Australian Government
Australian Transport Safety Bureau

Engine failure and collision with terrain involving Stoddard-Hamilton Glasair III VH-USW

near Jandakot Airport, Western Australia | 9 December 2013

Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
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Cover photo: **W. Keehner**

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Addendum

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Safety summary

What happened

VH-USW

Source: Aircraft owner

On 9 December 2013, the pilot/owner of an amateur-built Stoddard-Hamilton Glasair III aircraft, registered VH-USW and operated in the ‘experimental’ category, was conducting a local flight from Jandakot Airport, Western Australia with a passenger on board.

Shortly after take-off, when about 2 km from the airport, the aircraft’s engine stopped without warning. During the ensuing forced landing onto a sports oval, the aircraft’s left wing detached from the fuselage after striking a metal goal post. Fuel from the ruptured left wing fuel tank ignited as the aircraft tumbled across the ground.

The pilot and passenger sustained serious burns and were taken to hospital. The aircraft was destroyed by impact forces and an intense post-impact fuel-fed fire.

What the ATSB found

During the aircraft’s construction, modification of the electronic ignition system incorporated a single point of failure in the intended dual system, increasing the risk of the simultaneous failure of both systems and a total loss of engine power. In addition, the connector plug used for the modification was inappropriate for the in-line installation, increasing the risk of its disconnection and disabling the ignition system.

Examination of the engine found that the single wiring harness for the ignition system was disconnected from the connector plug. However, due to the level of impact and fire damage sustained by the aircraft, the ATSB was unable to conclusively establish if this occurred in-flight, resulting in the total engine power loss, or during the early stages of the impact sequence.

Safety message

The aviation industry has long recognised the need for redundant systems, particularly those relating to safety-critical components. The ATSB cautions that, even if unintended, the incorporation of a single point of failure into such systems during construction or modification can eliminate all levels of redundancy. In this case, damage to the aircraft’s modified single wiring harness resulted in the failure of an otherwise redundant system, with near-fatal consequences.

Contents

The occurrence

On the afternoon of 9 December 2013, the pilot/owner of an amateur-built Stoddard-Hamilton Glasair III aircraft, registered VH-USW (USW) and operated in the 'experimental' category, conducted a pre-flight inspection in preparation for a local flight from Jandakot Airport, Western Australia. The pilot reported that the aircraft's wingtip fuel tanks were empty, the main tanks were full and 25 L was uploaded into the header tank. The pilot and passenger then boarded the aircraft and taxied for the flight.

The flight was the first since the aircraft's electronic ignition system had undergone maintenance. While the ignition system was engine ground-run tested by a Licenced Aircraft Maintenance Engineer as part of that maintenance, the pilot elected to perform the engine run-up checks twice as a precaution. The pilot reported that the engine operated as normal.

At about 1434 Western Standard Time,[1] the pilot advised Jandakot Tower air traffic control that they were ready for departure and was subsequently cleared to take off from runway 24 Right (R). After take-off, the aircraft was climbed to 1,000 ft and a shallow right turn commenced toward Fremantle. The pilot and passenger stated that at about 1436 the aircraft's engine suddenly stopped without warning and the pilot broadcast on the Jandakot Tower radio frequency that they had experienced an engine failure. The pilot reported that, while there was insufficient altitude to conduct the engine failure 'trouble checks',[2] they moved the two toggle switches for the aircraft's ignition system to OFF and ON again in an attempt to re-start the engine, but with no effect.

The pilot focused on flying the aircraft and looking for a suitable landing area. With very few options available, the pilot, who was aware of powerlines in the vicinity (Figure 1), manoeuvred the aircraft for a forced landing in a nearby grassed area (Lakelands Reserve Oval). It was reported that the propeller was windmilling during the descent.[3]

