



Aviation Investigation Final Report

Location:	Antigo, Wisconsin	Accident Number:	CHI01LA216
Date & Time:	July 14, 2001, 13:00 Local	Registration:	N502SC
Aircraft:	Stemme S10-VT	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The motorglider was destroyed by fire after an emergency landing. After takeoff, the aircraft was passing through 1,000 feet agl, when the pilot heard a "loud pop" and smoke started coming into the cockpit. The engine started running rough and the pilot shut down the engine and executed an emergency landing. The fire consumed the wing attachment area and the cockpit forward of the engine compartment within five minutes of the initial engine failure. The examination of the wreckage revealed the cockpit, engine compartment, and inner wing were destroyed by fire. Only the tail section and about 10 feet of each outer wing panel remained intact. The fire in the engine containment area destroyed all non-metallic components. The left side of the engine sustained extensive heat damage resulting in the melting of the left carburetor, the left intake manifold, the left carburetor tray, and the engine alternator. The stainless steel firewall shroud in front, aft, and on top of the engine was found in place. The side cowlings that cover the engine compartment are made of composite materials and coated with fire retardant-not fire proof-paint. The side cowlings were consumed by fire. The inspection of the aircraft did not reveal what initiated the loss of engine power and subsequent in-flight fire. The total airframe time was 50 total hours and the engine time was 27 hours. An examination of a new production Stemme S10-VT motorglider revealed the following: 1) The forward and aft firewalls contained openings which did not incorporate fireproof grommets, bushings, or firewall fittings. 2) Rubber fuel lines and fittings within the engine compartment were not sealed or clamped to prevent exposure to engine fires. Rubber fuel lines and plastic fuel filters were mounted against the forward side of the engine firewall. 3) The carburetors and other associated fuel system components were located directly over unprotected exhaust system components. 4) The forward, top, and aft sides of the Stemme S10-VT engine compartment are made of 0.040-inch-thick stainless steel sheet metal. The sides and bottom of the engine compartment are made of composite material. The Stemme S10-VT is manufactured in Germany and certified in accordance with the JAR-22, Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes, effective through Change 4, including 22.375 of Amendment 22/90/1. The Type Certificate No. G06CE, for the Stemme

S10-VT, was issued by the FAA on September 22, 1997. The FAA is responsible for certifying the aircraft in the United States.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The cause of the loss of engine power and in-flight fire was undetermined.

Findings

Occurrence #1: LOSS OF ENGINE POWER

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. (C) REASON FOR OCCURRENCE UNDETERMINED

Occurrence #2: FIRE

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

2. FUEL SYSTEM - INADEQUATE

3. (C) REASON FOR OCCURRENCE UNDETERMINED

4. EXHAUST SYSTEM - INADEQUATE

5. FUSELAGE, FIREWALL - INADEQUATE

6. MATERIAL INADEQUATE - MANUFACTURER

7. INADEQUATE CERTIFICATION/APPROVAL - FAA(ORGANIZATION)

Occurrence #3: FORCED LANDING

Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #4: GEAR COLLAPSED

Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

8. FLARE - IMPROPER - PILOT IN COMMAND

Occurrence #5: FIRE

Phase of Operation: STANDING

Factual Information

HISTORY OF FLIGHT

On July 14, 2001, at 1300 central daylight time, a Stemme S10-VT motorglider, N502SC, was destroyed by fire after an emergency landing on runway 8 (3,400 feet by 75 feet) at the Langlade County Airport (AIG), Antigo, Wisconsin. The personal flight was operating under the provisions of 14 CFR Part 91 and was not on a flight plan. The pilot and passenger were not injured. The local flight departed from AIG at 1255. Visual meteorological conditions prevailed at the time of the accident.

The pilot reported he conducted a "disciplined" pre-flight inspection of the aircraft and found nothing unusual. He reported the start, taxi, and run-up were completed with no red lights and with all needles in the green. He departed runway 34. Takeoff power was set to 5,400 rpm. After takeoff, he accelerated to 62 knots in ground effect. He raised the gear and pulled the power back to 5,100 rpm.

