest inverted in an irrigation pond that was located about 770 feet beyond the departure end of runway 24. The first ground impact marks were located 574 feet from the departure end of the runway. Cleanly cut and snapped tree branches were located at 650 feet, and the direction of travel from the first ground contact to the main wreckage was about 230 degrees magnetic.

The wreckage was examined at the accident site by Federal Aviation Administration inspectors, and all major components of the airplane were accounted for at the scene. The airplane came to rest upside down in approximately 4 feet of water with the engine and cockpit submerged. Examination revealed substantial damage to the wings, fuselage, and empennage. Both wings remained attached to the fuselage. The entire empennage was twisted and ripped from the fuselage, but remained attached via

the control cables. The rudder and elevator remained attached and operational. The engine separated from the top of the firewall but remained partially attached to the bottom. The propeller hub remained attached to the crankshaft, and the spinner was crushed onto the propeller hub. One propeller blade displayed chordwise gouges across the leading edge and forward face. It was also gouged at the tip and exhibited span-wise twisting. The opposing propeller blade separated from the hub during the accident sequence and was not recovered. Control continuity was confirmed from the cockpit to each control surface.

Examination of the engine and airframe revealed no evidence of any preimpact anomalies or mechanical malfunctions that would have precluded normal operation. The oil filter was absent of metallic debris. Examination of the carburetor and fuel screen did not reveal any anomalies. Rotation of the crankshaft produced compression and suction at each cylinder. One spark plug was initially covered in mud but all spark plugs' electrodes were intact and they exhibited "normal" operating signatures. Both magnetos functioned "normally."

Various pieces of luggage, including a backpack, duffle bag, computer case, and several midsize overnight bags were recovered from the scene, and a witnesses who watched as the airplane was loaded described that the back seat and cargo area had been filled with luggage.

The pilot, age 65, held a private pilot certificate for airplane single-engine land, and a third-class airman medical certificate issued on August 8, 2013, with limitations/waivers for the wearing of corrective lenses. The pilot's latest flight review was conducted in the accident airplane on December 13, 2014. The pilot reported 467 total flight hours with 28 hours in make and model.

The airplane four-seat, low-wing, retractable landing gear-equipped airplane was manufactured in 1946. It was powered by a Continental E-185-3, 185-horsepower engine driving a two-blade Hartzell, controllable pitch propeller. Review of maintenance logbooks showed an annual inspection was completed October 1, 2014, at a recorded tachometer reading of 2,395.17. The engine had been operated about 130 hours since its most recent overhaul.

According to the airplane records, the airplane's maximum gross weight was 2,750 pounds with an empty weight of 1,644.30 pounds, and a useful load of approximately 1,106 pounds. The pilot reported that he performed a weight and balance calculation prior to the accident flight, but that he had not documented it in writing. He estimated that the gross weight of the airplane at the time of the accident was 2,557 pounds. Post-accident examination of the airplane's contents revealed that it contained about 90 pounds of cargo in the aft seating area and 107 pounds in the cargo compartment. The pilot weighed 210 pounds and the front passenger weighed 130 pounds. The airplane's main fuel tanks and fuselage auxiliary fuel tank were each topped off with 20 gallons of fuel, for a total of 360 pounds. Based on the weight of the cargo, fuel, and the pilot and passenger weights, the airplane's weight at the time of the accident was calculated as 2,538.3 pounds. The airplane's forward and aft center of gravity (CG) limits at this takeoff weight were 95.0 inches and 103.4 inches aft of datum, respectively. The airplane's estimated center of gravity at the time of the accident was 102.54 inches aft of datum, which, while in

the acceptable range, was .86 inches from the aft most acceptable position.

Extrapolations using Review of A the airplane take-off and climb performance data showed that at the estimated gross weight of 2,538 pounds at a field elevation of 1,436 feet and a density altitude of 2,200 feet, the airplane would have required about 1,100 feet of ground roll, and 1,800 feet to clear a 50-foot obstacle.

The weather conditions reported at Shenandoah Valley Regional Airport, (SHD) Harrisonburg, Virginia, located about 11 miles north of the accident site, at an elevation 1,200 feet, included calm winds, visibility of statute 10 miles, with no clouds or visibility restrictions. The temperature was 27 degrees C, with a dew point of 15 degrees C, and a barometric altimeter setting of 30.04 inches of mercury. The calculated density altitude was about 2,200 ft.

According to the FAA Airplane Flying Handbook, at forward CG loadings, an airplane will be more stable, with a slightly higher stalling speed, a slightly slower cruising speed, and favorable stall characteristics. At aft CGs, an airplane will be less stable, with a slightly lower stalling speed, a slightly faster cruising speed, and less desirable stall characteristics.

According to the FAA Pilot's Handbook of Aeronautical Knowledge, balance refers to the location of the CG of an aircraft, and is important to stability and safety in flight. The CG is a point at which the aircraft would balance if it were suspended at that point. The primary concern in balancing an aircraft is the fore and aft location of the CG along the longitudinal axis. The CG is not necessarily a fixed point; its location depends on the distribution of weight in the aircraft. As variable load items are shifted or expended, there is a resultant shift in CG location. The distance between the forward and back limits for the position of the center for gravity or CG range is certified for an aircraft by the manufacturer. The pilot should realize that if the CG is displaced too far forward on the longitudinal axis, a nose-heavy condition will result. Conversely, if the CG is displaced too far aft on the longitudinal axis, a tail heavy condition results. It is possible that the pilot could not control the aircraft if the CG location produced an unstable condition.

Loading in a nose-heavy condition causes problems in controlling and raising the nose, especially during takeoff and landing. Loading in a tail heavy condition has a serious effect upon longitudinal stability, and reduces the capability to recover from stalls and spins. Tail heavy loading also produces very light control forces, another undesirable characteristic.