Aviation Investigation Final Report

Location:	Breckenridge, Texas	**Accident Number:**	CEN14FA143
Date & Time:	February 18, 2014, 16:38 Local	**Registration:**	N13HP
Aircraft:	Hawker SEA FURY ISS 25	**Aircraft Damage:**	Destroyed
Defining Event:	Powerplant sys/comp malf/fail	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

After several hours of ground instruction and one solo flight, the private pilot was making only his second takeoff in a single-seat Hawker Sea Fury airplane. Two witnesses standing at midfield reported hearing abnormal engine and propeller sounds during takeoff, and the airplane's speed seemed to be slower than normal. Another witness, who had pilot experience in the Hawker Sea Fury, did not see the takeoff but reported that he could clearly hear the engine "screaming," and he knew at that moment that the accident pilot was experiencing a propeller overspeed.

A flight instructor was conducting a formation takeoff in trail behind the accident airplane to observe the flight. After his takeoff, he joined in on the right side of the accident airplane and he heard the accident pilot make a radio transmission that he had an overspeed and the airplane's rpm was at 3,500. The instructor reported that the maximum takeoff power was about 2,900 rpm. No further transmissions from the accident pilot were heard. The instructor kept repeating for the pilot to pull the power back and keep the nose down. Both airplanes climbed to about 1,000 ft above ground level, and the accident airplane began a slow turn to the left. The flight instructor continued to fly in formation with the accident airplane and continued to transmit instructions to the accident pilot to lower the nose and reduce the throttle. However, the accident airplane continued to slow and fly in a nose-up attitude until it stalled and rolled to the right. It then entered a vertical nose-down dive and impacted terrain. The flight instructor and witnesses reported that there was an immediate explosion and postimpact fire.

The witnesses' description of abnormal engine and propeller sounds and the accident pilot's report of 3,500 rpm are indicative of a runaway propeller. The Hawker Sea Fury emergency checklist indicated that recovery from a runaway propeller was possible when following the procedures listed in the checklist, which include reducing the throttle, decreasing the propeller angle, and maintaining an airspeed of 140 knots.

A postaccident examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation. A laboratory examination of the

impact- and thermally damaged propeller regulator did not show any obvious evidence of preimpact mechanical malfunction or abnormalities. The cause of the runaway propeller could not be undetermined.

Probable Cause and Findings

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

The pilot's inadequate emergency response to a runaway propeller and his failure to maintain airspeed, which resulted in the airplane exceeding its critical angle-of-attack and stalling. The cause of the runaway propeller was undetermined.

Findings

Aircraft	Propeller controlling system - Malfunction
Aircraft	Prop/rotor parameters - Malfunction
Not determined	(general) - Unknown/Not determined
Personnel issues	Incomplete action - Pilot
Personnel issues	Lack of action - Pilot
Personnel issues	Total experience w/ equipment - Pilot

Factual Information

History of Flight

Initial climb	Powerplant sys/comp malf/fail (Defining event)
Initial climb	Loss of engine power (partial)
Maneuvering	Attempted remediation/recovery
Maneuvering	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Part(s) separation from AC
Post-impact	Explosion (post-impact)
Post-impact	Fire/smoke (post-impact)

On February 18, 2014, about 1638 central standard time, a Hawker Sea Fury ISS-25 single-engine, single-seat airplane, N13HP, was destroyed after impacting terrain during climb at Stephens County Airport (BKD), Breckenridge, Texas. The pilot was fatally injured. The airplane was registered to Breckenridge Aviation Museum; Breckenridge, Texas, and at the time of the accident was in the process of changing registration to J R Consulting NV, LLC; Midland, Texas. It was operated by a private individual. Visual meteorological conditions (VMC) prevailed at the time of the accident and a flight plan had not been filed for the 14 Code of Federal Regulations Part 91 instructional flight.

