Aviation Investigation Final Report

Location:	Mokuleia, Hawaii	**Accident Number:**	ANC20FA024
Date & Time:	February 22, 2020, 09:20 Local	**Registration:**	N65070
Aircraft:	Cessna 305	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor was providing familiarization training to the airline transport pilot in the tailwheel-equipped airplane. Witnesses saw the airplane land hard; the pilots shut down the engine on the runway, the instructor got out and inspected the airplane, then boarded the airplane again and the pilots subsequently departed. The witnesses stated that, upon becoming airborne, the airplane entered a significant right yaw over the runway. The airplane continued to the right and subsequently impacted terrain about 1,000 ft from the runway.

Examination of the engine revealed no anomalies that would have precluded normal operation. Examination of the airframe revealed that the left rudder cable was separated at the rudder pulley area behind the rear seat floor and displayed a combination of severely frayed and fractured strands with tension overload signatures. There was evidence of cable abrasions and rubbing in the area of the pulley bracket. A detailed examination of the cable fractures revealed that only 16 of the 133 total wires that comprised the cable were intact before they failed in overload, resulting in cable separation. The remainder of the cable strand wires were either degraded, shortened, or bent, indicative of abnormal cable contact and abrasion. Although the aileron and elevator control cables were continuous or displayed indications of overload separation due to impact, all of the cables exhibited areas of fraying and extensive wear.

The most recent documented maintenance was a 100-hour inspection completed 5 months before the accident. The mechanic who had been responsible for maintaining the airplane for the previous 2 years stated that he cleaned, inspected, and lubricated the flight control cables during the inspection; however, the debris in the under-floor compartment, excessive black grease deposits, significant wear and fractured wires of each control cable were indicative of wear that had occurred over a period of time that should have been observed and rectified during previous inspections.

Based on witness statements and examination of the wreckage, the pilots experienced a loss of yaw control after takeoff due to an overload separation of the left rudder cable and were unable to regain adequate control to land safely. Although when the separation occurred could not be determined, it is possible that the hard landing just before the accident takeoff may have caused the already degraded rudder cable to be displaced and encounter excessive stress loads in the pulley area.

Probable Cause and Findings

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

A separation of the left rudder cable due to inadequate maintenance, which resulted in an in-flight loss of control and impact with terrain.

Findings

Aircraft	Rudder control system - Not serviced/maintained
Aircraft	Rudder control system - Fatigue/wear/corrosion
Aircraft	Yaw control - Attain/maintain not possible
Personnel issues	Scheduled/routine maintenance - Maintenance personnel

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Initial climb	Flight control sys malf/fail
Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Flight control sys malf/fail

On February 22, 2020, about 0920 Hawaii standard time, a Cessna Ector 305A, N65070, sustained substantial damage when it was involved in an accident near Mokuleia, Hawaii. The flight instructor and airline transport pilot receiving instruction sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

According to the operator, the instructor was providing familiarization training to the pilot receiving instruction in the accident airplane, commonly referred to as a Bird Dog or L-19. The flight departed about 0905 from Dillingham Airfield (PHDH), and according to multiple witnesses, the airplane completed one takeoff and landing in the airport traffic pattern, making a very hard landing on runway 8, and stopped abruptly. The airplane nosed over slightly and the tail impacted the runway surface. The engine was immediately shut down and the flight instructor, who was in the rear seat, exited and walked around the airplane, as if inspecting, and then boarded and started again. One witness saw the airplane perform a "zigzag taxi" on the runway, and then the airplane commenced another takeoff.

Witnesses stated that the airplane yawed to the right after becoming airborne. One witness, who was a pilot, stated that the airplane was, "very slow with an abnormal right crosswind crab with wings level" and that it appeared that "something was very wrong with the airplane that was beyond the pilot's control." That witness reported that the wind was light and "down the runway" at the time of the takeoff. Some witnesses reported the engine sound diminishing as the airplane approached a tree line on the right side of the runway, surge again as the airplane flew over or around the end of tree line, and then the engine sound went quiet. Other witnesses saw the airplane on a downwind leg and reported that it rolled rapidly, descended, and impacted the ground. Figure 1 shows the airplane's estimated flightpath based on witness statements and the location of the accident site.

