Aviation Investigation Final Report

Location:	Inverness, Mississippi	**Accident Number:**	CEN20LA353
Date & Time:	August 20, 2020, 09:00 Local	**Registration:**	N604MG
Aircraft:	Air Tractor AT602	**Aircraft Damage:**	Substantial
Defining Event:	Sys/Comp malf/fail (non-power)	**Injuries:**	1 None
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The turbine-powered agricultural airplane was on short final to land at the private airstrip. In attempt to slow down the airplane, the pilot actuated the power control lever (PCL) into beta, which caused the PCL, cam box, and associated linkage to get stuck in place. The airplane required more engine power to make the runway so he attempted to advance the PCL, but it would not move. The pilot made a forced landing in a field short of the runway, the airplane came to rest upright, and sustained substantial damage to both wings.

The engine data revealed that the PCL was moved to beta while the airplane was on short final. The beta signal was still on after engine shutdown, which indicates that the cam box was likely stuck in beta.

A service letter issued by the airplane manufacturer states that the use of beta mode in flight is not authorized and can result in a dangerous situation, leading to a loss of control.

In this event, when the PCL was actuated into beta in flight and the propeller servo pressure dropped to maintain control of the propeller, the servo pressure went into a negative range, and the propeller blade angle was quickly forced to the max reverse stop, which allowed the beta ring to move to the most forward position. Since the beta valve does not allow this amount of movement, the additional movement of the beta ring was transferred to the cam box and the cam box jammed in place.

Probable Cause and Findings

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

The pilot's decision to move the power control lever into beta during flight, which resulted in the power control lever and associated linkage becoming stuck in the beta position.

Findings

Personnel issues	Incorrect action selection - Pilot
Personnel issues	Use of equip/system - Pilot
Aircraft	Power lever - Incorrect use/operation

Factual Information

History of Flight

Approach	Off-field or emergency landing
Approach-IFR final approach	Sys/Comp malf/fail (non-power) (Defining event)

On August 20, 2020, about 0900 central daylight time, an Air Tractor AT602 airplane, N604MG, was substantially damaged when it was involved in an accident near Inverness, Mississippi. The pilot was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 137 aerial application flight.

The pilot stated that when he was on short final, the airplane required more engine power to reach the runway. He attempted to advance the power control lever (PCL), but it would not move. He subsequently made a forced landing in a field and the airplane sustained substantial damage to both wings. An initial examination of the PCL revealed that it was stuck near the idle position and could not be moved.

The pilot reported that during the accident flight, he positioned the PCL friction lock such that the lever would move smoothly and characterized its friction as a "medium range." He said that during some previous flights, he had used beta in flight to quickly slow the airplane. He could not recall if he had put the PCL into beta range before it became stuck but said it was possible.

The actual commanded position of the PCL provides an indication to the airplane's MVP-50T engine monitor. The recorded data revealed that the PCL was moved into beta during the accident flight. Also, the beta signal was still on after engine shutdown.

According to the Airplane Flying Handbook (FAA-H-8083-3B), the beta range of operation consists of power lever positions from flight idle to maximum reverse. Beginning at power lever positions just aft of flight idle, propeller blade pitch angles become progressively flatter with aft movement of the power lever until they go beyond maximum flat pitch and into negative pitch, resulting in reverse thrust.

To move the PCL into beta, a pilot moves the thumb latch on the top of the PCL forward, which raises the idle stop and allows the PCL to move aft of the anti-reversing plate. A fence on the power quadrant keeps the idle stop in line with the anti-reversing lock plate to prevent the PCL from inadvertently moving into beta.

When the PCL is actuated aft of the idle stop position and into the beta range it reduces the propeller blade angle below the flight idle position. Under some flight conditions blade angles below flight idle result in blade aerodynamic forces that cause the propeller servo pressure to decrease and the propeller to become uncontrolled by the propeller governor. In this condition

the propeller blade angle would be aerodynamically forced – without pilot action – to the max reverse stop.

When the propeller blade angle moves to the reverse stop, the beta ring moves to the most-forward position. If the propeller is not controlled by the governor/beta valve at this point, movement of the PCL out of beta range moves the beta valve to its max forward stop without corresponding aft movement of the propeller beta ring. With the beta ring and beta valve in those positions, no further movement of the reversing cable/reversing cam would be possible, and the cam box could get jammed. The cam box is the intermediate linkage between the cockpit levers, the propeller governor, and the fuel control unit. If the cam follower pin is in the reversing range of the cam when this occurs, it will prevent forward movement of the PCL.

Air Tractor Service Letter 364 states in part:

The use of beta mode in flight is not authorized on Air Tractor aircraft and can result in a dangerous situation, leading to aircraft loss of control…beta mode and reverse thrust settings are only authorized for ground operations. These settings may be used during taxi operations to reduce brake system wear and to reduce taxi speeds. Beta mode and reverse thrust may be used during the landing rollout, but only after all three wheels are on the ground.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	38,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	5-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	January 3, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 9, 2019
Flight Time:	7067 hours (Total, all aircraft), 445 hours (Total, this make and model), 6945 hours (Pilot In Command, all aircraft), 211 hours (Last 90 days, all aircraft), 63 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Air Tractor	**Registration:**	N604MG
Model/Series:	AT602	**Aircraft Category:**	Airplane
Year of Manufacture:	2019	**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	602-1306
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	December 19, 2019 Annual	**Certified Max Gross Wt.:**	12500 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo prop
Airframe Total Time:	375 Hrs at time of accident	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Not installed	**Engine Model/Series:**	PT6A-60AG
Registered Owner:	Gary Flying Service	**Rated Power:**	1173 Horsepower
Operator:	Gary Flying Service	**Operating Certificate(s) Held:**	Agricultural aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KGLH,128 ft msl	**Distance from Accident Site:**	22 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	294°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	23°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Inverness, MS (MS21)	**Type of Flight Plan Filed:**	None
Destination:	Inverness, MS (MS21)	**Type of Clearance:**	None
Departure Time:	08:15 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	LESTER FIELD MS21	**Runway Surface Type:**	Concrete;Grass/turf
Airport Elevation:	115 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	18	**IFR Approach:**	None
Runway Length/Width:	3000 ft / 65 ft	**VFR Approach/Landing:**	Forced landing;Full stop;Straight-in

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	33.336944,-90.58139(est)

Administrative Information

Investigator In Charge (IIC):	Lindberg, Joshua
Additional Participating Persons:	Michael Jones; Federal Aviation Adminstration; Jackson, MS Dakota Lowe; Air Tractor; Olney, TX Jeremy Ganivet; PWC Beverly Harvey; TSB Canada Les Doud; Hartzell; Piqua, OH Jim Rosplock; Woodward Inc.; Loves Park, IL
Original Publish Date:	June 14, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101837