



# Aviation Investigation Final Report

<b>Location:</b>	Orlando, Florida	<b>Accident Number:</b>	WPR18LA179
<b>Date &amp; Time:</b>	June 25, 2018, 08:15 Local	<b>Registration:</b>	N60E
<b>Aircraft:</b>	Cessna 340A	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Runway excursion	<b>Injuries:</b>	4 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

The pilot reported that engine start, run-up, and taxi were all normal in preparation for the personal flight. The pilot began the takeoff roll using the full length of the dry, paved 6,000-ft runway, but shortly thereafter he felt a "sudden lag." The maximum speed he observed on the airspeed indicator was 43 knots, and the airspeed indicator needle "seemed to be fluttering." He confirmed that the engine controls were properly set and then decided to discontinue the takeoff about halfway down the runway by reducing power and applying the brakes and spoilers to decelerate the airplane. The airplane did not appear likely to stop before overrunning the end of the runway, so the pilot steered the airplane to the right as it ran off the runway end. The airplane impacted and stopped in a culvert about 500 ft beyond the runway and sustained substantial damage to the fuselage nose.

Postaccident examination of the airplane, airspeed indication system, and engines did not reveal any preimpact mechanical malfunctions or failures that would have precluded normal operation. Several months after the accident, the airplane was repaired, and engine test runs revealed two minor but unrelated turbocharger problems. One problem affected the left engine, and the other affected the right engine, but they did not manifest themselves concurrently. In each case, the affected engine did not develop full rpm, but the other engine did develop full rpm. The investigation was unable to determine whether these problems existed at the time of the accident takeoff. If they did exist, unless they occurred simultaneously, they would have manifested as a significant asymmetric thrust between the two engines, which would have been obvious to the pilot. The pilot did not report any shortcomings in engine rpm or such thrust asymmetry. The airplane was subsequently ferried to its destination, and both engines operated normally for that flight.

Accident site review revealed that the airplane traversed a total distance of about 6,500 ft during its takeoff roll and stop. Calculations performed postaccident indicate that, with a normal acceleration to 43 knots, had the airplane continued at that speed, it would have taken 35 seconds to reach the halfway point of the runway, at which point the pilot would have had 3,000 ft remaining to stop from 43 knots, which should have been sufficient.

The investigation was unable to determine the reason for the airplane not accelerating above 43 knots. However, the pilot's delay in aborting the takeoff when the airplane did not accelerate above 43 knots resulted in the runway overrun.

## Probable Cause and Findings

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

The pilot's delayed decision to discontinue the takeoff when confronted with abnormal acceleration and airspeed indication; the reason for the abnormal acceleration could not be determined based on the available information.

### Findings

Not determined	(general) - Unknown/Not determined
Personnel issues	Identification/recognition - Pilot
Personnel issues	Delayed action - Pilot

# Factual Information

## History of Flight

Takeoff	Miscellaneous/other
Takeoff-rejected takeoff	Runway excursion (Defining event)

On June 25, 2018, about 0815 eastern daylight time, a Cessna 340A airplane, N60E, overran the runway during an aborted takeoff at Orlando Executive Airport (ORL), Orlando, Florida. The private pilot and 3 passengers were not injured. The airplane was substantially damaged when it encountered a drainage culvert after it exited the paved runway surface. The airplane was registered to Little Dreams Aviation, and operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions existed at ORL about the time of the accident. The flight was originating from ORL when the accident occurred.

According to the pilot the airplane remained unhangared at ORL for about a week before the accident. On the day of the accident the engine start, run-up, and taxi were all normal. The pilot began the takeoff roll using the full length of runway 7. He reported that at first, the takeoff roll and acceleration seemed normal, but then he felt a "sudden lag in...forward motion." The pilot stated that the maximum speed he observed on the airspeed indicator (ASI) was 43 knots, and that the ASI needle "seemed to be fluttering" at that speed, and was no longer indicating an increase in speed. Those observations prompted the pilot to verify that the mixture, propeller, and throttle controls were fully forward, which they were. The pilot did not observe or report any explicit engine problems or asymmetric power. However, based on the "lag" sensation and the ASI indications, the pilot decided to discontinue the takeoff.