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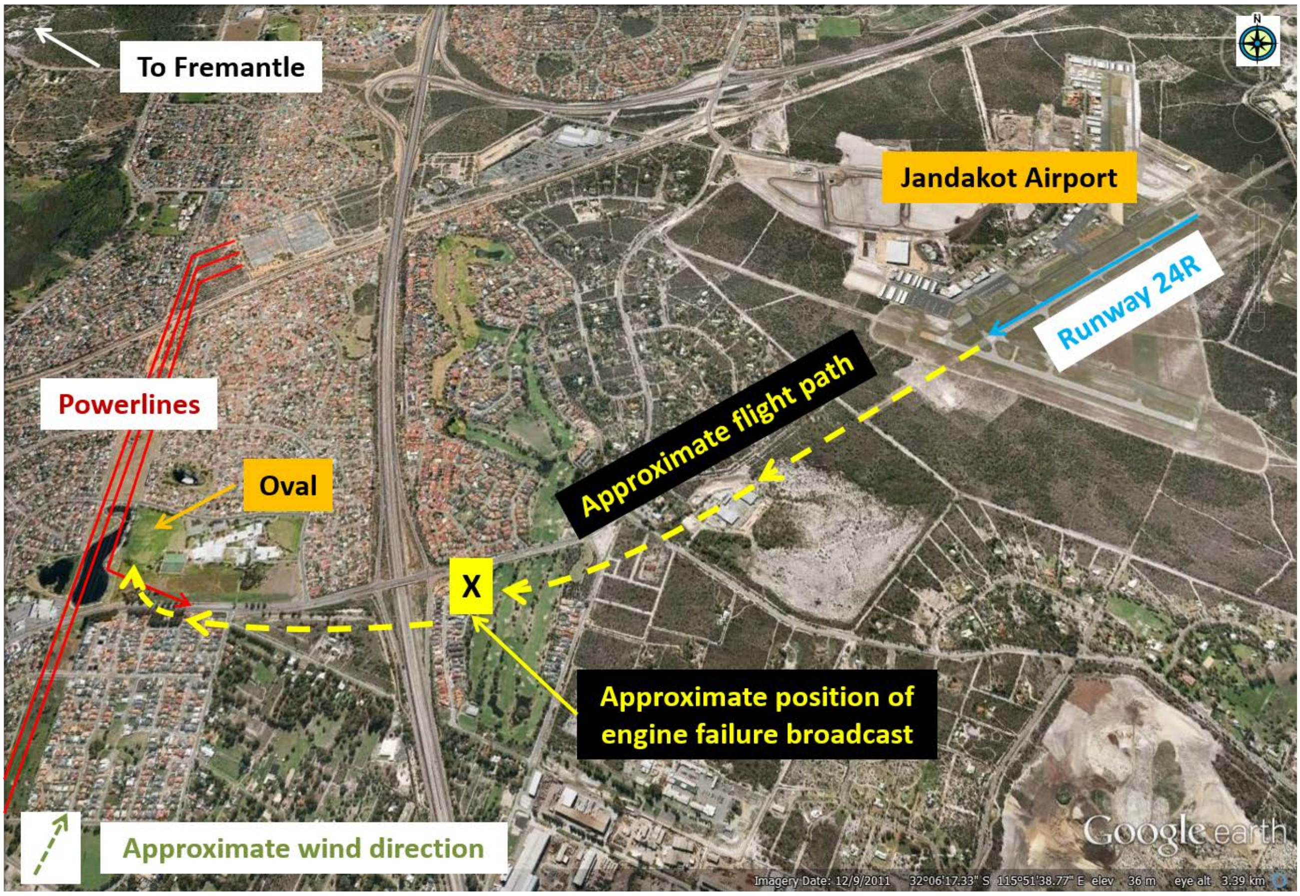
1. Western Standard Time (WST) was Co-ordinated Universal Time (UTC) + 8 hours.
2. Trouble checks are a way to diagnose or troubleshoot the causes of an engine failure. They cover most common causes and increase the chances of getting the engine running again. Critically, though, trouble checks are only completed when there is enough time. If there is not enough time, pilots will concentrate on flying the aircraft.
3. Term used to describe a rotating propeller being driven by the airflow rather than by engine power. This results in increased drag at normal propeller blade angles.

