

Brief of Accident

Adopted 02/26/2007

CHI05FA192  
File No. 20947                      07/14/2005                      Valparaiso, IN                      Aircraft Reg No. N365S                      Time (Local): 16:04 CDT

Make/Model:	Aerospatiale / AS365N	Fatal	0	Serious	0	Minor/None	3
Engine Make/Model:	Turbomeca / Arriel 1C	Crew	0				
Aircraft Damage:	Substantial	Pass	0		0		1
Number of Engines:	2						
Operating Certificate(s):	On-demand Air Taxi						
Name of Carrier:	CJ Systems Aviation Group						
Type of Flight Operation:	Air Medical (Medical Emergency); Non-scheduled; Domestic; Passenger Only						
Reg. Flight Conducted Under:	Part 135: Air Taxi & Commuter						

Last Depart. Point:	Same as Accident/Incident Location	Condition of Light:	Day
Destination:	Chicago, IL	Weather Info Src:	Weather Observation Facility
Airport Proximity:	On Airport/Airstrip	Basic Weather:	Visual Conditions
Airport Name:	Porter Memorial Hospital	Lowest Ceiling:	None
Runway Identification:	NA	Visibility:	7.00 SM
Runway Length/Width (Ft):	Unk/Nr	Wind Dir/Speed:	360 / 011 Kts
Runway Surface:		Temperature (°C):	28
Runway Surface Condition:		Precip/Obscuration:	No Obscuration; No Precipitation

Pilot-in-Command                      Age: 55

Flight Time (Hours)

Certificate(s)/Rating(s)  
Airline Transport; Flight Instructor; Multi-engine Land; Single-engine Land; Glider; Helicopter

Total All Aircraft: 9777  
Last 90 Days: 45  
Total Make/Model: 667  
Total Instrument Time: 357

Instrument Ratings  
Airplane; Helicopter

The helicopter was substantially damaged when it struck the helipad during an uncommanded yaw encountered during the initial hover after liftoff from a roof-top hospital heliport. The pilot reported that he picked up into a 4 to 6-foot hover and initiated a right pedal turn. He stated that as the helicopter reached a west heading "the aircraft would not turn any more" despite his continued application of right pedal. He stated: "As I continued to apply right pedal the aircraft then went into [a] sudden and uncommanded yaw to the left. I was unable to stop the yaw." The helicopter subsequently impacted the helipad and roof structure. It came to rest at the east edge of the helipad oriented on a southeast heading. A post accident inspection revealed that the Fenestron (tail rotor) drive shaft had failed approximately 6 inches aft of the main gearbox. The failure occurred at the point where the drive shaft entered a tunnel formed by the left and right engine firewalls. The firewalls and drive shaft segments in the vicinity of the point of failure exhibited scrape marks. Examination of the forward section of the drive shaft revealed features characteristic of an overload failure. The main gearbox output shaft assembly and rear transmission coupling connected the tail rotor drive shaft to the gearbox. Further examination revealed that the coupling flange could be moved laterally relative to the pinion approximately 3/32 (0.094) inch. Allowable lateral play in the drive flange was 1 millimeter (0.039 inch). Disassembly of the transmission coupling determined that the nut which secured the drive flange to the output assembly pinion gear was improperly installed. Wear patterns indicated that the locking tangs on the cup washer did not engage the corresponding slots on the shaft allowing the nut to loosen over time. In addition, the condition of the locking tangs indicated that they were folded over during installation causing them to separate from the cup. The resulting wear had removed material to such an extent that the contact face was no longer perpendicular to the longitudinal axis of the shaft. This allowed excessive radial play in the transmission coupling, which permitted contact between the tail rotor drive shaft and the firewalls. The FAA Rotorcraft

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Flying Handbook, FAA-H-8083-21, provided information related to failure of the anti-torque system on a helicopter. The handbook stated: "The loss of antitorque normally results in an immediate yawing of the helicopter's nose. The helicopter yaws to the right in a counter-clockwise rotor system and to the left in a clockwise system. . . . The severity of the yaw is proportionate to the amount of power being used and the airspeed. An antitorque failure with a high power setting at a low airspeed results in a severe yawing." The main rotor system of the accident helicopter rotated clockwise as viewed from above.

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Occurrence #1:     AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION  
Phase of Operation: HOVER - IN GROUND EFFECT

Findings

1. (C) ROTOR DRIVE SYSTEM, TAIL ROTOR DRIVE SHAFT COUPLING - LOOSE
  2. (C) MAINTENANCE, INSTALLATION - IMPROPER - COMPANY MAINTENANCE PERSONNEL
  3. (C) ROTOR DRIVE SYSTEM, TAIL ROTOR DRIVE SHAFT - FAILURE, TOTAL
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Occurrence #2:     LOSS OF CONTROL - IN FLIGHT  
Phase of Operation: HOVER - IN GROUND EFFECT

Findings

4. (C) AIRCRAFT CONTROL - NOT POSSIBLE - PILOT IN COMMAND
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Occurrence #3:     IN FLIGHT COLLISION WITH OBJECT  
Phase of Operation: HOVER - IN GROUND EFFECT

Findings

5. OBJECT - AIRPORT FACILITY
6. OBJECT - BUILDING(NONRESIDENTIAL)

Findings Legend: (C) = Cause, (F) = Factor

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The National Transportation Safety Board determines the probable cause(s) of this accident as follows.  
The loose tail rotor drive shaft coupling due to its improper installation by the operator's maintenance personnel, which resulted in the failure of the tail rotor drive shaft. An additional cause was the inability of the pilot to maintain control of the helicopter in the hover following the drive shaft failure.