



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	WRENS, GA	<b>Accident Number:</b>	ATL94FA011
<b>Date &amp; Time:</b>	11/01/1993, 2220 EST	<b>Registration:</b>	N964ST
<b>Aircraft:</b>	PIPER PA-32RT-300T	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>		<b>Injuries:</b>	5 Fatal
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Business		

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## Analysis

THE PILOT COULD NOT START THE AIRPLANE. ACCORDING TO LINE MAINTENANCE PERSON, THE PILOT WAS ASKED IF HE WANTED A 12 VOLT OR A 24 VOLT JUMP START. THE PILOT REPLIED THAT HE WANTED A 24 VOLT JUMP START. AFTER THE AIRPLANE STARTED THE FLIGHT DEPARTED WITHOUT FURTHER INCIDENT. WHILE CURISING AT 6000 FEET, THE PILOT REPORTED A LOSS OF ENGINE POWER. THE PILOT INFORMED DEPARTURE CONTROL OF HIS PROBLEM AND REQUESTED VECTORS TO THE NEAREST AIRPORT. THE PILOT WAS ISSUED VECTORS TO THE WRENS MEMORIAL AIRPORT; THE AIRPLANE CRASHED IN AN INVERTED ATTITUDE 1/4 MILE SHORT OF RUNWAY.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: WAS THE FATIGUE FAILURE OF THE IDLER GEAR WHICH RESULTED IN THE COMPLETE LOSS OF ENGINE POWER. A FACTOR WAS THE DARK NIGHT.

## Findings

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

### Findings

1. ACCESSORY DRIVE ASSY - FAILURE,TOTAL
2. ACCESSORY DRIVE ASSY,DRIVE GEAR - FATIGUE

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Occurrence #2: FORCED LANDING  
Phase of Operation: DESCENT - EMERGENCY

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Occurrence #3: IN FLIGHT COLLISION WITH OBJECT  
Phase of Operation: DESCENT - EMERGENCY

### Findings

3. OBJECT - TREE(S)
4. LIGHT CONDITION - DARK NIGHT

## Factual Information

### HISTORY OF FLIGHT

On November 1, 1993, at 2220 eastern standard time, a Piper PA- 32RT-300T, N964ST, collided with trees about 600 yards northeast of the Wrens Memorial Airport, Wrens, Georgia. The pilot was attempting an emergency landing when the collision occurred. The flight operated under 14 CFR Part 91 with an instrument flight clearance. Visual weather conditions prevailed at the time of the accident. The airplane was destroyed by impact forces and a post crash fire; four of the five occupants were fatally injured, and the pilot received serious injuries. The flight departed Augusta, Georgia, at 2201.

Approximately fifteen minutes into the flight, cruising at 6000 feet, the pilot reported an engine problem. Moments later, the pilot reported to Augusta Departure Control that the engine had stopped. The flight was cleared to the Wrens Memorial Airport that was located seven miles west of the flight's position. Seconds before the collision, a witness reported that the pilot turned on the landing lights, and that the airplane appeared to have been established on a final approach to the southwest runway. The airplane collided with trees prior to reaching the runway.

Examination of the engine revealed that there was fracture damage to internal drive gears. The accessory housing was not damaged, externally.

### PERSONNEL INFORMATION

Information on the pilot is included in this report at the data field labeled "First Pilot Information". The pilot's flight logs were not recovered for examination.

### AIRCRAFT INFORMATION

Information on the aircraft is contained in this report at the data field labeled "Aircraft Information". An overview of the engine components is shown in figure 1, as received. A review of the engine maintenance logs disclosed that the last entrance was made on October 25, 1993. At that time, the engine had 2,078 hours of total time, 241.4 of which had been since the last overhaul. The review also revealed that the propeller assembly had been repaired on June 21, 1993, as a result of a propeller strike. The annual inspection of the engine was performed on September 9, 1993. An examination of the engine case disclosed that the engine case had been stamped with the marking "AJAX 93779904" indicating that it was twice subjected to repairs by AJAX.

### METEOROLOGICAL INFORMATION

Visual weather conditions prevailed at the time of the accident. Weather information is contained in the report at the data field labeled "Weather Information".

### WRECKAGE AND IMPACT INFORMATION

The airplane collided with tree 1/4 mile east of the Wrens Memorial Airport in Wrens, Georgia. The metallurgist's examination of engine components disclosed the following:

Examination of the front end of the engine case disclosed that a set screw that prevents rotation of the governor drive idler gear shaft inside the bore was missing and a portion of the boss surrounding the screw was broken. The screw had been recovered after the

accident during original disassembly of the engine.

The governor gear train was disassembled and the liberated gears were examined visually and with the aid of a bench binocular microscope. The governor idler bevel gear and the governor shaft gear teeth had spalling at the pitch line on the pressure faces. Splines on the governor shaft had plastic deformation consistent with heavy loading; The governor idler shaft had circumferential score marks at both ends.

Examination of the aft end of the engine case revealed that the boss for the idler gear shaft was broken. Visual and magnified examination revealed that the separation of the boss occurred as a result of overload, and there was no signs of progressive cracking on the fracture surface. The bore in the boss appeared to be fairly cylindrical and was approximately 0.870 inch in diameter. Measurements indicated that the corresponding diameter of the shaft was 0.690 inch. AJAX Aviation, Inc. work order No. 9904, the boss for the idler gear was repaired on May 26, 1992. A representative of AJAX stated that during this repair the bore in the boss was enlarged and a bushing was installed by press fitting. The bushing (or its remnants) was not submitted for examination. AJAX reportedly keeps records of work orders for a duration of only two years.