Figure 1: Approximate flight path and forced landing area

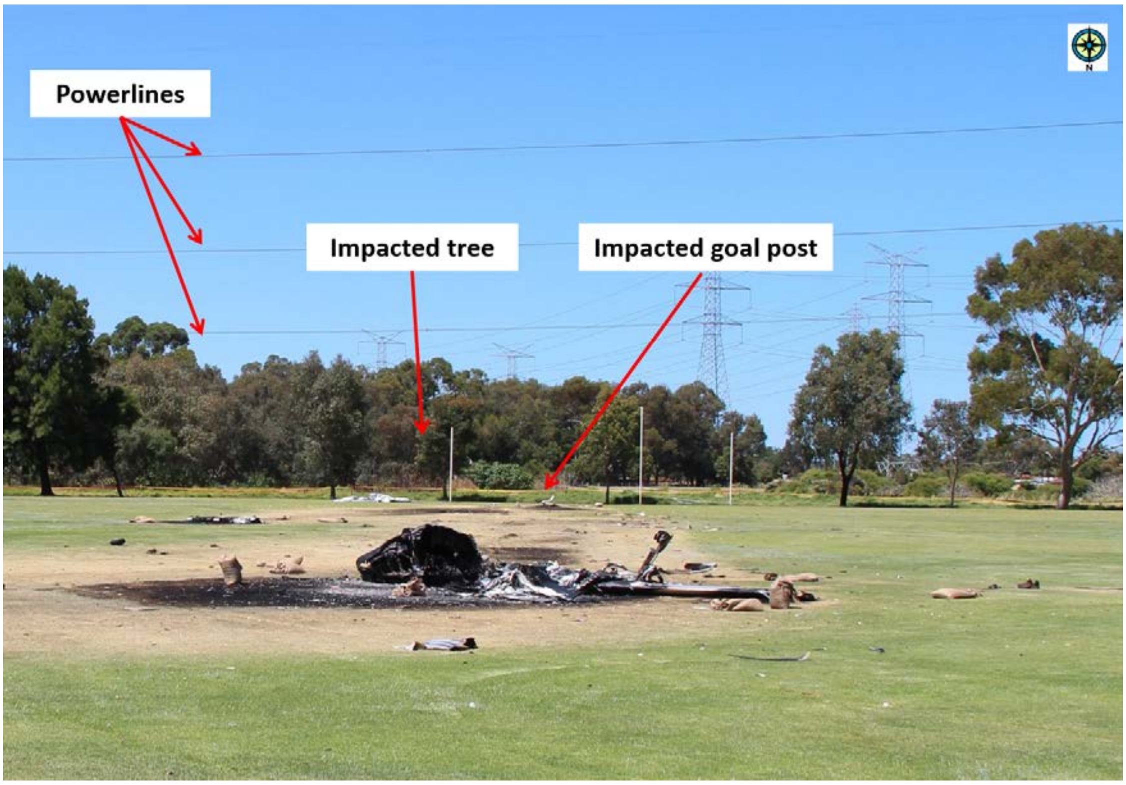


Source: Google earth, modified by the ATSB

Approaching the landing area, the pilot observed a powerline along the flight path and dived abruptly to pass beneath that line. At the same time, the pilot lowered the undercarriage and flaps to control the aircraft's airspeed and avoid overshooting the oval. The pilot elected not to turn the aircraft's electrical system off for the landing to ensure that the undercarriage lowered completely.

After flying under the powerline, the aircraft lightly clipped a tree bordering the oval before colliding with a metal goal post. The pilot reported not seeing the goal posts until it was too late to avoid the collision (Figure 2). The pilot recalled hearing the sound of the impact then next remembered lying on the ground and seeing the passenger nearby and the aircraft wreckage on fire. The pilot helped the passenger to move away from the wreckage and remove burning clothes items.

Figure 2: Three-strand powerline on late approach to the landing area and the impacted tree and goal post (looking back along the direction of travel)



Source: ATSB

Witnesses in the vicinity heard the sound of an impact and saw a fireball and the burning aircraft tumbling across the oval before coming to rest. A number of people rushed to assist and found the two occupants clear of the burning wreckage. They moved the occupants further away and administered first aid until emergency services personnel arrived.

The pilot and passenger both sustained serious burns and were taken to hospital. Emergency services extinguished the fire but the aircraft was destroyed by the impact forces and intense fuel-fed fire.

Context

Pilot information

The pilot held a Private Pilot (Aeroplane) Licence that was issued on 12 March 1990 and a valid Class 2 Aviation Medical Certificate.[4] The pilot had a total flying experience of 3,265 hours, of which 114.6 hours were conducted in the Glasair III aircraft. In the previous 90 days, the pilot had flown 10.2 hours and they last completed an aeroplane flight review on 1 November 2013. This review was carried out in a Van's Aircraft RV-8 and included a practice forced landing.

Aircraft information

General

The Stoddard-Hamilton Glasair III is a kit-built, all-composite aircraft (primarily fibreglass/resin and carbon fibre/resin) with a low-wing and retractable undercarriage. Consistent with its construction in the United States (US), an experimental amateur-built certificate of airworthiness was issued by the US Federal Aviation Administration (FAA) on 19 July 2000. The aircraft was subsequently purchased by the present owner/pilot and imported into Australia, where it was registered on 1 October 2008 as VH-USW. A special certificate of airworthiness designating the aircraft in the Experimental airworthiness category, and for operation as an amateur-built aircraft, was issued by a Civil Aviation Safety Authority (CASA) authorised person on 22 January 2009.

Engine and propeller

The aircraft was fitted with a six-cylinder, direct-drive, horizontally-opposed, air-cooled Textron Lycoming engine, model number IO-540-K1B5, serial number L-25612-48A. The engine drove a two-bladed Hartzell, constant-speed propeller, model HC-CZYK-1BF.

Maintenance

A review of the aircraft's logbook and other related documentation indicated that USW was maintained in accordance with an approved CASA maintenance schedule. The last periodic inspection was conducted on 11 March 2013, at which time the aircraft's total time in service was 223.2 hours. The aircraft last flew on 12 November 2012 and had undergone several ground runs following maintenance since that time.

Recent maintenance was carried out on the aircraft's Light Speed Engineering Plasma I capacitor discharge ignition (CDI) electronic ignition system. This included the removal of the aircraft's two CDI modules for upgrade by the manufacturer before they were refitted to the aircraft and ground tested satisfactorily.