He departed to the northwest. The canopy vents were open. He reported the engine operated normally during takeoff and climb, and he did not smell any smoke or fuel. When he was passing through 1,000 feet agl, he heard a "loud pop" and smoke started coming into the cockpit. He reported the engine started running very rough. He shut the power off, ignition off, and fuel off. He lowered the landing gear and got two green lights. He turned back to the airport and decided to land on runway 8. He retracted the propeller. He reported that while flying the base leg to landing, he pushed the fire button but the indicator light did not illuminate. There was no fire detect light or aural warning. He reported that there were no panel lights or indications after 30 seconds after the "loud pop." He pulled the emergency manual landing gear lever. He reported trying to lower the flaps but the detent was not holding. After 2 - 3 attempts he stopped trying to lower the flaps.

He reported he held 70 knots vice 62 knots on the final approach to the runway. The speed brakes were fully extended. The pilot reported the landing was hard and "not pretty," but not excessively hard. The motorglider was tracking down the center of the runway when the right landing gear collapsed and the aircraft veered off the right side of the runway into a potato field. He reported it was 3 - 4 minutes from the "loud pop" to touchdown.

The pilot reported that when he got out of the aircraft, he saw fire coming out of the left side of the engine compartment. He reported that he did not know the aircraft was on fire until he evacuated the aircraft. The pilot assisted the passenger exit the aircraft and they watched the fire consume the aircraft. He reported the fire consumed the wing attachment area and the cockpit forward of the engine compartment within 5 - 10 minutes of the initial engine failure.

A cropduster pilot reported he was at the airport and witnessed the flight. He reported, "I observed the aircraft on a left base for runway 08 with a light trail of smoke coming from it, the light trail turned to a heavy trail then the aircraft turned final. I was in my vehicle by this time on my way to the scene. I observed an orange glow at lower part of fuselage when aircraft was about to touch down. By the time I reached the scene, aircraft was engulfed in flames and occupants had already exited the aircraft."

PERSONNEL INFORMATION

The pilot was a private pilot with single engine land and glider ratings. He had a total of 500 hours of flight time, and 50 hours were in make and model. He had purchased N502SC new in April 2001. He had operated the aircraft with the engine operating for 27 hours, and had been soaring in the aircraft for another 23 hours.

AIRCRAFT INFORMATION

The Stemme S10-VT is a two seat side-by-side motorglider with a mid-mounted 115 horsepower Rotax 914 F2/S1 turbocharged engine. The maximum gross weight is 1,874 pounds. The pilot reported the total airframe time on N502SC was 50 total hours, and the engine time was 27 hours.

The Stemme S10-VT is manufactured in Germany and is certified in accordance with the JAR-22, Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes, effective through Change 4, including 22.375 of Amendment 22/90/1. The Federal Aviation Administration (FAA) Type Certificate No. G06CE, for the Stemme S10-VT, was issued on September 22, 1997.

WRECKAGE AND IMPACT INFORMATION

A Federal Aviation Administration Airworthiness Inspector, an engine manufacturer's technical representative from Kodiak Research/ROTAX, and an aircraft manufacturer's representative from Stemme AG Germany inspected the aircraft wreckage and wreckage site on July 25, 2002, at Antigo, Wisconsin. The aircraft wreckage had been moved to a hangar at AIG.

The inspection of the runway revealed that the motorglider created skid marks when it touched down on the runway and veered into the potato field. The FAA Airworthiness Inspector reported that debris was found on the runway after airplane's touchdown point. The parts included burned fragments of an inline fuel filter element, burned hose and grommet material, and a spring type hose clamp. The parts were consistent with those used in the Stemme S10-VT motorglider fuel system.

The examination of the wreckage revealed the cockpit, engine compartment, and inner wing were destroyed by fire. Only the tail section and about 10 feet of each outer wing panel remained intact. The fire in the engine containment area destroyed all non-metallic components. The left side of the engine sustained extensive heat damage resulting in the

melting of the left carburetor, the left intake manifold, the left carburetor tray, and the engine alternator.

The engine examination revealed that all the spark plugs were in place and in normal condition. The number 2 cylinder exhibited the most heat damage and was removed for inspection. The piston appeared normal with all slip rings intact with fresh lubrication traces. Valves, springs, rocker arms, and the combustion chamber exhibited no signs of abnormal combustion. Melted aluminum from the air intake had dripped through the outlet valve into the number 2 cylinder. All other cylinder head covers were removed and there were no signs of internal fire.