Figure 1. Google Earth image of runway 8 and estimated flightpath (yellow) based on witness statements.

Pilot Information

Certificate:	Commercial; Flight engineer; Flight instructor	**Age:**	78,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Glider	**Toxicology Performed:**	Yes
Medical Certification:	BasicMed None	**Last FAA Medical Exam:**	November 6, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 5000 hours (Total, all aircraft), 2000 hours (Total, this make and model)		

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	70,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 19, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	17500 hours (Total, all aircraft), 1 hours (Total, this make and model)		

The instructor was previously a designated pilot examiner for the Federal Aviation Administration (FAA) and had trained all of the operator's L-19 pilots. He was the lead glider instructor and tow instructor for the local Civil Air Patrol (CAP) squadron. On the morning of the accident, he flew from Kauai with a colleague in a CAP Cessna 172. His copilot reported that he was in good spirits that morning. His pilot logbook was not located, and his flight experience was estimated.

The pilot receiving training was a retired airline pilot who worked as a part-time flight instructor in various airplanes. His logbook was not located and listed flight times were obtained from his most recent FAA medical examination application.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N65070
Model/Series:	305 A	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	2035
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	September 16, 2019 100 hour	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	120 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental
ELT:	Installed	**Engine Model/Series:**	O-470
Registered Owner:	On file	**Rated Power:**	213 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane had been operated as a glider tow airplane by Honolulu Soaring for the previous 40 years. The company contracted a mechanic to maintain the airplane on a part-time basis. According to the mechanic, during the 100-hour inspection that was completed about 5 months before the accident, he opened all the flight control access panels and inspected and lubricated the flight control cables.

A pilot who previously worked at the operator stated that he experienced in-flight binding of the aileron controls some time before the accident. He was able to free them and land safely and he reported the event to the mechanic. The mechanic stated that he had an experienced pilot fly the airplane and could not duplicate the binding, so he did not inspect the aileron control system.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PHHI,840 ft msl	**Distance from Accident Site:**	11 Nautical Miles
Observation Time:	21:24 Local	**Direction from Accident Site:**	121°
Lowest Cloud Condition:	Clear	**Visibility**	8 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.14 inches Hg	**Temperature/Dew Point:**	21°C / 19°C
Precipitation and Obscuration:	Light - None - Drizzle		
Departure Point:	Mokuleia, HI (HDH)	**Type of Flight Plan Filed:**	None
Destination:	Mokuleia, HI (HDH)	**Type of Clearance:**	None
Departure Time:	09:15 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Dillingham Airfield PHDH	**Runway Surface Type:**	Asphalt
Airport Elevation:	14 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	08	**IFR Approach:**	None
Runway Length/Width:	9007 ft / 75 ft	**VFR Approach/Landing:**	Traffic pattern

Dillingham Airfield (PHDH) is a civil-use airport on US Army property that is used primarily for glider operations at the west end and parachute operations at the east end. Runway 8/26 is of asphalt composition and is 9,007 ft long by 75 ft wide, with about 1990 ft of displaced threshold at each end.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	21.576944,-158.200561(est)

The wreckage was located in a field of long grass about 1,000 ft south of the runway near an access road. The airplane came to rest upright on a magnetic heading about 100° in a slightly nose-down, left-wing-low attitude. All major components were located at the scene. The forward fuselage and left wing leading edge sustained significant crush damage. The propeller was separated from the engine and located in a 6-inch depression about 4 ft in front of the wreckage. One propeller blade was straight with no damage and the other was bent back about 40° at the midspan with some leading edge scratches. The fuselage exhibited buckling on the left side mid-section and the engine was displaced to the left. The left wing fuel tank was breached and fuel was leaking from the wing section. A few gallons of fuel were present in the right wing fuel tank and the fuel was free of contamination and consistent with aviation fuel.