The accident pilot had one previous flight earlier that morning, which had lasted about 20 minutes, and he was making only his second takeoff in a Hawker Sea Fury. Several witnesses near the runway at mid-field were actively watching as the southbound accident airplane took off. They reported hearing abnormal engine and propeller sounds and the airplane's vertical climb speed seemed to be slower than normal. One witness, who had pilot experience in the Hawker Sea Fury, reported that he could clearly hear the engine "screaming", and he knew at that moment that the accident pilot was experiencing a propeller overspeed.

The flight instructor was flying in a second single-seat Hawker Sea Fury airplane and was conducting a formation takeoff in trail behind the accident airplane. He reported that maximum takeoff power for the Hawker Sea Fury was about 2,900 rpm at about 50 inches of manifold pressure. After his takeoff in the second airplane he joined in on the right side of the accident airplane and he heard the accident pilot make one radio transmission that his "rpm was at 3,500". No further transmissions from the accident pilot were heard. Both airplanes climbed to about 1,000 feet above ground level (agl) and about one mile from the runway the accident airplane began a slow turn to the left. During this time the flight instructor was flying formation on the accident airplane and continued to transmit instructions to the accident pilot to lower the nose and reduce the throttle.

The accident airplane had almost completed a left turn to the downwind, had descended to about 500 feet above the ground, was slowing, and was flying in a nose-up attitude. The flight instructor reported that he saw the accident airplane stall and suddenly roll to the right. It then entered a vertical nose-down

dive and impacted terrain. The flight instructor and witnesses reported that there was an immediate explosion and postimpact fire.

Pilot Information

Certificate:	Private	**Age:**	38,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	August 6, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 4, 2012
Flight Time:	(Estimated) 527 hours (Total, all aircraft), 0 hours (Total, this make and model), 38 hours (Last 90 days, all aircraft), 16 hours (Last 30 days, all aircraft)		

The pilot, age 38, held an FAA private pilot certificate issued on December 4, 2012, with a rating in only airplane single engine land. He also held an unrestricted FAA third-class medical certificate, which was issued on August 6, 2012.

The pilot's personal logbooks were not available for examination by the NTSB during the course of the investigation. Based on a review of copies of partial pilot logbook entries, FAA documents, and statements from witnesses and other persons, the pilot's total flight experience on February 1, 2014, was estimated as a total of 527 hours in all aircraft, which included about 100 hours of pilot experience in a P-51 Mustang, and no previous experience in a Hawker Sea Fury airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Hawker	**Registration:**	N13HP
Model/Series:	SEA FURY ISS 25	**Aircraft Category:**	Airplane
Year of Manufacture:	1956	**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	37536
Landing Gear Type:	Retractable - Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	February 7, 2014 Condition	**Certified Max Gross Wt.:**	14650 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	2102 Hrs as of last inspection	**Engine Manufacturer:**	Curtiss-Wright
ELT:		**Engine Model/Series:**	R-3350-26WD
Registered Owner:	On file	**Rated Power:**	2800 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The low-wing, retractable conventional landing gear, single seat, single-engine airplane, manufacturer's serial number (s/n) 37536, was built in 1956 by Hawker Aircraft Limited.
It was originally powered by a 2,480 horsepower Bristol Centaurus 18-cylinder radial engine, and then had a maximum takeoff weight of 14,650 pounds and a listed maximum speed of 400 knots, which made it one of the fastest production single engine piston fighters ever built.

After being imported to the United States in 1976 the airplane had been extensively modified. In 1989, it was issued an FAA airworthiness certificate in the experimental exhibition category.

At the time of the accident the airplane was powered by a 2,800 horsepower Wright R-3350-26WD "Duplex Cyclone" 18-cylinder engine, with a displacement of 3,350 cubic inches. The geared nose case of the R-3350-26WD engine had an output gear ratio of 0.4375:1 which provided a propeller rpm of 1,225 at an engine rpm of 2,800.

The engine drove a 13 foot 6 inch diameter Aero Products A642 –G805 four-blade propeller which had a blade angle range of 40 degrees, from 27.5 degrees at low angle to 67.5 degrees at high angle. The hollow steel propeller blades were controlled by a doughnut-shaped hydraulic propeller regulator unit mounted on the propeller aft of the propeller hub and forward of the engine nose case.