The power feed to each system was also modified during that maintenance to enhance the independence of the two CDI systems. It was reported that a wire that led from the main power bus to the voltmeter switch was temporarily disconnected (see the section *Engine monitoring and recording*) and that the wire was not reconnected prior to the occurrence. The aircraft had not flown in the intervening period.

Alternator V-belt

The aircraft's maintenance records indicated that a notched alternator V-belt was fitted to the engine in about January 2000 and had not been replaced. The engine manufacturer specified that, following fitment of a new belt, the belt should be checked for correct tension 25 hours after installation. It was unknown if this had been conducted.

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[4] The pilot also held a Commercial Pilot (Aeroplane) Licence but, because their Class 1 Aviation Medical Certificate was out of date, could not perform flying duties associated with this licence.

Routine maintenance inspections were certified as conducted in the intervening 14-year period. According to the FAA and CASA maintenance schedules, these inspections included an inspection of the V-belt. The pilot indicated that when inspected, no problems were identified with the condition of the belt. According to the belt manufacturer, the belt had an acceptable storage life of 8 years, even if stored for this time on the drive under tension. Examination of the alternator belt tensioning arm showed a single, circular witness mark that coincided with the under-head washer on the bolt. Consistent with the maintenance records, this indicated that the alternator belt had likely not been replaced since initial installation during the construction of the aircraft.

Further, in order to prevent 'belt set',[5] the manufacturer recommended that tension be removed from the belt if storage time before re-use was greater than about 6 months. Depending on a number of factors including drive design, storage environment and maintenance practices, serious belt damage may occur when starting this type of belt if 'set' had occurred and/or the belt had lost tension. The maintenance records for USW indicated a maximum storage time of just over 6 months. As such, there would have been no need to remove tension from the belt.

Electronic ignition system

During the aircraft's construction, the engine was modified by replacing its dual magneto system and corresponding aircraft-type spark plugs and leads with the Plasma I capacitor discharge ignition (CDI) system (electronic ignition system). This system was originally designed to operate as a single CDI system and used dual-lead coils and automotive spark plugs and leads.

In normal operations, six-cylinder engine ignition timing on the Plasma I was achieved by a trigger coil system. As part of this system, a trigger plate mounted on the front of the engine crankcase contained three trigger coils and precisely-placed interrupter trigger bolts fastened to the ring gear support assembly (flywheel). This assembly is attached to the propeller hub. As the flywheel rotates, the trigger coils sense the trigger bolts and produce an electrical signal each time successive bolts pass the coils. This provides an indication of crankshaft position (timing) and allows the determination of the engine revolutions per minute (RPM) via wiring to the individual CDI modules located beneath the instrument panel in the cockpit. Timing, RPM and manifold pressure information is integrated by the CDI modules to optimise the timing of the spark in each cylinder.

Aircraft builders were supplied with a trigger plate assembly and were responsible for connecting a short wiring harness from the trigger plate to the pre-manufactured CDI module cable. The manufacturer's diagram recommended that the wiring harness be attached using a suitable connector. The manufacturer also recommended a soldered joint connection as a preference. These connections were based on a single electronic ignition system installation.

The aircraft's ignition system was further modified by the aircraft builder to include a second CDI module and an auxiliary battery. The addition of an auxiliary battery was recommended by the manufacturer and independently powered the second system. The aircraft's two CDI systems were intended by the builder to operate independently, providing redundancy in the event that one of the duplicated elements failed. To duplicate the wiring for the two CDI modules, the builder split the single wiring harness from the trigger plate into two using a MIL-SPEC connector plug.[6] This plug was designed to be attached to a metal box or a panel, such as a firewall. However, in USW, it was mounted onto a homemade, right-angled bracket that was fastened to the front of the engine crankcase (Figure 3). The connector plug and associated wiring were in an in-line arrangement.

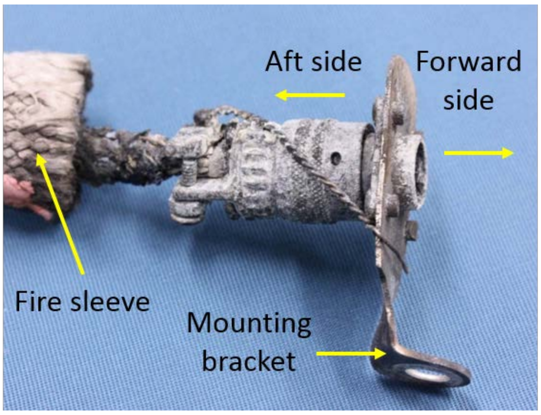
On the aft side of the connector plug in USW, the duplicated wires were clamped to relieve stresses from wire tension and were collectively shrouded in fire sleeving (Figure 3), which went to

5 When a belt remains under tension in the same position for a period of time, it will tend to adopt a shape or form consistent with its installation.

6 MIL-SPEC connectors are built in accordance with military specifications and protect the connection from environmental factors associated with military applications.