The firewall shroud in front, aft, and on top of the engine was found in place. The side cowlings that cover the engine compartment are made of composite materials and coated with fire retardant-not fire proof- paint. The side cowlings were destroyed by fire. (See photographs)

The Stemme AG aircraft representative stated in the "Accident Investigation Report Motorglider Stemme S10-VT Registration: N502SC, dated October 22, 2001, that, "No evident failure of an engine related system (fuel, ignition) or a human mounting mistake was found."

TESTS AND RESEARCH

National Transportation Safety Board (NTSB) and FAA investigators examined a new production Stemme S10-VT motorglider to determine the configuration of the firewall and the location of the fuel lines. During this examination, the investigators noted the following:

1. The forward and aft firewalls contained openings as large as 1 inch to accommodate aircraft structural members (tubular steel) and the propeller drive shaft. These openings did not incorporate fireproof grommets, bushings, or firewall fittings. The propeller drive shaft had a fire resistant material installed around the firewall opening, but it did not provide a complete seal that closed the gap around the propeller drive shaft.
2. Rubber fuel lines and fittings within the engine compartment were not sealed or clamped to prevent exposure to engine fires. Rubber fuel lines and plastic fuel filters were mounted against the forward side of the engine firewall.
3. The carburetors and other associated fuel system components were located directly over unprotected exhaust system components.
4. The forward, top, and aft sides of the Stemme S10-VT engine compartment are made of 0.040-inch-thick stainless steel sheet metal. The sides and bottom of the engine compartment are made of composite material.

JAR-22, Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes, contain the

following certification requirements:

JAR 22 Requirement: Power-Plant Fire Protection

JAR 22.1191 "FIREWALLS" states the following:

- (a) The engine must be isolated from the rest of the sailplane by a firewall, shroud or equivalent means.
- (b) The firewall or shroud must be constructed so that no hazardous quantity of liquid, gas or flame can pass from the engine compartment to other parts of the sailplane.
- (c) The firewall and shroud must be fireproof and protected against corrosion.

JAR 22 Requirement: Exhaust System

JAR 22.1121 "General" states the following:

- (a) The exhaust system must ensure safe disposal of exhaust gases without fire hazard or carbon monoxide contamination in any personnel compartment.
- (b) Each exhaust system part with a surface hot enough to ignite flammable fluids or vapors must be located or shielded so that leakage from any system carrying flammable fluids or vapors will not result in a fire caused by impingement of the fluids or vapors on any part of the exhaust system, including shields for the exhaust system.
- (c) Each exhaust system component must be separated by fireproof shields from adjacent flammable parts of the sailplane that are outside the engine compartment.
- (d) No exhaust gases may discharge dangerously near any oil or fuel system drain.
- (e) No exhaust gases may be discharged where they will cause a glare seriously affecting pilot vision at night.
- (f) Each exhaust system component must be ventilated to prevent points of excessively high temperature.

JAR 22 Requirement: Fuel System

JAR 22.993 "Fuel System Lines and Fittings" states the following:

- (a) Each fuel line must be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure and accelerated flight conditions.

(b) Each fuel line connected to components of the sailplane between which relative motion could exist must have provisions for flexibility.

(c) Each flexible hose must be approved or must be shown to be suitable for the particular application.

(d) Each fuel line and fitting in any area subject to engine fire conditions must be at least fire resistant.

On May 24, 2002, the NTSB issued Safety Recommendations A-02-09 through -11. The NTSB recommended that the FAA:

1. Require that existing Stemme S10, S10-V, and S10-VT powered gliders be modified to reduce the risk of fires in the engine compartment, including sealing the engine compartment, protecting fuel lines and fittings, and shielding exhaust components. (A-02-09)
2. Require that future Stemme S10, S10-V, and S10-VT powered gliders be designed and manufactured to reduce the risk of fires in the engine compartment, including sealing the engine compartment, protecting fuel lines and fittings, and shielding exhaust components. (A-02-10)
3. Notify all registered operators of Stemme S10, S10-V, and S10-VT, powered gliders about the circumstances of the July 14, 2001, Antigo, Wisconsin, accident, including their related design deficiencies. (A-02-11)

Additional Information

The aircraft manufacturer issued Service Bulletins A31-10-057, dated June 7, 2001, and A31-10-061, dated April 22, 2002, that addressed specific design details concerning the modification of the fuel system, the inspection and sealing of all fuel line connections in the engine compartment, and the sealing of the firewall and cockpit.

