Aviation Investigation Final Report

Location:	RENO, Nevada	**Incident Number:**	LAX98IA218
Date & Time:	June 29, 1998, 12:02 Local	**Registration:**	N520CS
Aircraft:	Aero Commander 681B	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The aircraft experienced an uncontained engine failure of the number 2 engine. The pilot returned to the airport and landed. The FAA inspector who examined the aircraft reported that there was a hole approximately 2 to 3 inches in diameter through the turbine section, and the fuselage had about seven puncture holes. The side window had seven holes through it and the pressure vessel had been punctured. The first and third stage turbine disks were not located, nor was the turbine bearing, turbine bearing carrier assembly, aft main shaft section, aft main shaft nut, and turbine bearing scavenge pump.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The failure and separation of the first and third stage turbine disks for undetermined reasons.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: DESCENT - NORMAL

Findings
1. 1 ENGINE
2. (C) TURBINE ASSEMBLY,TURBINE WHEEL - FAILURE,TOTAL
3. (C) TURBINE ASSEMBLY,TURBINE WHEEL - SEPARATION
4. (C) REASON FOR OCCURRENCE UNDETERMINED

Factual Information

On June 29, 1998, at 1202 hours Pacific daylight time, an Aero Commander 681B, N520CS, experienced an uncontained failure of the No. 2 engine while on descent to the Quincy, California, airport. The aircraft sustained minor damage, and the pilot and two passengers, the sole occupants, were not injured. The aircraft was being operated by Medic Air of Reno, Nevada, as a 14 CFR Part 91 positioning flight to pickup a patient for medical transport. Visual meteorological conditions prevailed and there was no flight plan on file.

The pilot reported that he was on descent to the Quincy airport at 9,500 feet agl, when the aircraft experienced the uncontained engine failure. He returned to the Reno/Tahoe airport and landed. The pilot was in communication with the Reno Air Traffic Control Tower at the time of the accident.

A Federal Aviation Administration inspector from the Reno Flight Standards District Office examined the aircraft and reported that there was a hole approximately 2 to 3 inches in diameter through the turbine section, and the fuselage had approximately seven puncture holes. The side window had seven holes through it and the pressure vessel had been punctured.

The engine was removed from the airplane and shipped to Allied Signal in Phoenix, Arizona, for disassembly under the supervision of a powerplant engineer from the Safety Board. A copy of his factual group chairman report is appended to this file. He reported that the exhaust duct had a 15-inch-long (circumferential) by 3-inch-long (axial) hole from 11:00 to 4:00 o'clock, as viewed from the aft looking forward. The plenum had a 4-inch-long by 2-inch-wide hole at the 7:00 o'clock position, at the location of a primary fuel nozzle fitting. The propeller governor reset head shaft hub was broken off. The shaft hub remained attached to the engine with the speed lever "Christmas tree" connecting rod.

The first and third stage turbine disks were missing, as was the turbine bearing, turbine bearing carrier assembly, aft main shaft section, aft main shaft nut, and turbine bearing scavenge pump. The main shaft was separated just aft of the center curvic coupling splines.

The second stage turbine disk had 38 of 40 airfoils fractured transversely across the pedestal below the blade root platform. There were two airfoils fractured transversely across the airfoil just above the blade root platform that were approximately 90 degrees apart. The disk section did not have any 360-degree circumferential rubs on either face.

The second stage stator ring was intact. There were 11 of the 31 vanes that had axial cracks from the trailing edge. The cooling holes in all of the vanes were open except one that had a piece of debris at the outer end of the passageway. The entire shroud portion of the ring is

missing. The feltmetal seal was separated from the seal support assembly. The braze that attaches the seal support to the inner diameter of the vane ring was intact. The inner transition liner had 11 or the 12 mount ears missing. The stator support ring nut was intact, but had a 45-degree arc that was bent radially outward.

The forward stator support was separated from the rear section. The forward portion was damaged with the front flange bent or portions of the front flange broken off in a radially outward direction.

Three of the six first stage stator shrouds were recovered. The inner surfaces of the shrouds were damaged with nicks and circumferential gouging.

The aft portion of the stator support had a 6-inch-long by 3-inch-wide hole at the 7:00 o'clock position about 2 1/2 inches aft of the forward flange. The three bearing struts were missing. The strut at the 12:00 o'clock position had the forward portion, about 1/2 inch long broken adjacent to the case wall and the rear portion of the strut was missing with the adjacent case wall. The strut at the 4:00 o'clock position was broken off adjacent to the case wall. The strut at the 7:00 o'clock position was missing completely with the adjacent case wall.

The center curvic coupling was removed. Both the forward and aft curvic coupling gear teeth (curvics) were damaged. The aft coupling "V" seal was still in place. This seal had no cooling holes by design.

A four vane segment of the third stage stator vane ring was recovered and returned with the engine. The vanes were fractured transversely across the airfoils about 1 1/2 inches from the outer ring.

There were 11 pieces of the turbine blade platform sections that were recovered from the engine and cowling and were returned with the engine. It was not possible to determine the stage of the airfoil pieces.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	40,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	March 10, 1998
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	3094 hours (Total, all aircraft), 70 hours (Total, this make and model), 2869 hours (Pilot In Command, all aircraft), 91 hours (Last 90 days, all aircraft), 35 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Aero Commander	**Registration:**	N520CS
Model/Series:	681B 681B	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	6061
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	April 25, 1998 100 hour	**Certified Max Gross Wt.:**	9400 lbs
Time Since Last Inspection:	44 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	8060 Hrs	**Engine Manufacturer:**	Garrett
ELT:	Installed, not activated	**Engine Model/Series:**	TPE-331-1-151
Registered Owner:	BRS SERVICES INC	**Rated Power:**	575 Horsepower
Operator:	MEDIC AIR	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	MCIA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	RNO ,4412 ft msl	**Distance from Accident Site:**	
Observation Time:	11:56 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	15 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	280°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	26°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(RNO)	**Type of Flight Plan Filed:**	None
Destination:	QUINCY , CA (210)	**Type of Clearance:**	VFR
Departure Time:	11:30 Local	**Type of Airspace:**	Class C

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	39.480548,-119.740653(est)

Administrative Information

Investigator In Charge (IIC):	Mucho, Gary
Additional Participating Persons:	ADRIAN GRIEVE; RENO , NV PETER BAKER; PHOENIX , AZ
Original Publish Date:	December 1, 1999
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45921