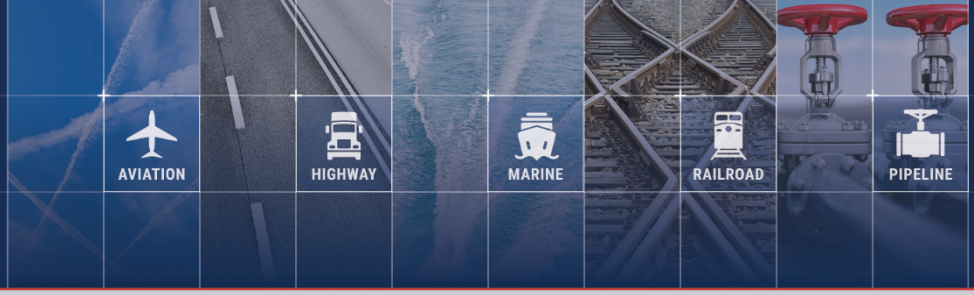

Aviation Investigation Final Report

Location:	Leesburg, Virginia	**Accident Number:**	ERA21LA106
Date & Time:	January 19, 2021, 10:55 Local	**Registration:**	N5880L
Aircraft:	American AA5	**Aircraft Damage:**	Substantial
Defining Event:	Flight control sys malf/fail	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor reported that, during a local instructional flight, while descending in smooth air at an airspeed below the yellow arc, the airplane began shaking and buffeting violently and loudly. The control yoke was also shaking violently (left, right, fore, and aft), and the airplane was pitching up and down. The instructor took control of the airplane from the student pilot, declared an emergency, then returned for landing after being informed by the pilot of a chase airplane that their left elevator was “flapping in the wind.” With reduced elevator authority due to the displaced position of the left elevator, the airplane landed hard, and the nose landing gear collapsed.

Postaccident examination of the airplane revealed that the left elevator remained attached to the bellcrank and supported at the inboard support bearing assembly, but the outboard support bearing assembly was separated from the outer rib of the left horizontal stabilizer, leaving the elevator displaced down from its normal position. The outboard support bearing assembly and a separated aft section of the outboard rib of the left stabilizer were not located or recovered. Relatively coarse striations intermixed with dimple features, consistent with cyclic overstress loading, were noted on the fractured outer rib of the left horizontal stabilizer.

Additionally, the aft spar for the left horizontal stabilizer was buckled on the upper and lower flanges, consistent with upward and downward overstress loading during a flutter event. The cracks and fractures on the right outboard rib had coarse striations intermixed with dimple features, consistent with cyclic overstress loading, providing further evidence of loading associated with elevator flutter.

The elevator flutter likely occurred due to separations at the bondlines of the left horizontal stabilizer that reduced the overall stiffness of the structure. Bondline separations in the horizontal stabilizer, such as those observed on an exemplar horizontal stabilizer, may have

been present at the outboard rib-to-skin bondlines, which could have weakened the area around the outboard bearing support bracket and made the elevator more susceptible to flutter. Since a separation of the left outboard elevator bearing support bracket would tend to relieve loads on the aft spar, this indicated the failure of the left horizontal stabilizer outboard rib likely occurred after the aft spar buckled due to overstress loading.

Although both elevator trim tabs were disbonded along most of the length of the trailing edge, which would have made them more susceptible to flutter due to their reduced structural stiffness, a representative from the current type certificate holder reported that the overall damage pattern was not consistent with a trim tab flutter event.

While the airplane maintenance manual (AMM) contained a specific instruction to inspect the bondlines, and a 100-hour inspection was performed in accordance with the AMM about 51 flight hours before the accident, it is likely that internal corrosion on the interior of the upper skin of the left horizontal stabilizer and bondline separation at the outboard rib of the left horizontal stabilizer existed at the time of the inspection; therefore, the failure of maintenance personnel to detect the disbonding at the outer rib of the left horizontal stabilizer likely contributed to the accident.

Following this accident, a service bulletin and Federal Aviation Administration airworthiness directive were issued regarding bondline inspections.

Probable Cause and Findings

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

The weakened structure of the left horizontal stabilizer, which resulted in elevator flutter and subsequent partial separation of the left elevator in flight. Contributing to the accident were the lack of elevator authority while landing due to the damaged left elevator and the inadequate inspection of the airplane, which failed to detect the disbonding of the left horizontal stabilizer.