Aircraft maintenance logbooks could not be located during the course of the investigation. Based on interviews with persons at the scene the accident pilot was probably carrying the maintenance logbooks inside the cockpit of the accident airplane and the maintenance logbooks were most likely consumed in the postimpact fire.

Based on FAA records and records from the Inspection Authority mechanic, the accident airplane had completed a satisfactory annual condition inspection on February 7, 2014. The flight times on that date were estimated as an aircraft total time of 2,102.2 hours, and estimated engine and propeller total times of 902.2 hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBKD,1284 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	16:30 Local	**Direction from Accident Site:**	335°
Lowest Cloud Condition:	Clear	**Visibility**	7 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots / 18 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.82 inches Hg	**Temperature/Dew Point:**	30°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Breckenridge, TX (BKD)	**Type of Flight Plan Filed:**	None
Destination:	Breckenridge, TX (BKD)	**Type of Clearance:**	None
Departure Time:	16:36 Local	**Type of Airspace:**	Class G

At 1630 the Automated Surface Observation System at BKD reported wind from 260 degrees at 10 knots gusting to 18 knots, visibility 7 miles, clear of clouds, temperature 30 degrees Celsius (C), dew point 7 degrees C, and an altimeter setting of 29.83 inches of mercury.

Data from the National Oceanic and Atmospheric Administration showed that, at the accident location, at 1638, the altitude of the sun was about 20 degrees above the horizon and the azimuth of the sun was about 241 degrees. Apparent sunset occurred at 1824.

Airport Information

Airport:	STEPHENS COUNTY BKD	**Runway Surface Type:**	Asphalt
Airport Elevation:	1284 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	17	**IFR Approach:**	None
Runway Length/Width:	4997 ft / 100 ft	**VFR Approach/Landing:**	None

The FAA Airport/ Facility Directory, South Central U. S., indicated that BKD was a non-towered airport with a field elevation of 1,284 feet mean sea level (msl). The longest runway was 17-35, which was an asphalt runway 4,997 feet long by 100 feet wide. Runway 17 was oriented to 180 degrees true and 173 degrees magnetic. Records show that runway 17 had a 0.5 percent upslope gradient to the south. Other shorter runways at BKD were also listed.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal	**Latitude, Longitude:**	32.696945,-98.882499(est)

The wreckage was located on dirt and rocky terrain in a remote wooded area at an estimated elevation of about 1,250 feet msl about 1 mile southeast from BKD. Evidence at the scene showed the airplane impacted in a nearly vertical nose-down attitude. There was evidence of a postimpact fire which thermally damaged most of the vegetation within a diameter of more than 100 feet.

The initial impact crater was about 1 foot deep and about 5 feet in diameter. The completely separated front section of the engine was found upright on the southeast edge of the impact crater. The propeller hub remained attached to the engine's propeller shaft and two blades of the propeller remained attached to the propeller hub. The other two blades were completely impact separated from the hub, but were found adjacent to the engine and impact crater. The propeller blades showed evidence of leading edge impact damage and showed evidence of chordwise smearing on the blade faces. Broken tree limbs almost directly above the separated engine had impact damage which corresponded to the damage to several of the propeller blades. Broken tree branches from those overhead limbs littered the area. Dirt and rock ejecta from the crater was found mostly to the east and within about 30 feet from the crater.

The engine was examined on-scene and the engine oil filter was removed from the wreckage and disassembled. The examination of the engine oil filter showed no evidence of preaccident contamination.

The completely separated outer portion of the right wing was located about 20 feet to the north-northwest from the impact crater. The upright right wing had impact damage which corresponded to damage on adjacent trees. The right aileron remained attached to its attach points.