Further inspection of the aft end of the engine revealed that a portion of the magneto gear boss was cut off or ground by a contact with the idler gear teeth. The teeth imprints were visible on the cut surface of the magneto gear boss when viewed under oblique light. The depth of the cut was approximately 0.004 inch.

Examination of the accessory housing revealed that a portion of the boss for the idler gear shaft was broken off.

The fracture face on the broken off piece was examined with the bench binocular microscope and then at higher magnifications with a scanning electron microscope (SEM). The fracture surface features were completely obliterated by post fracture damage in some areas. Examination of the undamaged regions showed dimpled fracture mode consistent with an overstress separation.

Examination of the forward end of the camshaft revealed no damage to the governor drive gear. The driving faces on the gear teeth were slightly polished, typical of normal tooth wear. Examination of the aft end of the camshaft revealed heavy grinding damage to the forward portions of the top faces in six (6) adjacent teeth of the aft camshaft gear.

Substantial portions of the two adjacent teeth were broken off at the forward end of the gear. Magnified inspection disclosed that these teeth broke as a result of overload. Severe plastic deformation and cracking were observed on the forward portions of the top and driving faces of all other gear teeth.

The idler gear contains two differing diameter gear teeth. The larger diameter gear teeth (forward teeth) are driven by the crankshaft gear and drives the camshaft gear. The smaller diameter gear teeth (aft teeth) drives the magneto drive gear. Two teeth were missing from the larger diameter gear teeth. All remaining teeth in this gear had either heavy pitting or spalling along the pitch line.

Segments of the gear containing the missing teeth were cut off and the fracture faces were examined with the stereomicroscope and then at higher magnifications with the SEM.

Approximately 80% of the fracture surface area in the tooth was relatively smooth and

contained crack arrest positions characteristic of fatigue cracking. The fatigue cracking originated at the root of the tooth. SEM examination revealed fissuring (micro cracking) in the fatigue zone and dimpled rupture mode in the overstress separation zone.

Examination at higher magnifications with SEM revealed micro fissuring, typical of fatigue cracking. The fatigue cracking emanated from an area of the thread root and extended throughout almost the entire fracture surface.

Both teeth faces of the larger diameter gear teeth are pressure faces. The fatigue cracking in teeth "1" and "2" originated on the opposite sides of the teeth.

The smaller diameter gear teeth also had two missing teeth. Examination revealed that the breakage of this tooth occurred as a result of overstress or after only a few cycles of very high stress.

Examination of the magneto drive gear disclosed pitting and spalling along the pitch line of some of the teeth. Plastic deformation of the pressure faces in several teeth and a pattern of tooth contact imprints was consistent with sliding of the mating gear under heavy loading.

#### MEDICAL AND PATHOLOGICAL INFORMATION

The pilot expired on January 2, 1994; no autopsy or toxicological examinations were requested.

#### ADDITIONAL INFORMATION

The aircraft wreckage was released to: Mr. Phil Connell (operator)

#### Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	42, Male
<b>Airplane Rating(s):</b>	Single-engine Land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane Single-engine; None	<b>Toxicology Performed:</b>	
<b>Medical Certification:</b>	Class 2 Valid Medical--no waivers/lim.	<b>Last FAA Medical Exam:</b>	12/25/1992
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	300 hours (Total, all aircraft), 200 hours (Total, this make and model)		

## Aircraft and Owner/Operator Information

Aircraft Make:	PIPER	Registration:	N964ST
Model/Series:	PA-32RT-300T PA-32RT-30	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	32RT887281
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	09/09/1993, Annual	Certified Max Gross Wt.:	3600 lbs
Time Since Last Inspection:	20 Hours	Engines:	1 Reciprocating
Airframe Total Time:	1299 Hours	Engine Manufacturer:	LYCOMING
ELT:	Installed, not activated	Engine Model/Series:	TIO-540-S1AD
Registered Owner:	CONNELL, LAMAR	Rated Power:	300 hp
Operator:	CONNELL, LAMAR	Operating Certificate(s) Held:	None

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	AGS, 145 ft msl	Distance from Accident Site:	30 Nautical Miles
Observation Time:	2221 EST	Direction from Accident Site:	45°
Lowest Cloud Condition:	Clear / 0 ft agl	Visibility	12 Miles
Lowest Ceiling:	None / 0 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	Calm /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	1° C / 0° C
Precipitation and Obscuration:			
Departure Point:	AUGUSTA, GA (AGS)	Type of Flight Plan Filed:	IFR
Destination:	TIFTON, GA (TMA)	Type of Clearance:	IFR
Departure Time:	2201 EST	Type of Airspace:	Class G

## Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	4 Fatal	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	5 Fatal	Latitude, Longitude:	

## Administrative Information

**Investigator In Charge (IIC):** PHILLIP POWELL, **Report Date:** 10/20/1994

**Additional Participating Persons:** ROBERT WEST; COLLEGE PARK, GA

**Publish Date:**

**Investigation Docket:** NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at [pubinq@ntsb.gov](mailto:pubinq@ntsb.gov), or at 800-877-6799. Dockets released after this date are available at <http://dms.nts.gov/pubdms/>.

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