Findings

Aircraft	Horizontal stabilizer - Damaged/degraded
Aircraft	Elevator control system - Malfunction
Aircraft	Elevator control system - Not specified
Aircraft	Elevator control system - Damaged/degraded
Personnel issues	Scheduled/routine inspection - Maintenance personnel
Aircraft	Scheduled maint checks - Inadequate inspection
Personnel issues	Use of equip/system - Instructor/check pilot

Factual Information

History of Flight

Enroute-descent	Flight control sys malf/fail (Defining event)
Landing-flare/touchdown	Hard landing

On January 19, 2021, about 1055 eastern standard time, an American AA-5, N5880L, was substantially damaged when it was involved in an accident near Leesburg, Virginia. The flight instructor and student pilot were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

The flight instructor stated that, while flying direct to Leesburg Executive Airport (JYO), Lees burg, Virginia, in smooth air in a slight descent at 1,500 to 1,700 ft mean sea level while belo w the yellow arc indicated airspeed, the airplane began shaking
and buffeting violently and loudly. The control yoke was also shaking violently, left and right, fore and aft, and the airplane was pitching up and down. He took control of the airplane from the student and initially thought there was an engine issue. He applied carburetor heat, redu ced the throttle to idle and slowed to the airplane's best glide speed, which was 80 mph, and completed the engine failure checklist from memory. He circled left looking for a suitable fiel d in which to perform an emergency landing and declared an emergency to the JYO tower controller. As the instructor proceeded to JYO, the pilot of another airplane flew alongside and reported that the accident airplane's elevator was "flapping in the wind."

The flight was cleared to land on runway 17. As the airplane approached the runway, the instructor reduced power to idle and attempted to flare normally. The nose pitched down qui ckly, impacting the runway, and the
airplane skidded on the nose landing gear and propeller. After coming to rest, the airplane w as secured and both occupants egressed.

Flight instructor Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	60,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	July 14, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 12, 2020
Flight Time:	2180 hours (Total, all aircraft), 84 hours (Total, this make and model), 1551 hours (Pilot In Command, all aircraft), 74 hours (Last 90 days, all aircraft), 28 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Student pilot Information

Certificate:	Student	**Age:**	17,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	August 22, 2020
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 14 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	American	**Registration:**	N5880L
Model/Series:	AA5 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1972	**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	AA5-0080
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 15, 2020 100 hour	**Certified Max Gross Wt.:**	2200 lbs
Time Since Last Inspection:	51 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2879 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed	**Engine Model/Series:**	O-320-E2G
Registered Owner:	PHIL FOUR SIX LLC	**Rated Power:**	150 Horsepower
Operator:	Aero Elite Flight Training LLC	**Operating Certificate(s) Held:**	None

The airplane was equipped with two Garmin G5's each without an externally removable microSD card. The devices were shipped to the NTSB's Vehicle Recorder Division; however, since no microSD cards were installed, no flight data was recovered from either of the devices.

The AA-5 Traveler airplane has horizontal stabilizers, elevators, and anti-servo tabs which are constructed using a metal-to-metal bonding process.

The elevator assembly consists of the elevator, and an anti-servo tab which extends the full length of the elevator and is attached to the trailing edge by a piano hinge. The elevator is composed of a torque tube bonded to honeycomb ribs, which are bonded to a one-piece aluminum skin formed around the elevator leading edge and bonded to the rear spar.

The elevator was attached/supported at the inboard and outboard ends. The inboard end of each elevator torque tube was supported by a bearing support bracket attached to the aft side of the horizontal stabilizer spar connector, and the torque tube was mechanically connected to a bellcrank by a bolt, washers, and a nut. The outboard end of each elevator torque tube was supported by a bearing support bracket attached to the outboard face of the outboard rib on the horizontal stabilizer assembly. As assembled, each outboard elevator bearing support bracket was attached with two threaded fasteners that are threaded into nut plates riveted to the interior surface of each outboard rib.

According to the airplane maintenance manual (AMM), at each annual or 100-hour inspection, an inspection of the bond lines for any indication of damage, peeling, or cracks should be performed. The AMM also indicated to inspect the horizontal stabilizers for

damage and secure mounting.

In over 45 years, 7 months of airframe maintenance records, there was no entry associated with repairs to the left horizontal stabilizer or outer rib of the left horizontal stabilizer. The airplane's last 100-hour inspection in accordance with the AMM was completed on December 15, 2020, at a tachometer time of 2,879.3 hours. At the time of the accident, the airplane had accrued about 51 hours since the most recent inspection.

Airworthiness Directive (AD) 76-17-03, associated with delaminations in bonded skin with an effective date of August 30, 1976, was a one-time inspection that was completed on July 15, 1977.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KJYO,389 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	10:55 Local	**Direction from Accident Site:**	166°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.16 inches Hg	**Temperature/Dew Point:**	7°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Leesburg, VA	**Type of Flight Plan Filed:**	None
Destination:	Leesburg, VA	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	

Airport Information

Airport:	Leesburg Executive Airport JYO	**Runway Surface Type:**	Asphalt
Airport Elevation:	390 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	17	**IFR Approach:**	None
Runway Length/Width:	5500 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	39.081972,-77.559229(est)

The airplane came to rest upright on the runway with the nose landing gear collapsed. The left elevator remained attached at the inboard bellcrank and supported at the inboard support bearing assembly, but was separated at the outboard attach point. The elevator was displaced down from its normal position hinging on the bellcrank and inboard support bearing assembly. Movement of the control yoke produced movement of each elevator control surface.