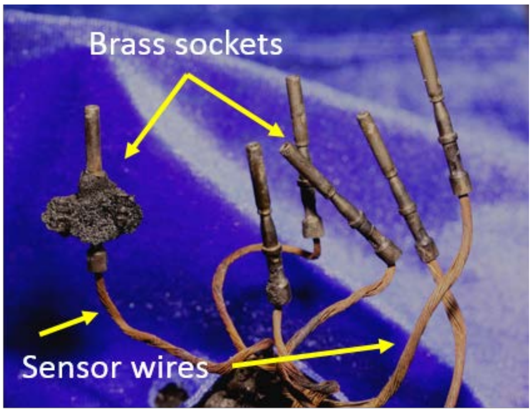
each CDI module. On the forward side of the plug, the single set of wires from the trigger plate was inside two plastic sleeves and their ends inserted into brass sockets, which were crimped for security (Figure 4). The sockets were then pushed into the forward side of the connector plug through a rubber sealing grommet and held in place in the cylindrical, plastic insulator by plastic clips. There was no means on this type of connector for relieving any stresses placed on the wires.

Figure 3: Bracket-mounted connector plug and fire sleeve



Source: ATSB

Figure 4: Sensor wires and brass sockets



Source: ATSB

Light Speed Engineering Plasma II and III ignition systems, such as the direct crank sensor installation, are now available as a dedicated dual system, with two independent wiring harnesses originating from the sensor plate and connecting directly to each CDI module. No intermediate plug, such as the connector plug used on USW, is required.

Engine monitoring and recording

The aircraft was fitted with a Vision Microsystems Inc. VM 1000 engine management system and an EC 100 electronic checklist and caution advisory system. The VM 1000 was normally used to display engine and aircraft system parameters during a flight. Additionally, when the engine RPM increased above 1,500 RPM, the VM 1000 automatically recorded the minimum and maximum values for various operating parameters for the flight. The system also had a built-in warning system whereby any out-of-tolerance parameter flashed on the display.

The recorded data for the occurrence flight was retrieved from the VM 1000 following the accident. This data showed a voltmeter reading of zero for the flight. This was consistent with the reported disconnection of the wire between the main power bus and voltmeter switch, which had been selected to indicate main bus voltage. The remaining values, including engine oil pressure and temperature, ammeter and fuel flow and pressure gave no indication of the reason for the engine failure.

The EC 100 operated in conjunction with the VM 1000 and alerted the pilot to abnormal conditions or trends in the engine operating parameters. The pilot could not recall a warning of a problem with the engine, but had reportedly mentioned to witnesses immediately after the accident that an unspecified engine warning had been received. The passenger reported not paying any particular attention to the warning display during the flight.

Fuel system and selection

The fuel was carried in integral fuel tanks located in each wing, with a reported total capacity of 114 L in each tank. A fuselage header tank located between the engine firewall and the cockpit had a total capacity of 25 L. Additionally, USW was fitted with optional wingtip tanks, but the pilot reported that they were empty for the flight.

A four-position fuel selector was located on the centre console near the pilot's right knee. To prevent inadvertent selection, a button on the selector had to be raised in order to select the OFF position. The pilot reported selecting the left fuel tank for the flight.

The pilot also reported a previous temporary fuel starvation event with the header tank selected. In that instance the engine had coughed and surged, providing sufficient warning for the pilot to change tanks.

Meteorological information

The automatic terminal information service[7] at Jandakot Airport indicated a 14 kt (26 km/h) surface wind between 140° and 200° (south-south-easterly to south-south-westerly) and a temperature of 27 °C at the time. A nearby surveillance camera showed smoke from the post-impact fire being blown from the south-west.

Wreckage and impact information

An examination of the wreckage found that the aircraft's right wingtip clipped a tree on the southern boundary of the oval before the left wing was sheared off at the wing root by the collision with a tubular, metal goal post. This impact ruptured the left wing fuel tank and severed aircraft wiring from the fuselage into the left wing. Images from a nearby surveillance camera showed that the fuel ignited shortly after the collision with the goal post (Figure 5).

Figure 5: Security camera image of the fire (looking south-south-east)

Source: Channel 7

Damage to the aircraft was consistent with witness descriptions and the surveillance images depicting the aircraft tumbling before coming to rest with the fuselage, attached right wing and tailplane inverted. The engine, upper engine cowling, engine mounts and header tank were orientated in an upright position. The upper engine cowling was in situ and intact, with the engine still attached to the firewall assembly via the support frame. The damage to the propeller blades and strike marks on the ground were consistent with the propeller rotating at impact but the engine producing no power (Figure 6 inset).

The impact and fuel-fed fire destroyed the cockpit and severely damaged the composite airframe. This included the destruction of components of the electronic ignition and fuel systems, limiting or preventing examination of these parts.

7 An automated pre-recorded transmission indicating the prevailing weather conditions at the aerodrome and other relevant operational information for arriving and departing aircraft.

