National Transportation Safety Board
Aviation Accident Final Report

Location:	Clarksdale, MS	**Accident Number:**	ERA14FA322
Date & Time:	07/01/2014, 1730 CDT	**Registration:**	N91331
Aircraft:	AIR TRACTOR INC AT-602	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 137: Agricultural		

Analysis

During an aerial application flight, the pilot initiated a low-level right turn to reverse course. A witness saw the airplane's bank angle increase to vertical, and the airplane subsequently descended into the ground. Examination of the accident site indicated a relatively straight-line impact path with the airplane's right wing tip hitting first followed by the nose. Examination of the wreckage revealed no preexisting mechanical anomalies that would have precluded normal operation; the engine was under power at impact, and the propeller was in the normal operating (not feathered) range. In addition, an autopsy of the pilot did not note any pertinent preexisting medical conditions. The airplane's high angle-of-bank turn, its subsequent descent to ground impact, and the resultant wreckage path were consistent with an accelerated stall.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain adequate airspeed during a low-level, high angle-of-bank turn, which resulted in an exceedance of the critical angle of attack and a subsequent accelerated stall.

Findings

Aircraft	Airspeed - Not attained/maintained (Cause) Lateral/bank control - Not specified Angle of attack - Capability exceeded (Cause)
Personnel issues	Aircraft control - Pilot (Cause)

Factual Information

HISTORY OF FLIGHT

On July 1, 2014, about 1730 central daylight time, an Air Tractor AT-602, N91331, operated by Shannon Agricultural Flying, Inc., was destroyed when it impacted a bean field in Clarksdale, Mississippi. The commercial pilot was fatally injured. Visual meteorological conditions prevailed, and the airplane, which departed Shannon Field (02CD), Clarksdale, Mississippi, was not operating on a flight plan. The local aerial application flight was conducted under the provisions of 14 Code of Federal Regulations Part 137.

According to company personnel and onboard GPS data, the airplane was applying fertilizer in both directions in an east-west race track pattern. After completing each leg, the airplane would make a 20- to 30-degree left turn, followed by a right turn to reverse course and fly the next track. The GPS track indicated that the airplane was on its fourth circuit, with the data ending prior to the final turn.

A witness on his lawn mower noticed the airplane when it flew over his property about 150 feet above the ground. He heard the airplane's engine running over the sound of the mower, and saw the airplane turn right, to the north, and the wings go vertical. The airplane then impacted the ground, and when it did, the witness saw smoke and fertilizer being ejected upwards. The witness then went to the wreckage and found the pilot unresponsive.

PILOT INFORMATION

The pilot, age 58, held commercial pilot certificate with an airplane single engine land rating. His latest FAA second class medical certificate was issued February 27, 2014. The latest flight time logged by the pilot indicated 12,051 hours of flight time with 4,358 hours in airplane make and model.

A calendar with recorded Hobbs times for each flight was found in the wreckage. For the day preceding the accident, the pilot logged five events for a total of 8.2 hours of airplane operation. On the day of the accident, prior to the accident flight, the pilot logged six events for a total of 6.3 hours of airplane operation. The Hobbs meter after the accident flight indicated an additional 0.3 hours.

AIRPLANE INFORMATION

The low-wing, conventional landing gear (tail dragger) agricultural application airplane was powered by a Pratt and Whitney Canada PT6A-60AG engine driving a Hartzell five-bladed, hydraulically operated, constant speed propeller with feathering and reversing capabilities. Oil pressure from the propeller governor was used to move the blades to the low pitch direction. Blade-mounted counterweights and feathering springs would have actuated the blades towards the high pitch direction in the absence of governor oil pressure. The propeller incorporated a Beta mechanism that actuated when blade angles were lower than the flight idle position. The blades were of aluminum construction, and the hub and blade clamps were steel. Propeller rotation was clockwise as viewed from the rear.

The airplane's latest annual inspection was recorded on November 25, 2013, at 5,200 hours of operating time.

METEOROLOGICAL INFORMATION

Weather, recorded at an airport about 10 nautical miles to the north, at 1735, included clear skies, wind form 200 degrees true at 9 knots, temperature 32 degrees C, dew point 24 degrees true, altimeter setting 29.90 inches Hg.

WRECKAGE AND IMPACT INFORMATION

The initial impact occurred on flat terrain in the vicinity of 34 degrees north, 06.34 minutes north latitude, 090 degrees, 34.26 minutes west longitude, at an elevation of about 160 feet. The wreckage path, which began with green lens material, included airplane parts centered along an almost straight line, about 360 degrees magnetic. Approximately 75 feet beyond the initial impact point, there was a 3-foot-deep, 10-foot-long crater with the propeller hub and four of the five propeller blades partially embedded at its right edge. Beginning about 20 feet beyond the crater was the fifth propeller blade and the rest of the airplane.

The airplane was fractured into multiple sections and pieces, with all flight control surfaces located at the scene. The cockpit and rollover structure were intact. Flight control continuity was confirmed via the control cables from the cockpit to the rudder and elevator, and through push rod and bellcrank fractures to the ailerons.