Postaccident examination of the airplane following recovery from the runway was performed by representatives of the Federal Aviation Administration (FAA), as well as representatives of the airplane type certificate holder.

Examination of the left horizontal stabilizer revealed that the upper skin at the juncture of the surface and outboard rib showed evidence of upper surface debonding from the rib. The debonding measured approximately 9 1/2”, as measured from the upper horizontal surface training edge forward to the visible termination of the debonding. The end rib displayed an approximate 7/8” vertical crack emanating from the upper edge of the rib at the 7 1/2” location, as measured from the upper horizontal surface trailing edge forward. Corrosion was noted throughout the interior of the left horizontal stabilizer and under the bond lines where debonding occurred and also on the outboard surface of the left horizontal stabilizer outboard rib, just below and just aft of the forward lightening hole. The bearing support assembly, part number (P/N) 301030-501, was missing from the left horizontal stabilizer end rib. A section of the outboard rib was missing from the aft end of the lightening hole to the aft spar of the horizontal stabilizer. The aft spar was structurally damaged.

Examination of the elevator control system revealed no discrepancies with the elevator stops, mass balance weights, or four “idler” pulleys. Control cable tension checks of the upper and lower elevator control cables revealed that the upper and lower cables were less than the minimum specified. The upper and lower cables were a maximum of 12.5 pounds and 18.5 pounds, respectively, less than the lower specified limit. Although there was no maintenance manual requirement for a “Free Play” check of the elevator trim tab for the accident make and model airplane, an inspection of the accident airplane using the procedures for an AA5A or AA5B was performed for the right side and the free play measured 0.031 inch, while the maximum specified for the AA5A or AA5B was 0.27 inch. Rigging check of the elevator using the right elevator revealed the nose-up was 3.0° greater than the maximum limit, while the nose

down was 5.8° less than the minimum limit. It was noted that the damage could have affected the measurements.

The right elevator remained attached at the bellcrank and both the inboard and outboard attach points; however, the associated trim tab had disconnected from its inboard control arm and was only attached to the elevator by its hinge attachment.

The horizontal stabilizer assembly, both elevators with trim tabs from the accident airplane, as well as the horizontal stabilizer assembly from another AA5 were sent to the NTSB Materials Laboratory for examination.

According to the NTSB Materials Laboratory Factual Report of the accident airplane components, the aft spars on the horizontal stabilizers were fractured at approximately left station 19 to 20 and right station 14. On the left horizontal stabilizer aft spar, the upper flange was fractured at left station 19 and buckled and cracked at left station 14.75, and the lower flange was buckled and fractured at left station 20. On the right horizontal stabilizer aft spar, the lower flange was buckled and the upper flange was slightly buckled near the fracture at right station 14. The lower flange was also buckled and cracked at right station 17. The upper and lower skins around each aft spar damage area also showed buckling deformation. Bondline separations were observed between the ribs and the skins on both horizontal stabilizers. On the fractures intersecting the aft lightening hole of the left outboard rib, rough fracture features with out-of-plane bending deformation were observed. Scanning electron microscope (SEM) imaging of the fracture surfaces of the left outboard rib showed dimple features consistent with ductile overstress fracture.

On the right horizontal stabilizer, bondline separations were observed between the inboard rib and the upper skin extending 2.5 inches aft from the leading edge and 14 inches forward from the trailing edge. Additional separations were observed between the inboard rib and the lower skin extending 0.75 inches aft from the leading edge and along a 2.5-inch-long segment in a damaged area near the forward fuselage attachment flange. At the outboard rib for the right horizontal stabilizer, bonds with the upper and lower skins were separated extending 4.5 inches and 2.75 inches forward from the aft spar, respectively. The leading edge was deformed aft, and the lower skin was buckled and separated from the outboard rib extending 1.25 inches aft from the rib leading edge.

Examination of the exemplar airplane horizontal stabilizer revealed multiple cracks at the upper and lower bondlines as well as bondline separation on the left and right sides.

Following this accident, the airplane type certificate holder issued Service Bulletin (SB) 195 on May 24, 2021 (followed by revision A issued June 1, 2021). The SB required bondline inspections of the wings, stabilizers, and fuselage to detect bondline separations. Following issuance of the SB, the Federal Aviation Administration issued Airworthiness Directive 2021-14-12, effective July 27, 2021, requiring inspection of horizontal stabilizers within 25 hours

time-in-service or at the next scheduled 100-hour or annual inspection, whichever occurs first, with particular attention paid to the bondlines.

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Jeff Baumgartner; FAA FSDO; Dulles, VA J. Kevin Lancaster; True Flight Holdings LLC; Valdosta, GA
Original Publish Date:	April 19, 2023
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=102531