Aviation Investigation Final Report

Location:	NEW MILFORD, Connecticut	**Accident Number:**	NYC99LA102
Date & Time:	May 1, 1999, 15:03 Local	**Registration:**	N400FJ
Aircraft:	Glaser-Dirks DG-400	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While in flight, at an indicated airspeed of 60 knots, a 'loud bang' was heard and the gear warning alarm began to sound. The pilot looked to the left and observed the left wing displaced 20 degrees up from its normal position. The glider began to descend and control inputs by the pilot were unresponsive. In the decent, as the glider's speed began to increase, the pilot elected to egress from the glider. The glider broke apart in flight and descended to the ground. A piece of the glider's fiberglass skin that contained a residue of an adhesive on the inside surface was removed and examined. The adhesive area would have attached spar pin-lock assembly, which secured the wing spar pins. The surface of this epoxy layer contained impression marks similar to a cross-weave pattern found on the surface of fiberglass. The cross-weave pattern on the surface of the epoxy was consistent with a fracture that traveled between the UD-glass fabric tape and the epoxy layer. This separation was characterized as an adhesive separation. The surface of the epoxy layer also contained exposed voids. No bonding between the epoxy and UD-glass fabric tape was observed in the void areas.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The manufacturer's use of inadequate adhesive material which resulted in the de-bonding and subsequent failure of the wing spar pin-lock assembly.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE - NORMAL

Findings
1. (C) WING,WING ATTACHMENT FITTING - DEBONDED
2. (C) MATERIAL DEFECT(INADEQUATE QUALITY OF MATERIAL) - MANUFACTURER

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

On May 1, 1999, about 1503 Eastern Daylight Time, a Glaser-Dirks DG-400, N400FJ, was destroyed when it impacted terrain after an in-flight breakup, while in cruise flight near New Milford, Connecticut. The certificated commercial pilot received minor injuries. Visual meteorological conditions prevailed and no flight plan was filed for the local flight conducted under 14 CFR Part 91.

The pilot stated that the powered glider was assembled with a one-man rig. The wing spars were inserted into the fuselage of the glider and pins were inserted through a brass bushing hole in both spars. The handles of the pins were then rotated toward the fuselage and secured into a pin lock assembly.

The pilot confirmed that a pin-lock assembly was installed on the left and right inside walls of the fuselage, behind the pilot's seat. The pin-lock assembly contained a rectangle frame and a spring-loaded pin within the frame. A white ball was located at the forward end of the spring-loaded pin. The spring caused the aft end of the spring-loaded pin to remain extended. The ball was then pulled forward by hand to place the handle of the spar pin adjacent to the fuselage wall. When the ball was released, the spring-loaded pin would extend aft, and the handle of the spar pin remained secured between the extended spring-loaded pin and the fuselage. The spar pin was now in the secured (locked) position. The pin-lock assembly was a safety devise that kept the handle of the spar pin from rotating inboard and down. In the secured position, the wing spar would remain attached to the fuselage.

A preflight check of the glider was conducted, which included that the natural wing frequency was within limitations. The frequency was determined by bouncing the left wing tip up and down and observing 132 cycles per minute with a tuning fork. The frequency was normal for the 17-meter configuration.

The glider was self-launched from Mountain Meadow Airport, Burlington, Connecticut, about 1330. With the engine stowed, moderate turbulence was encountered at 3,000 feet, and the pilot climbed to 6,500 feet. Flying straight and level, at an indicated airspeed of 60 knots, the pilot heard a "sharp bang" that sounded like the glider had struck an object. Both wings on the glider were observed to be undamaged, and the pilot turned the glider 360 degrees to look for any other traffic in the area. As the glider rolled out of the turn, heading west, at 60 knots, a "loud bang" was heard and the gear warning alarm began to sound. The pilot looked out to the right side of the glider and observed no abnormalities, he then looked out the left side, and observed the left wing displaced 20 degrees up from it's normal position. The glider began to descend and control inputs by the pilot were unresponsive. In the decent, as the glider's speed began to increase, the pilot elected to egress from the glider as it neared a vertical attitude.

During the parachute drift down, the pilot noticed several items fluttering to the ground, including a flap and aileron. The pilot landed on top of a tree, then swung himself to the trunk of the tree and remained there until rescue personnel arrived.

The wreckage was examined at the accident site about 4 hours after the accident. Parts of the glider were found scattered over a wide area. The right wing was found about 41 degrees, 35 minutes north latitude, and 73 degrees, 20 minutes west longitude. The right wing was in a vertical position with the wing root spar buried in soft soil among large hardwood trees. The cockpit of the glider was found about 500 yards to the north of the right wing. The empennage and engine came to rest in a grass field about 100 yards to the north of the cockpit. The left wing and its control surfaces were found on May 3 about 1,000 yards to the north of the cockpit and examined on May 6. Continuity was established on all existing flight controls.