Figure 6: Aircraft wreckage and propeller damage (see inset)

Source: ATSB

Fire

Shortly after colliding with the ground, a significant fire commenced that was initially fed by fuel from the ruptured left wing tank. The right wing and header tanks were also breached during the impact sequence. The fire was subsequently extinguished by local fire authorities. The aircraft was destroyed in the fire and the occupants received serious burn injuries. The investigation was unable to identify the ignition source(s) for the fire; however, disruption of the aircraft's wiring while still powered provided a potential ignition source for the fire.

The emergency procedures section of the Glasair III owner's manual detailed the actions in the event of an engine failure, in particular, once committed to landing. These included the requirement for the aircraft's alternator, master and ignition switches to be selected to OFF. In addition, the FAA Airplane Flying Handbook stated that:

> Deactivation of the airplane's electrical system before touchdown reduces the likelihood of a post-crash fire. However the battery master switch should not be turned off until the pilot no longer has any need for electrical power to operate vital airplane systems.

In this instance, due to the difficult approach and landing area constraints, the pilot lowered the flaps and undercarriage to assist with controlling the aircraft's landing speed and prevent an overshoot. As the undercarriage required electrical power to extend, the pilot elected to leave the aircraft's electrical system on for the landing. This was consistent with the FAA guidance.

Survival aspects

The pilot reported that he and the passenger most likely escaped the burning wreckage during the break-up of the fuselage as the aircraft tumbled across the oval. This dislodged the seatbelt attachment points from the fuselage and released the pilot and passenger from the wreckage.

Tests and research

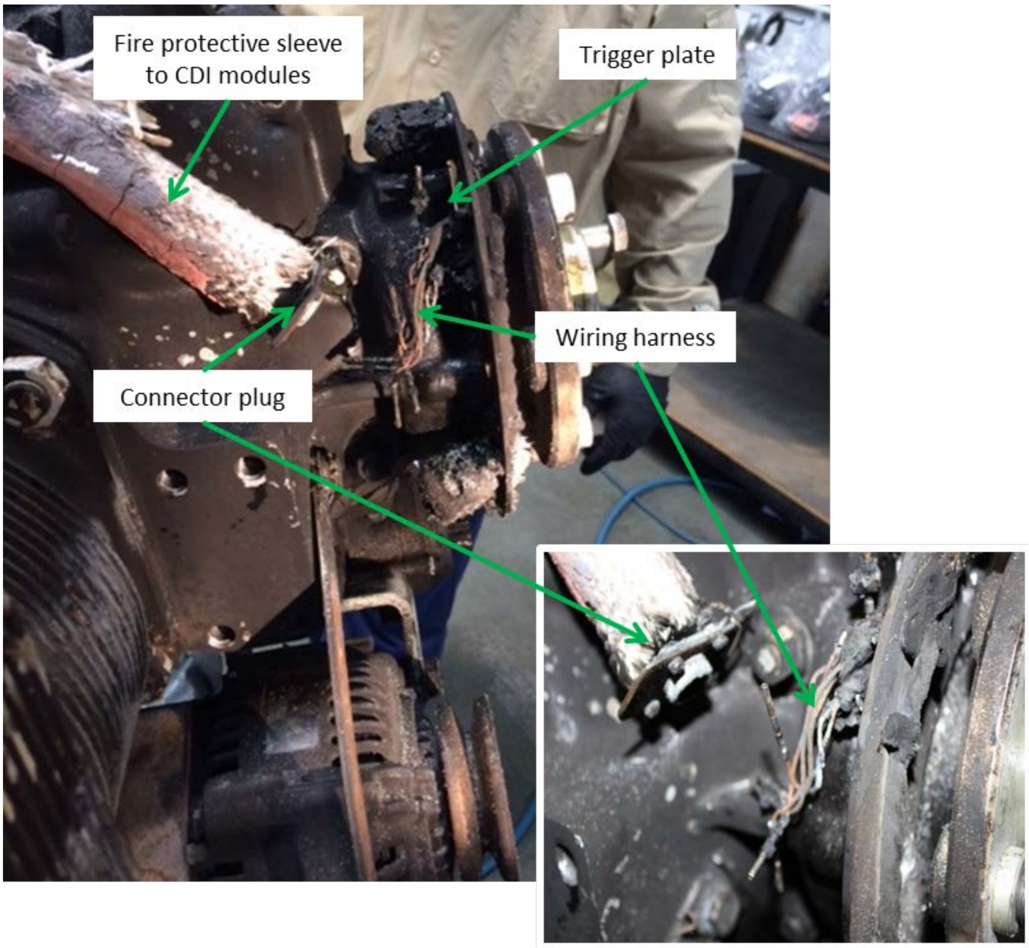
Engine examination

The engine was recovered from the wreckage and transported to an approved overhaul facility for technical inspection under the supervision of the ATSB. The examination found no evidence of internal mechanical failure of the engine that would have prevented normal operation prior to the occurrence.