The airplane exhibited extensive corrosion damage on the engine cooling fins, wing surfaces, elevator control rod connections, elevator trim chain and control rod, tailwheel assembly, rudder control rod connections, and ignition harness leads.

The engine case and cylinders were intact and control continuity was demonstrated. The accessories were secure in place however, the magnetos had fractured cases and the ignition leads had impact cuts. Spark was produced at the magneto terminals when rotated. Thumb compressions were good and valve train continuity was established. The carburetor bowl had fuel present and a minor amount of dirt-like debris. The fuel finger filter also had debris present. The gascolator fuel filter had similar debris around the upper gasket area. The oil filter had a moderate amount of nonmetallic debris. The cylinder and pistons exhibited normal wear and the valve rocker assemblies had oil present and moved appropriately when the crank shaft was manually rotated.

The flight controls in the cockpit could not be moved due to crush damage of the fuselage floor. The elevator control cables were continuous and connected. The aileron controls were continuous from the control stick to the wing roots, where the left wing root cables exhibited clean cuts and the right wing cable exhibited broomstraw signatures at the separation, consistent with overload separation. The left rudder cable was separated at the rudder pulley area behind the rear seat floor and exhibited a combination of severely frayed and fractured strands with tension overload signatures. A cotter pin extended out of the pulley bracket with metal shavings evident in the thick, grease-like debris around the pulley (see figure 2).