The completely separated wing, including the spars, right flap, both flap actuators, both main landing gear, and the left aileron were located upright about 45 feet east from the initial impact crater and were oriented with the leading edge of the wing to the south, and with the long dimension of the wing spars oriented east-west. The flap actuators were in the up position and both main landing gear legs were observed in the up or retracted position. The fuel caps were impact damaged and thermally damaged, but were intact and remained latched and closed.

Almost all portions of magnesium structure in the separated wing section had been completely consumed by fire and had left a fine white ash which had a distinctive smell. The same fine white ash covered much of the entire accident scene for a distance of more than 50 feet in all directions. All aluminum and steel portions of the separated wing spar were thermally damaged with evidence of puddled aluminum in some areas.

The empennage was located about 70 feet east-northeast from the initial impact crater and was

completely separated from the fuselage, oriented to 210 degrees, and was resting upright about 20 degrees left side down. The horizontal stabilizer, elevator, vertical stabilizer, and rudder remained attached and did not show signs of significant impact damage. The tail wheel was retracted into its wheel well. The empennage and tail section had thermal damage which consumed or damaged most of the exterior paint, and partially consumed part of the aluminum skin on the empennage and tail surfaces. The completely separated left flap was located under the left side of the empennage. Flight control continuity was confirmed from the elevator and rudder to the separations at the front of the empennage.

The upper section of the cockpit fuselage was mostly consumed by fire and almost unrecognizable. Portions of the instrument panel had completely separated and were located mostly within about 30 feet to the south and southeast from the empennage. The completely separated cockpit canopy frame was located about 20 feet west from the empennage. Portions of the completely separated canopy rail were located about 30 feet east from the empennage. The cockpit seat frame was completely separated and located about 10 feet east from the front end of the empennage.

The portion of the wreckage most distant from the initial impact crater was the completely separated rear section of the engine, which included the supercharger section and accessory gearbox. It was located 95 feet to the east on a bearing of 085 degrees from the initial impact crater.

All portions of the airplane were accounted for at the accident scene. Impact and thermal damage to the wreckage prevented an examination of the ignition system or the induction system components and prevented a complete assessment of flight control continuity.

The on-scene examination of the wreckage revealed no evidence of preimpact mechanical malfunctions or failures that would have precluded normal operation.

Communications

The Unicom radio frequency at BKD was not recorded.

Medical and Pathological Information

An autopsy was performed on the pilot by the Tarrant County Office of the Chief Medical Examiner in Fort Worth, Texas.

Forensic toxicology was performed on specimens from the pilot by the FAA Civil Aerospace Medical Institute (CAMI), Oklahoma City, Oklahoma. The toxicology report stated that tests for carbon

monoxide and for cyanide were not performed, ethanol was not detected in vitreous, and no listed drugs were detected in blood.

Tests and Research

The propeller regulator, including the control input rod ends, mechanical controller, internal hydraulic gear pump assembly, and the drive gear were removed from the wreckage and were examined at the NTSB Materials Laboratory in Washington, D. C.

Examination of the broken control input connecting rod showed the fracture surfaces were consistent with fracture from bending overstress.

The drive gear had deformation which was consistent with twisting and bending. Four of the gear teeth contained smear marks on their aft faces which was consistent with teeth-shaped witness marks on the forward face of the hydraulic gear pump housing. A 0.5 inch long radial tear exhibited characteristics consistent with overstress fracture. A key inside the circumferential face of the gear bore was still in place in the gear slot and exhibited smearing and deformation consistent with impact with an adjacent part and corresponded with similar marks on the inner face of the drive gear bore.

The hydraulic gear pump was still attached to the surrounding propeller housing that had fractured and separated from the rest of the airplane. The fracture surfaces were consistent with overstress fracture.

The pump assembly was removed from the fractured housing. Two of the three bolts were still fixed with safety wire attached. The inboard faces of the pump exhibited darkening and soot consistent with fire exposure. The right inboard side of the forward face of the pump exhibited four teeth-shaped impressions. Those witness marks corresponded with the smear marks on the drive gear teeth. The shape of the gear marks was consistent with the drive gear rotating clockwise (forward looking aft).