The pilot said that he began the abort procedure when the airplane was about half-way down the runway, and that he "pulled power" and used the brakes and spoilers to decelerate the airplane. He determined that the airplane did not appear likely to stop before overrunning the end of the runway, and in order to avoid a collision with antennae and lights beyond the runway end, he steered the airplane off the right side of the end of the runway. The airplane tracked though grass for a distance, and then struck and stopped in a drainage culvert that was oriented parallel to the runway. The pilot shut down the airplane and the occupants exited.

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	55,Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 With waivers/limitations	<b>Last FAA Medical Exam:</b>	May 31, 2018
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	May 11, 2018
<b>Flight Time:</b>	1078 hours (Total, all aircraft), 33 hours (Total, this make and model), 997 hours (Pilot In Command, all aircraft), 33 hours (Last 90 days, all aircraft), 24 hours (Last 30 days, all aircraft)		

Federal Aviation Administration (FAA) records indicated that the pilot held a private pilot certificate with airplane single-engine land, multi-engine land, and instrument airplane ratings. The pilot reported that he had a total flight experience of about 1,078 hours, including about 396 hours in multi-engine aircraft, and about 33 hours in the accident airplane make and model. His most recent flight review was completed in May 2018, and his most recent FAA third-class medical certificate was also issued in May 2018.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N60E
<b>Model/Series:</b>	340A A	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1979	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	340A0663
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	
<b>Date/Type of Last Inspection:</b>	October 2, 2017 Annual	<b>Certified Max Gross Wt.:</b>	6390 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	2 Reciprocating
<b>Airframe Total Time:</b>	4518 Hrs	<b>Engine Manufacturer:</b>	CONT MOTOR
<b>ELT:</b>	Installed	<b>Engine Model/Series:</b>	TSIO-520 SER
<b>Registered Owner:</b>		<b>Rated Power:</b>	335 Horsepower
<b>Operator:</b>		<b>Operating Certificate(s) Held:</b>	None

The airplane was manufactured in 1979, and was equipped with two Continental Motors TSIO-520 series engines. The airplane was registered to the pilot on March 27, 2018. The pilot reported that the airplane had a total time (TT) in service of about 4,518 hours. The left engine had a TT of about 2,642 hours, and a time since major overhaul (TSMOH) of about 385 hours. The right engine had a TT and

TSMOH of about 1,043 hours. The airplane's most recent annual inspection was completed in October 2017.

In 1998 the airplane was modified by RAM Aircraft Corporation to install multiple engine, propeller, and airframe modifications intended to improve overall airplane performance. In addition, the modification package provided an increase in the airplane maximum allowable takeoff weight from the Cessna value of 5,990 lbs to the RAM value of 6,390 lbs. Airplane documentation indicated that RAM included a modified "Operations Manual" and a "Supplemental Flight Manual" to reflect the operational and performance changes.

The airplane was equipped with a single pitot tube, which was mounted on the lower portion of the fuselage nose. Two static ports, one per side, were mounted on the fuselage nose. The pilot reported that he had covered the pitot tube during the week the airplane was in ORL, but that he did not, and normally did not, cover the static ports. He reported that during his preflight inspection, he removed the pitot cover, inspected all three articles, and did not detect any anomalies.

The airplane was equipped with a total of three airspeed indication displays. Two, one each per left and right side instrument panel, were the standard 3" diameter mechanical-pneumatic analog devices. The third display was a digital value presented on the Garmin Primary Flight Display (PFD) that was installed on the left side instrument panel.

#### Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KORL, 112 ft msl	<b>Distance from Accident Site:</b>	0 Nautical Miles
<b>Observation Time:</b>	07:53 Local	<b>Direction from Accident Site:</b>	
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	4 knots /	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	70°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.11 inches Hg	<b>Temperature/Dew Point:</b>	26°C / 24°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Orlando, FL (ORL )	<b>Type of Flight Plan Filed:</b>	IFR
<b>Destination:</b>	Winston Salem, NC (INT )	<b>Type of Clearance:</b>	IFR
<b>Departure Time:</b>	12:15 Local	<b>Type of Airspace:</b>	

The 0753 ORL automated weather observation included winds from 070°; at 4 knots, visibility 10 miles, clear skies, temperature 26°; C, dew point 24°; C, and an altimeter setting of 30.11 inches of mercury.

## Airport Information

<b>Airport:</b>	Orlando Executive ORL	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	113 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	7	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	6004 ft / 150 ft	<b>VFR Approach/Landing:</b>	None

ORL was situated at an elevation of 113 ft above mean sea level, and was equipped with two paved runways, designated 07/25 and 13/31. Runway 7/25 was asphalt, and measured 150 ft by 6,004 ft. ORL was equipped with an air traffic control tower, which was staffed and operating at the time of the accident.

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 None	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	3 None	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	4 None	<b>Latitude, Longitude:</b>	28.545555,-81.333053(est)

Tire tracks in the grass indicated that the airplane exited the southeast corner of the paved surface of runway 7. The airplane came to a stop upright, partially in the drainage culvert, with a significant nose down pitch attitude. The stopping point was about 500 ft beyond the runway pavement end, and offset about 300 ft from the runway centerline. The stopping point was located about 6,500 ft from where the airplane began its takeoff roll. The nose and nose landing gear were substantially damaged, and the right side propeller was also damaged.

The engines remained attached to the airframe. One propeller blade on the right engine was bent aft at midspan of the blade. The top and side cowlings were removed from both engines. No anomalies were visually observed. The top spark plugs were removed, and the electrodes exhibited normal worn out signatures compared to the Champion Check a Plug chart.

The crankshafts were rotated manually using the propellers. Sparks were observed on all top ignition leads, and thumb compressions were obtained on all cylinders. Visual inspections of the cylinder combustion chambers via lighted borescope did not reveal any anomalies.

A test of the airplane airspeed indicating system, minus the pitot tube, was conducted. A test unit was coupled to the pitot input line just downstream of where the pitot tube had been connected. The test unit provided known pressure inputs corresponding to known airspeeds, in 20 kt increments from 20 to 100 kts inclusive, and then two more stepped inputs of 150 and 200 kts. The airspeed values were displayed on the Garmin PFD and two other mechanical ASIs mounted on the instrument panel. All three ASI values corresponded to the test pressure/speed values throughout the entire speed range of the test, and no leaks were detected in the system.

## Additional Information

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### Weight and Balance

The pilot provided the following values as the basis for his airplane weight calculations:

Airplane empty weight = 4,700.71 lbs

Combined front seat pilot and passenger weight = 321.5 lbs

Combined aft seat passenger weight = 276 lbs

Baggage weight = 152.76 lbs.

Ramp fuel weight = 966 lbs

Takeoff fuel weight = 936 lbs

The pilot provided both maximum allowable and calculated ramp and takeoff weights for the flight. According to the pilot, the maximum allowable ramp weight was 6,430 lbs, and his calculated ramp weight was 6,417 lbs. The maximum allowable takeoff weight was 6,390 lbs. The pilot allowed a start/taxi fuel value of 30 lbs (5 gallons), which resulted in his calculated takeoff weight of 6,387 lbs. The pilot's calculations indicated that the airplane was loaded within the allowable CG range.

None of the pilot's airplane, payload, or fuel weight values were able to be independently verified by the investigation.

### Airplane Performance

The airplane manufacturer (Cessna) provided separate takeoff distance charts for the 'accelerate-go' and the 'accelerate-stop' cases. These charts presented data for a maximum airplane weight of 5,990 lbs. Although the airplane documentation indicated that RAM provided modified Operations Manual and a Supplemental Flight Manual, the pilot did not provide those documents to the investigation.