A fiberglass section from the right side of the fuselage, where the spar locking pin assembly was attached, was removed, and sent to the Safety Board Materials Laboratory for examination. The fiberglass section also contained a residue of an adhesive on the inside surface.

According to the Safety Board Materials Laboratory Factual Report, the frame for the right-hand pin-lock assembly and the fabric tape had separated from the fiberglass section. Only remnants of the adhesive remained attached to the inside surface of the fiberglass section. The fabric tape and pin-lock assembly was not recovered from the accident site.

The skin of the glider was manufactured from fiberglass. According to Bundesstelle fur Flugunfalluntersuchung Baunschweig (BFU), the frame of the pin-lock assembly is manufactured from an aluminum alloy. This frame is attached to the skin by a two step method. The first step involves bonding the frame directly to the skin. In this step, a polyester adhesive thickened with cotton flakes is placed between the frame and the skin. The polyester adhesive is brown in color. In the second step, three layers of UD-glass fabric tape, that resembles a "Band-Aid," are inserted through the rectangle frame and, in turn, the fabric tape is bonded to the skin. The fabric tape is bonded with an epoxy adhesive to the fuselage skin and frame. According to the Luftfahrt-Bundesamt (LBA), the polyester adhesive was not intended to be a structural adhesive, but was used to temporarily bond the frame of the pin-lock assembly to the fuselage skin during production so that the frame does not fall down when the UD-glass fabric tape laid up.

The Safety Board Materials Lab Factual Report additionally disclosed the following information:

The inside surface of the skin piece from the accident airplane contained a brown substance consistent with the color of the recommended polyester adhesive. Bench binocular microscope examination of the skin revealed the polyester adhesive residue contained a rectangle impression mark that measured approximately 1.2 inch x 0.5 inch. The rectangle mark is consistent with the shape of a frame for the pin-lock assembly. This impression mark

was flat and contained fine gouge marks. These fine gouge marks appeared similar to those on a metallic surface that was cleaned by a grinding wheel. The grind marks were oriented in different directions at different areas of the rectangle impression. The flat area contained particles with a metallic luster, similar to aluminum. Close examination of the adhesive revealed the separation of the pin-lock assembly was located between the frame and the polyester adhesive, which was characteristic of an adhesive separation. The area outside the impression mark contained excess "squeeze-out" of the polyester adhesive. The surface of the excess "squeeze-out" portion of the adhesive was smooth and contained no indication of bonding with another surface, with the exception of one small area.

The area located outside the polyester adhesive was the region where the UD-glass fabric tape had separated from the inside surface of the skin. This area was referred to as a "debond region". The "debond region" that extended to one side of the polyester adhesive area contained no fiber pullout, whereas, the "debond region" that extended to the other side of the polyester adhesive area contained minor fiber pullout. The surface of the "debond region" contained a transparent, light green, layer consistent with clear epoxy. The surface of this epoxy layer contained impression marks similar to a cross-weave pattern found on the surface of fiberglass. The cross-weave pattern on the surface of the epoxy was consistent with a fracture that traveled between the UD-glass fabric tape and the epoxy layer. This separation was characterized as an adhesive separation.

The surface of the epoxy layer also contained exposed voids. A void was an air pocket that was formed between the epoxy layer and the fiberglass surface region. No bonding between the epoxy and UD-glass fabric tape was observed in the void areas.

The 1453 weather reported at an airport located 13 miles to the south was, clear skies, winds from 120 degrees at 8 knots, gusts to 16 knots.

Pilot Information

Certificate:	Commercial	**Age:**	78,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Center
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	May 3, 1996
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	4750 hours (Total, all aircraft), 1840 hours (Total, this make and model), 21 hours (Last 90 days, all aircraft), 21 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Glaser-Dirks	**Registration:**	N400FJ
Model/Series:	DG-400 DG-400	**Aircraft Category:**	Glider
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	4-78
Landing Gear Type:	Retractable - Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	June 18, 1998 Annual	**Certified Max Gross Wt.:**	1015 lbs
Time Since Last Inspection:	62 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1840 Hrs	**Engine Manufacturer:**	Bombardier
ELT:	Installed, activated, aided in locating accident	**Engine Model/Series:**	505
Registered Owner:	FREDERICK L. JACOBS	**Rated Power:**	43 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	DXR ,458 ft msl	**Distance from Accident Site:**	14 Nautical Miles
Observation Time:	14:53 Local	**Direction from Accident Site:**	225°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / 16 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	19°C / 2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BURLINGTON , CT (22B)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	13:30 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Demko, Stephen
Additional Participating Persons:	DAVID HEDMAN; WINDSOR LOCKS , CT
Original Publish Date:	August 13, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=46237