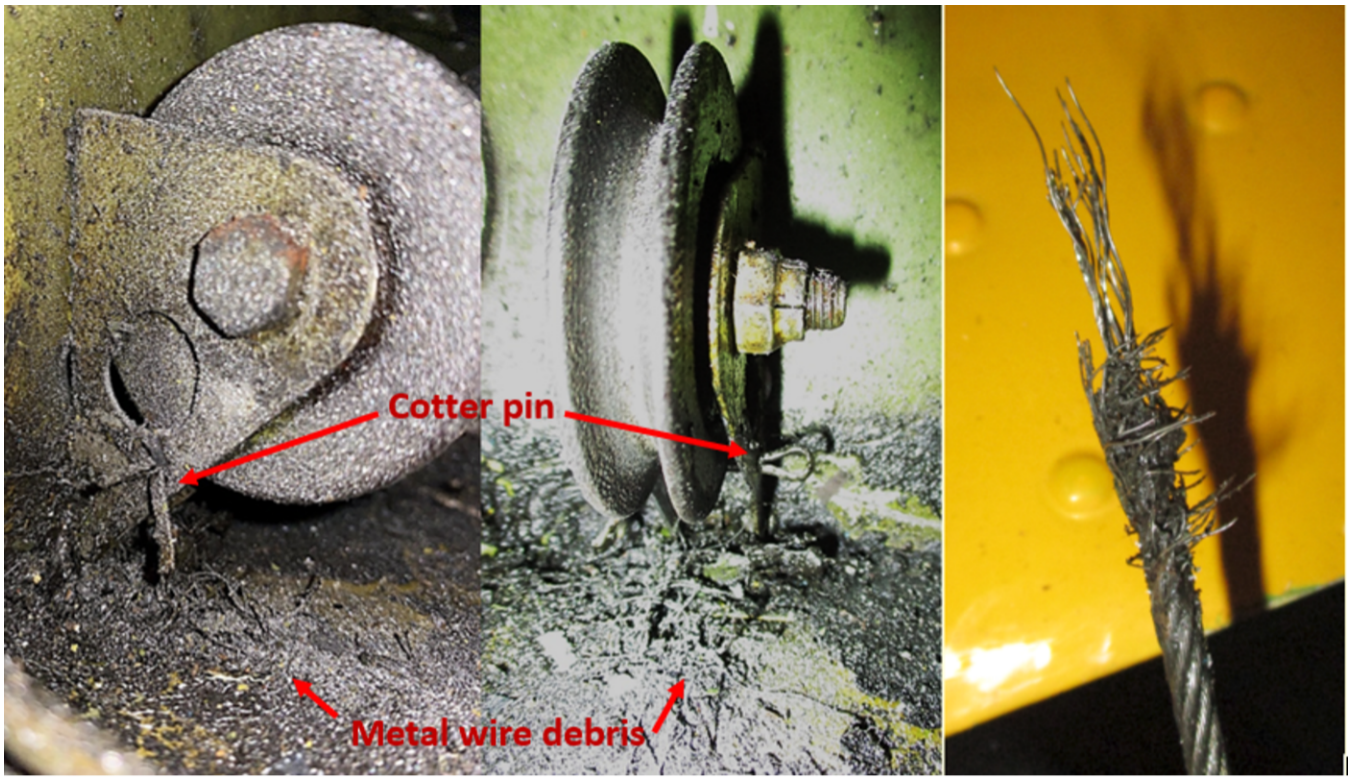

Figure 2. Photographs of the left and right side of left rudder cable pulley and the fractured left rudder cable forward end.

There were thick, black grease deposits around each of the three pulleys in the under-floor area. The elevator cables and right rudder cable displayed multiple frayed cables and shiny degraded areas consistent with excessive wear. The right and left wing aileron cables in the area of the upper fuselage pulleys also exhibited areas of frayed strands.

A detailed examination of the left rudder pulley assembly and rudder cable fractures was conducted at the National Transportation Safety Board materials laboratory. The cable was constructed of 7 strands (one core strand surrounded by six outer strands), each strand containing 19 wires. On the forward cable, 17 of the 19 core strand wires extended about 1/2 to 1 inch beyond the surrounding wires, which were bent back and frayed. On the aft cable section,16 core strand wires extended beyond the rest of the wires. Examination under a scanning electron microscope revealed that of the extended core wires, 9 were thinned to less than half the wire diameter and 17 exhibited necking deformation at the ends, consistent with ductile overstress. Most of the wires on the outer strands that were bent back and frayed were worn to a chisel-like tip and were shorter than the extended wires, indicating abnormal wear.

The left rudder pulley bracket was partly covered in black grease deposits. The areas around the through-hole at the forward side of the bracket and near the cotter pin at the lower aft side of the bracket displayed missing paint and reflective textured appearance consistent with abrasion from contact with the cable. A cable wire was lodged in the hole for the cotter pin in the lower aft side of the bracket. The pulley cable guide groove exhibited one area in which the groove was deeper, consistent with the pulley not rotating while in contact with the moving control cable. The pulley rotated smoothly when removed and operated by hand.

Additional Information

Airworthiness

FAA Advisory Circular 43.13-1B Section 8, paragraph 7-149, Cable System Inspection, states that at each annual or 100-hour inspection, all control cables must be inspected for broken wire strands. Any cable assembly that has one broken wire strand located in a critical fatigue area must be replaced. A critical fatigue area is defined as the working length of a cable where the cable runs over, under, or around a pulley, sleeve, or through a fair lead.

Close inspection in these critical fatigue areas must be made by passing a cloth over the area to snag on broken wires.

Mechanic

A pilot who was a prior employee of Honolulu Soaring and flew in the accident airplane often stated that he left the company because he did not trust the maintenance that was conducted on the airplane. When he went to the mechanic with an issue, the mechanic was “never interested in taking care of it.” There was no company record for maintenance performed other than inspections and major repairs.

The mechanic who performed the inspections and repairs to the accident airplane had his inspection authorization and airframe and power plant mechanic certificate revoked in 2005 and he stated that the FAA reinstated his certificate the following year. In 2019, the FAA issued an emergency revocation of his certificate after an investigation into the circumstances surrounding a Beechcraft 65-A90 accident at PHDH. The FAA determined that the airframe maintenance logbook indicated that flight control cable tensions were recorded as out of specification, with no record of corrective action taken.

Administrative Information

Investigator In Charge (IIC):	Price, Noreen
Additional Participating Persons:	Joseph Monfort; Federal Aviation Administration; Honolulu, HI
Original Publish Date:	March 11, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100980