The wires from the engine timing trigger plate for the aircraft's electronic ignition system were found disconnected from the connector plug and displaced in the direction of engine rotation (Figure 7). In addition, there was no evidence of the alternator V-belt. Whether the belt failed or dislodged from the drive prior to or during the accident sequence, or was consumed in the post-impact fire could not be determined.

The remaining components from the aircraft's ignition system and the alternator were removed from the engine. Together with the already-removed flywheel, these items were transported to the ATSB technical facilities in Canberra, Australian Capital Territory for further examination.

Figure 7: Disconnected engine timing trigger plate wiring and connector plug (engine positioned upright)



Source: Aircraft owner, modified by the ATSB

Electronic ignition system examination

The wires for each of the trigger coils on the engine timing trigger plate were resistance tested and found within manufacturer's specifications. A check for short circuiting between the wires was also conducted, with nil evidence found. This indicated that the trigger coils were capable of functioning prior to the occurrence.

Examination of the pins and brass sockets on the forward side of the connector plug showed damage consistent with the wiring harness being forcefully and unevenly disconnected either in-flight or during the early stages of the impact sequence. However, no witness marks were identified on the two flywheel trigger bolts to indicate contact with another part of the engine or its accessories. This and the fire damage to the plastic insulation on the wiring harness meant that there was insufficient evidence to conclude that they had contacted a trigger bolt.

System redundancy and single points of failure

On 22 June 2001, the pilot of an amateur-built Quickie Aircraft Corporation Q2 aircraft reported that their aircraft's engine stopped during the climb. The pilot attempted a forced landing at the departure aerodrome. The pilot reported that, as the aircraft approached the runway, they 'encountered sink' and undershot the runway. The aircraft collided with a boundary fence before coming to rest. The pilot reported that the switch for the aircraft's ignition system had failed. The aircraft was fitted with a dual magneto ignition system but had a single ignition selector switch. The pilot indicated that not being able to select the individual ignition systems reduced the redundancy of the system (ATSB occurrence 200103043).

Downer (2009) described system redundancy as follows:

> An element is redundant if it contains backups to do its work if it fails; a system is redundant if it contains redundant elements. This can mean having several elements that work simultaneously but are capable of carrying the 'load' by themselves if required…

Describing the advantages of system redundancy, Dekker (2011) highlighted that:

> …redundancy is the best way to protect against hazard…safety-critical systems usually have multiple redundant mechanisms…it protects them against the failure of a single component or part that could directly lead to a bad outcome.

The October 2014 edition of the Sport Aircraft Association of Australia *Airsport* magazine included an article on the occurrence involving USW and the aircraft's electronic ignition system. Specifically, the article discussed that, while the ignition system was well-built, with redundancies in place, the wiring from the trigger plate was a potential common point of failure that, if damaged, would result in a sudden and total power loss. The article further suggested a number of strategies to help manage this risk, including the installation of a hybrid ignition system (one magneto and one electronic ignition system) and/or ensuring the wiring was protected from mechanical damage. The manufacturer of the ignition system fitted to USW noted the benefits of having a dual electronic ignition system. In particular, dual ignition would provide enhanced performance and reliability when compared with traditional (two magnetos) or hybrid ignition systems. Regardless of the solution adopted by builders, the manufacturer reinforced that, in order to address the risk of a single point of failure, it is crucial that dual electronic ignition systems operate independently.

The US Federal Aviation Administration Advisory Circular 25.1309-1A (*System design and analysis*) suggests that in any safety-critical system, the failure of a single element, component or connection should be assumed, regardless of the probability. However, such single-point failures should not compromise the safety of a flight or significantly reduce the aircraft's capability or a crew's ability to cope with the resultant failure. A single point of failure can simultaneously eliminate all levels of redundancy (Berk 2009).

Safety analysis

The loss without warning of engine power at about 1,000 ft shortly after take-off, combined with the surrounding built-up area and obstacles, presented the pilot with very few landing options. The loss of the left wing from the collision with the goal post contributed to the aircraft tumbling across the sports oval, increasing the severity of the occupants' injuries and aircraft damage.

The extensive damage from impact forces and the post-impact, fuel-fed fire precluded examination of a number of the aircraft's fuel system components. However, the pilot's description of the symptoms associated with a previous loss of engine power from fuel starvation, and the amount of fuel on board so shortly after take-off, indicated that fuel-related issues were not a factor in the sudden engine power loss.

While the engine examination identified no internal mechanical failure or abnormality that would have precluded normal operation, the single wiring harness to the aircraft's electronic ignition system was found disconnected.

This analysis will discuss the aircraft's electronic ignition system and the possible reasons for, and timing of the disconnection of the wiring harness. It will also consider the suitability of the associated connector plug and discuss the risks to aircraft systems of single points of failure.