The rear and sides of the housing exhibited a few indications of damage. The most notable area was one of the side flanges with a bolt hole that had been worn away. The four bolts in the aft of the pump were still in place, with the safety wire affixed.

The hydraulic pump was disassembled and examined. The surfaces were covered in a gelatinous substance consistent with dried hydraulic fluid which left gear teeth impressions on the surfaces, consistent with the position of the gears at the time of the accident. The cylindrical surfaces exhibited longitudinal marks consistent with the positions of the internal gear teeth crests. Ferrous corrosion product was present in the housing interior. However, this corrosion product was confined to the corners of each gear recess. The pattern of corrosion was consistent with pooled water after the accident. There were no indications of excessive wear or smearing on the interior housing surfaces. None of the channels for hydraulic fluid flow contained any indications of blockage.

An examination of the hydraulic pump gears after removal from the pump showed that they were relatively undamaged and were able to be rotated about their shafts. The exterior faces of the gear teeth exhibited some rotational wear marks, consistent with typical service wear. The teeth exhibited some

ferrous corrosion product, which was limited to four of the forward teeth faces and two gear teeth valleys on each gear. This corrosion was consistent with pooled water incurred after the accident.

The laboratory examination of the impact damaged and thermally damaged propeller regulator and other parts revealed no evidence of preimpact mechanical malfunctions or failures that would have precluded normal operation.

Additional Information

According to the Checklist for the Hawker Sea Fury: the Emergency Checklist procedure for "Runaway Propeller" on page 36 states:

"Failure of the governor to operate properly may result in a runaway propeller. A runaway propeller goes to full low pitch and may result in an engine rpm of 3600 or more. When such a failure occurs, the only method of reducing rpm is to pull the throttle back and decrease airspeed. In doing this, it is highly important to reduce airspeed in order to maintain the maximum horsepower available. The following procedure is recommended:

Throttle . . . . . .REDUCED (2900 RPM)
Propeller . . . . . .DECREASE

Note: In case of an overspeed, moving the propeller control lever toward DECREASE may bring the propeller under control.

Airspeed . . . . . .140 KNOTS

Raise the nose to lose speed and then return to level flight attitude keeping IAS at approximately 140 knots.

When over a landing area, lower the gear and make an approach at normal landing speed.

Caution: If engine rpm cannot be kept within limits, expect the engine to quit or seize at any time".

Land . . . . . .ASAP"

According to the Department of Energy Handbook DOE-HDBK-1081-94, December 1994 Magnesium Properties – on pages 20 through 22, and page 34 states:

"The ignition temperature of massive magnesium is very close to its melting point of 1,202 degrees Fahrenheit (F). Solid metal ignition of magnesium can occur at 1,153 degrees F. Metal marketed under different trade names and commonly referred to as magnesium may be one of a large number of different alloys containing magnesium, but also significant percentages of aluminum, manganese, and

zinc. Some of these alloys have ignition temperatures considerably lower than pure magnesium, and certain magnesium alloys will ignite at temperatures as low as (800 degrees F). Flame temperatures of magnesium and magnesium alloys can reach (2,500 degrees F)."

"The more massive a piece of magnesium, the more difficult it is to ignite, but once ignited, magnesium burns intensely and is difficult to extinguish".

According to "Civil Pilot Accident Experience With High Performance Military Surplus Type Aircraft" (1967); R. G. Snyder: The study of one particular type of military type aircraft during a 26 month period showed that, of the 80 operational airplanes of that type, 25 of the airplanes were involved in aircraft accidents which resulted in 12 fatalities and 4 serious injuries. The conclusions on page 32 noted that the "major cause of these accidents was overwhelmingly pilot experience".

Administrative Information

Investigator In Charge (IIC):	Latson, Thomas
Additional Participating Persons:	Daniel Vengen; FAA Lubbock FSDO; Lubbock, TX Stanley P Hinds; FAA Lubbock FSDO; Lubbock, TX
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