Aviation Investigation Final Report

Location:	Puyallup, Washington	**Accident Number:**	WPR17LA114
Date & Time:	May 30, 2017, 16:00 Local	**Registration:**	N399DG
Aircraft:	TAPPEN CHRIS VELOCITY SUV	**Aircraft Damage:**	Substantial
Defining Event:	Sys/Comp malf/fail (non-power)	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot stated that, during the landing roll, the right brake of the experimental amateur-built airplane failed. The airplane subsequently departed the runway and impacted an airport fence, resulting in substantial damage. The airplane was equipped with a castering nosewheel and steering was accomplished through differential brake pressure; therefore, the pilot did not have any other means to either stop the airplane or maintain directional control once it had slowed to a speed below which rudder authority was available.

Postaccident examination revealed that the right brake disc had detached from the wheel hub. None of its attachment bolts were found, and the attachment bolts on the left brake disc were loose. The bolts and discs had holes to accommodate safety wires, but no safety wires were found on either assembly.

The pilot had recently purchased the airplane following the completion of a condition inspection. Before the inspection, the airplane's builder had adjusted the landing gear, which necessitated removal of the brake discs. The builder could not recall using safety wires to secure the brake discs during the reinstallation, and the mechanic who performed the subsequent inspection also could not recall if safety wires were used.

Probable Cause and Findings

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

The airplane builder's failure to install safety wires on the brake disc attachment bolts, and the mechanic's failure to identify the omission during the condition inspection. The subsequent brake disc separation resulted in a loss of directional control during the landing roll.

Findings

Aircraft	Brake - Incorrect service/maintenance
Aircraft	Brake - Inadequate inspection
Personnel issues	Scheduled/routine maintenance - Maintenance personnel
Aircraft	Directional control - Attain/maintain not possible

Factual Information

History of Flight

Landing-landing roll	Sys/Comp malf/fail (non-power) (Defining event)
Landing-landing roll	Runway excursion
Landing-landing roll	Collision during takeoff/land

On May 30, 2017, about 1600 Pacific daylight time, an experimental amateur-built Velocity SUV, N399DG, departed the runway after landing at Pierce County Airport - Thun Field, Puyallup, Washington. The pilot was not injured, and the airplane sustained substantial damage to the canard and both wings after striking an airport fence. The airplane was registered to, and operated by, the private pilot as a 14 *Code of Federal Regulations* Part 91 personal flight. The local flight departed Thun Field about 5 minutes before the accident. Visual meteorological conditions prevailed and no flight plan had been filed.

The pilot had purchased the airplane in Tennessee from its builder about one week before the accident, and spent the intervening period flying it back to his home base of Thun Field. He stated that during taxi after one of the return flight legs, the right brake became ineffective, and therefore he was unable to turn the airplane right. He inspected the brake system and was not able to find any anomalies, and on the next three flights, he could not duplicate the problem.

On the day of the accident, he planned to fly the airplane in the traffic pattern. He performed a preflight inspection, and reported that during the engine ground-run he checked the brakes, and they held. Additionally, the taxi route from his hangar to the runway required multiple right turns. The takeoff, climbout, and landing approach were uneventful, and he touched down just beyond the runway numbers, at an airspeed of 82 knots. He applied pressure to the combination rudder/brake foot pedals to slow the airplane down, and once it had reached about 35 knots, the resistance in the right pedal suddenly dropped, and the pedal moved to almost full travel.

The airplane immediately veered to the left, and the pilot released pressure on the left pedal. He began to "pump" the right pedal in an attempt to regain braking action, but the airplane did not slow down. As the airplane approached a runway light, the pilot applied left pedal pressure, and the airplane veered left, departed the runway, and struck the fence.

Pilot Information

Certificate:	Private	**Age:**	41,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	June 11, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 14, 2016
Flight Time:	465.1 hours (Total, all aircraft), 25 hours (Total, this make and model), 431 hours (Pilot In Command, all aircraft), 65 hours (Last 90 days, all aircraft), 27 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	TAPPEN CHRIS	**Registration:**	N399DG
Model/Series:	VELOCITY SUV NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	2012	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	115
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	May 26, 2017 Condition	**Certified Max Gross Wt.:**	2250 lbs
Time Since Last Inspection:	21 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	138 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	C126 installed, not activated	**Engine Model/Series:**	LIO-360-C1E6
Registered Owner:	On file	**Rated Power:**	200 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KPLU,539 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	23:55 Local	**Direction from Accident Site:**	54°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	15°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Puyallup, WA (PLU)	**Type of Flight Plan Filed:**	None
Destination:	Puyallup, WA (PLU)	**Type of Clearance:**	None
Departure Time:	16:55 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	PIERCE COUNTY - THUN FIELD PLU	**Runway Surface Type:**	Asphalt
Airport Elevation:	537 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	35	**IFR Approach:**	None
Runway Length/Width:	3650 ft / 60 ft	**VFR Approach/Landing:**	Traffic pattern

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:**	47.103889,-122.287223(est)

Tests and Research

Brake and Steering System

The airplane was equipped with a castering nosewheel, with steering accomplished through differential brake pressure once rudder effectiveness had reduced at slower speeds. The brakes were activated by the pilot through the rudder pedals. The design did not incorporate conventional toe-brakes, but instead braking action was applied directly via the rudder pedals once they had been pushed about 2 ½ inches. The main landing gear struts were equipped with Matco W600 series brake and wheel assemblies, which incorporated a triple-piston brake caliper, and a steel brake disk which was attached to a threaded aluminum wheel hub by three hex-head bolts. Each wheel assembly was enclosed in a composite wheel pant, which covered the caliper and brake rotor.

Post-accident examination revealed that all three hex bolts for the right brake disk were missing, and the disk had become detached from the wheel hub. The disk on the left side was still in place, but was loose, and the three bolts were finger-tight. The bolts and disks had holes to accommodate safety wire, but no safety wire was found on either assembly.

Right Brake Disk Detached from Wheel Hub

Maintenance

Construction of the airplane was completed in June 2012, and at the time of the accident, it had accrued a total flight time of about 138 hours. Maintenance records indicated that it failed to pass its conditional inspection on May 19, 2017, due to the lack of an emergency locator transmitter (ELT). An entry by the builder dated May 26 detailed that he installed an ELT and completed a series of repairs and upgrades including the replacement of the brake master cylinders, adjustment of the main landing gear camber and toe-in, (due to uneven tire wear), along with modifications to the avionics system.

The builder stated that the toe-in adjustment required removal of the brake assembly (including the three hex bolts) and installation of shims at the wheel axle mounting points. He could not recall if he had used safety wire to secure the hex bolts, or if he had ever used safety wire for their retention in the past. He further reported that the master cylinders were replaced because he encountered a loss of brake effectiveness in the right brake, which could be overcome by "pumping" the right pedal.

The builder stated that all the work, except for the ELT installation, had actually been completed prior to the conditional inspection on May 19, but that he did not record the entry until one week later.

On May 26, 2017, the same airframe and powerplant rated mechanic (with inspection authorization) who initially inspected the airplane, certified that it was airworthy. The mechanic reported that he had examined the brake system at the time of the initial inspection, but could not recall if safety wire had or had not been installed on the disk bolts. He did not re-examine the brakes during the follow-up inspection, as the ELT was the only item which required attention.

During the 21-flight hour period leading up to the accident no other brake-related maintenance procedures were performed.

Administrative Information

Investigator In Charge (IIC):	Simpson, Eliott
Additional Participating Persons:	Kris Slater; Federal Aviation Administration FSDO; Renton, WA
Original Publish Date:	September 6, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95265