When asked for his takeoff performance charts, the pilot provided 'accelerate-go' and 'accelerate-stop' charts that bore the logo "SIMCOM," and a RAM chart for "normal takeoff distance." SIMCOM was a commercial flight training company.

Comparisons of the Cessna and SIMCOM charts indicated that they presented the exact same performance data; neither the Cessna nor SIMCOM charts provided performance data or accountability for takeoffs at weights above 5,990 lbs. The RAM chart indicated that it was to be used for takeoff weights between 5,990 lbs and 6,390 lbs.

Review of the Cessna and SIMCOM accelerate-go performance charts for the ambient conditions and a takeoff weight of 5,990 lbs resulted in a total takeoff distance (to 50 ft) of about 4,924 ft. The RAM chart, for a takeoff weight of 6,390 lbs, yielded a takeoff distance of about 2,350 ft.

The Cessna and SIMCOM charts for the ambient conditions and a takeoff weight of 5,990 lbs resulted in an accelerate-stop distance of about 3,510 ft. The RAM chart did not provide any data or means to enable calculation of accelerate-stop distances for any weight, including weights above 5,990 lbs.

## Discontinued Takeoff Procedures Information

The "Amplified Procedures" section of the Cessna POH provided the following guidance regarding discontinued takeoff considerations:

"Before initiating the takeoff roll, a go, no-go decision should have been made in the event an engine failure should occur."

"Signs of rough engine operation, unequal power between engines, or sluggish engine acceleration are good cause for discontinuing the takeoff."

The accelerate-stop distance charts indicated that they were based on an engine failure speed of 91 knots for the 5,990 lb takeoff weight. The chart-specified procedure was to bring the engine(s) to "idle power" and apply "maximum effective braking" at engine failure.

According to the pilot, the airplane speed never exceeded about 43 knots during the takeoff attempt. The pilot reported his executed procedure as "immediately pulled the power, applied brakes, and actuated the spoilers in an effort to reduce speed as quickly as possible."

## Time and Distance Estimates

Calculation estimates based upon available performance data and standard equations of motion indicated that the airplane would have taken about 13 seconds and about 450 ft to accelerate to a speed of 43 knots. If the speed then remained at 43 knots, it would have taken an additional 35 seconds to reach the half-way point on the runway, and afforded the airplane 3,000 ft of pavement to stop.

If the pilot initially accelerated the airplane to 43 knots, and then permitted it to remain at that speed, a total of about 88 seconds would have been required to travel the 6,000 ft runway.

## Ferry Flight Information

The airplane remained at ORL after the accident, where it was prepared for a ferry flight back to Michigan. In mid-October 2018, once all the repairs were completed, the mechanics test-ran the engines. The right engine operated normally, but the left engine would not develop full rpm; it only came up to about 2,000 rpm. Analysis by the mechanics indicated that a carbon buildup on the turbocharger wheel shaft resulted in non-operation of the turbocharger. According to the mechanics, the turbine wheel was found to be "stuck," but was able to be freed with finger pressure, and after that, the engine developed full rpm during ground operation.

About 10 days later a pilot was sent to ORL to retrieve and ferry the airplane. During his engine runup, he was unable to develop full rpm in the right engine. Examination by mechanics indicated that the turbocharger wastegate was sticking. The wastegate was lubricated and then functioned normally. A few days later, on October 30, 2018, the airplane was successfully ferried from ORL to Michigan, and both engines operated normally for that ferry flight.



## Administrative Information

<b>Investigator In Charge (IIC):</b>	Huhn, Michael
<b>Additional Participating Persons:</b>	Rudolf Nudo; FAA; Orlando, FL Christopher Lang; Continental Motors; Mobile, AL
<b>Original Publish Date:</b>	June 3, 2020
<b>Note:</b>	The NTSB did not travel to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=97597">https://data.nts.gov/Docket?ProjectID=97597</a>

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