Electronic ignition system installation

During construction, the aircraft was fitted with a single electronic ignition system that was then modified by the builder of the aircraft with the addition of a second ignition module. The installation was intended by the builder to create a dual system that would provide for redundancy. That is, in the event of one system failing, the other would continue to operate. However, the modification retained the original single wiring harness from the engine timing trigger plate to the connector plug, incorporating a single point of failure in the intended dual system.

Cessation of the engine timing signal, such as from the disconnection of the single wiring harness, would result in the loss of timing signals to both ignition modules and failure of the ignition system. Without an ignition source, the engine would stop operating.

The alternator V-belt and the engine timing trigger bolts on the flywheel were the only two moving components within the vicinity of the single wiring harness and connector plug with the potential to disconnect the harness. The still-rotating propeller meant that, dependent on the presence of an operational alternator belt, these components may still have been rotating at impact. However, the unavailability of the alternator belt for examination prevented any conclusion on its pre-impact condition or contribution to the disconnection of the harness. Regardless, the continued use of the V-belt, which had been stored under tension for longer than the manufacturer's acceptable storage life, increased the risk of belt failure.

As with the difficulty determining the contribution, if any, of the V-belt to the occurrence, the lack of witness marks on the two flywheel trigger bolts and the fire damage to the plastic insulation on the wires precluded a conclusion that the wiring harness had contacted a trigger bolt.

In any case, examination of the connector plug and sensor wire sockets showed that the wiring harness was forcibly disconnected prior to the fire. However, given the number and nature of the multiple impacts with terrain during the accident sequence, the timing of the disconnection could not be established.

Suitability of the wiring harness connector plug

The connector plug and associated wiring forward and aft of the plug were an in-line installation. The connector allowed duplication of the wiring for the intended dual ignition system and provided clamping on the aft side of the plug to relieve wire tension. The clamping was not repeated forward of the plug, where the single wiring harness from the engine timing trigger plate had disconnected.

The wiring on the forward side of the plug relied on friction and an internal, plastic locking mechanism to retain the sensor wires and sockets in position. The limited support provided on the forward side of the plug increased the risk of the wiring harness disconnecting from the in-line installation.

Single point of failure

The aviation industry has long recognised the need for redundant systems, particularly those relating to safety-critical components. Incorporating a single point of failure into such systems during construction or modification can eliminate all levels of redundancy. In this case, the loss of the single wiring harness resulted in failure of an otherwise redundant system, with near-fatal consequences.

Findings

From the evidence available, the following findings are made with respect to the engine failure at about 1,000 ft shortly after take-off, and subsequent collision with terrain in a nearby sports oval involving an amateur-built Stoddard-Hamilton Glasair III aircraft, registered VH-USW, near Jandakot Airport, Western Australia on 9 December 2013. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The aircraft's engine stopped without warning and, with very few landing options available and a number of obstacles on short finals to the intended landing area, the forced landing resulted in a collision with terrain.

Other factors that increased risk

- Modification of the aircraft’s electronic ignition to an intended dual system during aircraft construction incorporated a single point of failure, increasing the risk of the simultaneous failure of both systems and a total loss of engine power.
- The connector plug for the aircraft’s electronic ignition system was inappropriate for an in-line installation, increasing the risk of the single wiring harness becoming disconnected and disabling the ignition system.
- The alternator V-belt fitted to the aircraft exceeded the manufacturer's storage life of 8 years, increasing the risk of belt failure.

Other findings

- Although the initiator and timing of the disconnection could not be conclusively determined, the single wiring harness for the aircraft’s electronic ignition system was found disconnected from the connector.

General details

Occurrence details

Date and time:	9 December 2013 – 1436 WST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	4 km south-west of Jandakot Airport, Western Australia	
	Latitude: 32° 6.502’ S	Longitude: 115° 50.542’ E

Aircraft details

Manufacturer and model:	Stoddard-Hamilton Glasair III	
Year of manufacture:	2000	
Registration:	VH-USW	
Serial number:	SH-3311	
Total Time In Service	223.2 hours (as at last periodic inspection)	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 1 (Serious)	Passengers – 1 (Serious)
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the pilot and passenger of VH-USW
- the Licenced Aircraft Maintenance Engineer and electrical technical expert for VH-USW
- Light Speed Engineering
- a number of witnesses
- the Civil Aviation Safety Authority.

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GatesFacts *Extended Storage of Belt Drives* and *Analyze Your Way to Longer Lasting, Better Performing V-belt Drives.*

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the pilot and passenger of VH-USW, the aircraft's electrical technical expert, Light Speed Engineering, the Civil Aviation Safety Authority and the United States National Transportation Safety Board.

A submission was received from Light Speed Engineering. The submission was reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

Engine failure and collision with terrain involving Stoddard-Hamilton Glasair III, VH-USW, near Jandakot Airport Western Australia, 9 December 2013

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