Service Bulletin A31-10-057, "Measures for Sealing of Cockpit," provided improved cockpit sealing against warm air coming out of the engine compartment via the firewall gap around the drive shaft. The service bulletin provided for the installation of the propeller dome tube seal and the installation of the flywheel clutch seal.

Service Bulletin A31-10-061, "Additional Measures Fire Protection," provided additional measures for fire protection. The service bulletin provided for the following modifications to the fuel system:

1. For all fuel lines on top of the upper firewall: Installation of spacers between the fuel lines and the firewall.

2. Installation of new metal water separators in front of the forward firewall instead of the old plastic inline fuel filters.
3. Replacement of the plastic distributor in the fuel return line on top of the engine compartment by a metal distributor.
4. Installation of heat reflecting sleeves around all fuel lines near the engine compartment.
5. Replacement of the plastic quick-connectors between the wing and the fuselage with metal quick-connectors.

The German Civil Authority, Luftfahrt-Bundesamt (LBA) issued Airworthiness Directive 2002-156 that required:

1. Modification of the fuel system.
2. Inspection and sealing of all line connections in the engine compartment.
3. Sealing of the firewall and cockpit.

The Federal Aviation Administration issued a Special Airworthiness Information Bulletin (SAIB), No. CE-02-35, on June 20, 2002. The SAIB provided safety information to Stemme Model S10-VT sailplane owners concerning fire protection and the preventive actions for enhanced fire protection. The SAIB stated the following:

"The FAA is currently conducting an assessment of foreign airworthiness directives that have been issued by the German Luftfahrt-Bundesamt (LBA) on the Model Stemme S10-VT sailplanes. We are currently assessing the need to issue a corresponding U.S. Airworthiness Directive (AD) for the Stemme S10-VT sailplanes. In the interim, we are using this SAIB to inform U.S. owners of the modifications Stemme GmbH & Company have developed. If an AD is determined to be appropriate, we will issue a Notice of Proposed Rulemaking."

Parties to the investigation included the Federal Aviation Administration, Stemme GmbH & Co., and Rotax Aircraft Engines.

Pilot Information

Certificate:	Private	Age:	44,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Glider	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	None	Last FAA Medical Exam:	
Occupational Pilot:	No	Last Flight Review or Equivalent:	May 14, 2001
Flight Time:	500 hours (Total, all aircraft), 50 hours (Total, this make and model), 500 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Stemme	Registration:	N502SC
Model/Series:	S10-VT	Aircraft Category:	Glider
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	0-56
Landing Gear Type:	Retractable - Tailwheel	Seats:	2
Date/Type of Last Inspection:		Certified Max Gross Wt.:	1874 lbs
Time Since Last Inspection:	40 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	40 Hrs at time of accident	Engine Manufacturer:	Rotax
ELT:	Not installed	Engine Model/Series:	914 F2/S1
Registered Owner:	Stuart Cornew	Rated Power:	115 Horsepower
Operator:		Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	AUW,1201 ft msl	Distance from Accident Site:	26 Nautical Miles
Observation Time:	12:54 Local	Direction from Accident Site:	240°
Lowest Cloud Condition:	Few / 8500 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	10 knots / 15 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	260°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.04 inches Hg	Temperature/Dew Point:	31°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Antigo, WI (AIG)	Type of Flight Plan Filed:	None
Destination:	Antigo, WI (AIG)	Type of Clearance:	None
Departure Time:	12:55 UTC	Type of Airspace:	Class E

Airport Information

Airport:	Langlade County Airport AIG	Runway Surface Type:	Asphalt
Airport Elevation:	1521 ft msl	Runway Surface Condition:	Dry
Runway Used:	8	IFR Approach:	Unknown
Runway Length/Width:	3400 ft / 75 ft	VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Destroyed
Passenger Injuries:	1 None	Aircraft Fire:	In-flight
Ground Injuries:	N/A	Aircraft Explosion:	In-flight
Total Injuries:	2 None	Latitude, Longitude:	45.139503,-89.150192(est)

Administrative Information

Investigator In Charge (IIC):	Silliman, Jim
Additional Participating Persons:	Steven Talbot; FAA; Milwaukee, WI Erik Tucker; ROTAX; Nassau, Bahamas Martin Just; Stemme; Strausberg, Germany Chuck Ebert; FAA; Milwaukee, WI
Original Publish Date:	May 13, 2003
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=52733

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).