Aviation Investigation Final Report

Location:	WILLIAMS, California	**Accident Number:**	LAX96LA196
Date & Time:	May 11, 1996, 08:00 Local	**Registration:**	N447AT
Aircraft:	Ayres S2R-G6	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The pilot reported that as the aircraft reached the takeoff rotation point, the engine's turbine section disintegrated, throwing large chunks of turbine wheels and other debris through the top and side of the engine cowling. The pilot lost directional control while attempting to stop the aircraft on the 2,700 foot-long dirt runway and it veered off the right side of the airstrip, crossed a drainage canal, and collided with the opposite embankment. Engine disassembly revealed that the second stage turbine wheel rim separated over almost its entire circumference. Detailed examination of the hub's fracture found machining type scoring to a depth of about 0.1 inches on the forward face of the wheel, which reduced the strength in the wheel web until overload failure occurred. Inspection of the second stage turbine stator assembly found that the sheet metal support for the turbine wheel to stator air seal was separated from the stator and had shifted forward to contact the failed wheel. Twenty-two out of 31 cooling passages which pass through the stator vanes from the outside diameter of the stator to the seal support area were completely plugged by braze repair material. The braze material had flowed from the outside diameter toward the inside during an attempt to braze repair the sheet metal on the castings outside diameter. The seal support showed evidence of operation at a temperature a few hundred degrees hotter than normal. Allied Signal reported that this overtemp condition will cause the seal support to crack after a few hundred hours of operation. Review of the Allied Signal overhaul documents for the second stage stator assembly disclosed that a braze repair is only authorized for the rear air seal attachment to the casting, and not in the area of the cooling passages. The historical engine maintenance records disclosed that the second stage stator was overhauled on August 23, 1995, and installed in the engine on October 23, 1995, 207 hours and 230 cycles since overhaul.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain directional control during a rejected takeoff, and the catastrophic failure of the engine's turbine section due to an improper overhaul procedure. A factor in the accident was the close proximity of the drainage ditch to the edge of the private airstrip's runway.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: TAKEOFF - ROLL/RUN

Findings
1. (C) TURBINE ASSEMBLY,AIR SEAL - OVERTEMPERATURE
2. (C) MAINTENANCE,OVERHAUL - IMPROPER - OTHER MAINTENANCE PERSONNEL
3. (C) TURBINE ASSEMBLY,TURBINE WHEEL - DISINTEGRATED

Occurrence #2: LOSS OF CONTROL - ON GROUND/WATER
Phase of Operation: TAKEOFF - ABORTED

Findings
4. (C) DIRECTIONAL CONTROL - NOT MAINTAINED - PILOT IN COMMAND
5. (C) GROUND LOOP/SWERVE - NOT CORRECTED - PILOT IN COMMAND

Occurrence #3: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER
Phase of Operation: TAKEOFF - ABORTED

Findings
6. (F) TERRAIN CONDITION - DITCH

Factual Information

On May 11, 1996, about 0800 Pacific daylight time, a Ayers S2R-G6, N447AT, collided with ground obstructions during a rejected takeoff at a private agricultural airstrip near Williams, California. The aborted takeoff was precipitated by a catastrophic failure of the airplane's Garrett TPE-331 turboprop engine at the rotation point in the takeoff ground roll. The aircraft was owned and operated by Caldwell Flying Service, Inc., of Williams, and was beginning a local area aerial application flight. Visual meteorological conditions prevailed at the time and no flight plan was filed. The aircraft sustained substantial damage. The certificated commercial pilot, the sole occupant, was not injured.

The pilot reported that as the aircraft reached the takeoff rotation point, the engine's turbine section disintegrated, throwing large chunks of turbine wheels and other debris through the top and side of the engine cowling. The pilot lost directional control while attempting to stop the aircraft on the 2,700 foot-long dirt runway and it veered off the right side of the airstrip, crossed a drainage canal, and collided with the opposite embankment.

The Garrett TPE-331-6 engine, serial number 20025C, was removed from the airframe and shipped to the facilities of Allied Signal Aerospace (Garrett) for disassembly and investigation under the supervision of an FAA airworthiness inspector from the Scottsdale, Arizona, Flight Standards District Office. The disassembly revealed that the second stage turbine wheel rim separated over almost its entire circumference. The wheel hub remained in the engine. Detailed examination of the fracture area on the hub revealed machining type scoring to a depth of about 0.1 inches on the forward face of the wheel. According to a materials laboratory report from Allied Signal, the scoring reduced the strength in the wheel web until overload failure occurred.

Inspection of the second stage turbine stator assembly revealed that the air seal between the stator and second stage turbine wheel was destroyed. The sheet metal seal support is attached to the inner diameter of the second stage stator and was noted to be separated from the stator. Allied Signal reported that a separation of the aft side of the seal support can allow the sheet metal support to deform and contact the second stage turbine wheel. Further detailed examination of the stator disclosed that 22 out of 31 cooling passages which pass through the stator vanes from the outside diameter of the stator to the seal support area were completely plugged by braze repair material. The examining metallurgist opined that the material flowed from the outside diameter toward the inside during an attempt to braze repair the sheet metal on the castings outside diameter. The metallurgist also noted that examination of the remaining seal support material showed evidence of operation at a temperature a few hundred degrees hotter than normal.

Allied Signal reported that their past experience is that "depending on the number of cooling

holes plugged the seal support will crack after a few hundred hours of operation."

Review of the Allied Signal overhaul documents for the second stage stator assembly disclosed that a braze repair is only authorized for the rear air seal attachment to the casting.

Examination of the historical engine maintenance records disclosed that the second stage stator was overhauled on August 23, 1995, and installed in the engine on October 23, 1995. The overhaul was accomplished by AIM, Inc., of Durant, Oklahoma. The engine was installed in the airframe on November 2, 1995. At the time of the accident the stator had accumulated 207 hours and 230 cycles since overhaul.

Pilot Information

Certificate:	Commercial	**Age:**	40,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Center
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	February 13, 1996
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	8000 hours (Total, all aircraft), 2000 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Ayres	**Registration:**	N447AT
Model/Series:	S2R-G6 S2R-G6	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	G6-103
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	April 26, 1996 100 hour	**Certified Max Gross Wt.:**	6000 lbs
Time Since Last Inspection:	70 Hrs	**Engines:**	1 Turbo prop
Airframe Total Time:	9414 Hrs	**Engine Manufacturer:**	Garrett
ELT:	Not installed	**Engine Model/Series:**	TPE-331-6
Registered Owner:	CALDWELL FLYING SERVICE, INC.	**Rated Power:**	840 Horsepower
Operator:		**Operating Certificate(s) Held:**	
Operator Does Business As:		**Operator Designator Code:**	NGPG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	15 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:		**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	00:00 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	PRIVATE AG AIRSTRIP	**Runway Surface Type:**	Dirt
Airport Elevation:	47 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	34	**IFR Approach:**	None
Runway Length/Width:	2700 ft / 70 ft	**VFR Approach/Landing:**	None

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:**	39.110073,-122.270553(est)

Administrative Information

Investigator In Charge (IIC):	Rich, Jeff
Additional Participating Persons:	EARL BENEDICT; SACRAMENTO , CA
Original Publish Date:	December 16, 1996
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=29441