After the airplane's removal to a storage facility, the engine was partially disassembled. Soil was found in the gas generator case and throughout the combustion section. The compressor turbine blade tips exhibited smearing and the turbine shroud exhibited corresponding circumferential rubbing. The compressor disc outer rim exhibited circumferential rubbing with frictional heat discoloration and material in the vicinity of the 1st stage power turbine vane ring and baffle. The findings were all consistent with the engine being under power at impact.

Of the five propeller blades, Nos. 1 through 3 remained attached to the hub via the clamps, and Nos. 4 and 5 were fractured off the hub. The latter two blades left witness marks on the hub. Those two marks and a cylinder-to-piston contact mark were consistent with propeller pitch being in the normal operating range and not feathered upon ground impact.

MEDICAL AND PATHLOGICAL INFORMATION

An autopsy of the pilot was conducted at the Mississippi State Medical Examiner's Office, Jackson Mississippi, where cause of death was reported as "multiple blunt force injuries." Toxicological testing was conducted by the FAA, Forensic Toxicology

Research Team, Oklahoma City, Oklahoma, with no anomalies noted.

ADDITIONAL INFORMATION

According to FAA-H-8083-25, "Pilot's Handbook of Aeronautical Knowledge," Chapter 3, "The stalling speed of an airplane is higher in a level turn than in straight-and-level flight. This is because centrifugal force is added to the airplane's weight, and the wing must produce sufficient additional lift to counterbalance the load imposed by the combination of centrifugal force and weight. In a turn, the necessary additional lift is acquired by applying back pressure to the elevator control. This increases the wing's angle of attack, and results in increased lift. The angle of attack must increase as angle of bank increases to counteract the increasing load caused by centrifugal force. If at any time during the turn the attack of attack becomes excessive, the airplane will stall."

The Handbook further notes: "At the point of stall when the upward force of the wing's lift and the downward tail force cease, an unbalanced condition exists. This allows the airplane to pitch

down abruptly, rotating about its center of gravity."

According to FAA-H-8083-3a, "Airplane Flying Handbook," Chapter 4, "At the same gross weight, airplane configuration, and power setting, a given airplane will consistently stall at the same indicated airspeed if no acceleration is involved. The airplane will, however, stall at a higher indicated airspeed when excessive maneuvering loads are imposed by steep turns, pull-ups, or other abrupt changes in its flight path. Stalls entered from such flight situations are called "accelerated maneuver stalls, a term, which has no reference to the airspeeds involved."

In addition, "Stalls which result from abrupt maneuvers tend to be more rapid, or severe, than the unaccelerated stalls, and because they occur at higher-than-normal airspeeds,

and/or may occur at lower than anticipated pitch attitudes, they may be unexpected."

History of Flight

Maneuvering-low-alt flying	Aerodynamic stall/spin Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Commercial	**Age:**	58
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With Waivers/Limitations	**Last Medical Exam:**	02/27/2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	01/22/2014
Flight Time:	12051 hours (Total, all aircraft), 4358 hours (Total, this make and model), 12051 hours (Pilot In Command, all aircraft), 183 hours (Last 90 days, all aircraft), 120 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	AIR TRACTOR INC	**Registration:**	N91331
Model/Series:	AT-602	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Restricted	**Serial Number:**	602-0622
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	06/09/2014, 100 Hour	**Certified Max Gross Wt.:**	12500 lbs
Time Since Last Inspection:	94 Hours	**Engines:**	1 Turbo Prop
Airframe Total Time:	5222 Hours	**Engine Manufacturer:**	Pratt & Whitney
ELT:	Not installed	**Engine Model/Series:**	PT6A-60(AG)
Registered Owner:	SHANNON AGRICULTURAL FLYING INC	**Rated Power:**	1020 hp
Operator:	SHANNON AGRICULTURAL FLYING INC	**Air Carrier Operating Certificate:**	Agricultural Aircraft (137)

Meteorological Information and Flight Plan

Observation Facility, Elevation:	CKM, 173 ft msl	**Observation Time:**	1735 CDT
Distance from Accident Site:	10 Nautical Miles	**Condition of Light:**	Day
Direction from Accident Site:	360°	**Conditions at Accident Site:**	Visual Conditions
Lowest Cloud Condition:	Clear	**Temperature/Dew Point:**	32°C / 24°C
Lowest Ceiling:	None	**Visibility**	8 Miles
Wind Speed/Gusts, Direction:	9 knots, 200°	**Visibility (RVR):**	
Altimeter Setting:	29.9 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Clarksdale, MS (02CD)	**Type of Flight Plan Filed:**	None
Destination:	Clarksdale, MS (02CD)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal		

Administrative Information

Investigator In Charge (IIC):	Paul R Cox	**Adopted Date:**	10/19/2015
Additional Participating Persons:	Trey McClure; FAA/FSDO; Jackson, MS Kyle Schroeder; Air Tractor, Inc.; Olney, TX Thomas Berthe; Pratt & Whitney Canada; Longueuil, QC Daniel Boggs; Hartzell Propeller, Inc.; Piqua, OH Daniel Shannon; Shannon Agricultural Flying, Inc.; Clarksdale, MS		
Publish Date:	10/19/2015		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=89584		