



May 25, 2012

To: Accident Case File # **120502/269C/0694C**
N380TL/ Canyon State Aero, LLC
Phoenix, Arizona
NTSB Case # **WPR12LA191**

From: A. Booth, Boeing Accident Investigation

Subject: Field Investigation Notes, May 24, 2012
Canyon State Aero, Falcon Field, Mesa, AZ 85215

Copies Furnished: Tom Little, NTSB

1. Participants to the onsite investigation:

Tom Little, IIC, NTSB, Lynnwood, WA [REDACTED]
Jack Ogle, FAA-Scottsdale FSDO, Scottsdale, AZ [REDACTED]
Steve Gleason, ASI, Sikorsky Aircraft Company, Horseheads, NY [REDACTED]
Mike Binder, ASM, Sikorsky Aircraft Company, Coatsville, PA [REDACTED]
Jan Sandberg, Canyon State Aero, LLC, Mesa, AZ [REDACTED]
Adrian Booth, ASI, The Boeing Company, Mesa, AZ [REDACTED]

2. General Information: The mishap aircraft, a Hughes Model 269C (SN: 0694C), U.S. Reg No. N380TL is owned by Canyon State Aero LLC, of Gilbert, AZ. The helicopter was maintained and operated out of Hanger 101, Falcon Field, Mesa, AZ. The two man crew, a pilot and passenger/ photographer were on a local area photo mission. Visual meteorological conditions prevailed at the time of the accident. A VFR flight plan was not filed. The helicopter was being operated in accordance with 14 Code of Federal Regulations Part 91.

On May 2, 2012, at 11:12 AM (MST) while in cruise flight at approximately 75 KIAS and 500 Ft AGL over a residential area some four miles north of Sky Harbor International Airport, the helicopter experienced a reported loss of anti-torque control. Prior to the mishap, the pilot described "feeling a vibration throughout the airframe" and then subsequently hearing a loud "clunking" noise followed by a loss of anti-torque pedal response. The pilot reported reducing collective then retarding the throttle and entering an autorotation. The pilot made the appropriate control inputs as necessary to maintain helicopter control during the descent. The Hughes 269C helicopter was heavily damaged as a result of striking trees, a block wall and a structure during its descent and landing. The helicopter experienced major damage to the cockpit, fuselage, tail boom, drivetrain, main rotor and tail rotor systems. The pilot and passenger received major injuries and both egressed from the aircraft unassisted. Local crash/rescue services responded to the crash site and assisted as necessary. There was no post-crash fire. There was no reported fuel spillage. The helicopter was recovered and transported to Hanger 101, Falcon Field, Mesa, AZ. for further investigation and storage as directed by the NTSB.

3. Aircraft/Maintenance history: At the time of the mishap, the helicopter had accumulated approximately

1584 Hours Total Time Airframe (TTAF) (Hobbs 899). The last period inspection completed was a 100 Hour Inspection on May 1, 2012. The previous periodic inspection encompassed a 25-50-100-200-400 Hr Inspections completed on March 29, 2012 at 1481.4 hours (Hobbs-796.4). The last Annual Inspection was reported as being completed on May 6, 2011 at 981.6 Hrs TTAF. In each case, the required inspections were completed and the subsequent MOCs and maintenance test flights were signed off as satisfactory.

A limited review of the aircraft records was conducted. The records review indicated compliance with all Manufacturer's Service Notices, and applicable FAA Airworthiness Directives. Maintenance on the helicopter generally appeared to be in accordance with the manufacturer's publications. However, completion of required maintenance procedures could not be verified due to non-availability of recent inspection records. Pertinent records have been requested by the NTSB. There were some minor maintenance discrepancies noted during the inspection. None were causal to the mishap.

4. Aircraft Weight & Balance and Performance data:

a. Operational performance data: The aircraft performance was reviewed considering the aircraft configuration and the approximate power available conditions at the time of the mishap. The review indicated that there was sufficient power available for the conditions and configuration to perform the planned mission. The aircraft could be operated within published operational/performance parameters and were not considered causal to the mishap.

b. Weight & Balance: The weight and balance review was made using an estimate of the aircraft weight for its configuration at the time of the mishap. Allowing for minor deviations in weight and configuration, the aircraft was being operating in accordance with the published weight and balance constraints. Helicopter weight and balance was not considered to be causal to the mishap.

5. Systems examination:

a. Airframe/fuselage/landing gear: There was extensive visible damage to the fuselage, cockpit frame, tail boom and drive system. The lightweight tubular steel center airframe was severely damaged. Both forward/aft right and left frame cluster fittings were intact, however several struts were fractured just short of the fittings. The upper seat back structure was intact but distorted and bent aft on the left side as it was pushed back against the static mast and associated main rotor flight control linkage. The canopy frame was separated from the fuselage. The lower forward fairing assembly to include the air induction system inlet and the filter housing was distorted from impact forces.

The tail boom was intact and had remained attached even though the forward boom attach fitting had fractured. The right lower tail boom support strut was fractured and bent. The left lower tail boom support struts, tail boom center attachment fitting and frame mounting lugs were undamaged. The middle and upper support struts were damaged but still attached. The tail boom and support struts exhibited contact damage from impacting the ground and structures during the crash sequence.

The tail empennage, to include the tail rotor system and the horizontal and vertical stabilizers, remained in position on the aft portion of tail boom. The lower vertical fin was nearly severed at mid-span and exhibited damage to the tail boom mount, leading and trailing edge and the metal skin surfaces. The horizontal stabilizer exhibited impact damage to the leading and trailing edge and the lower and upper skin surfaces. The tailskid had separated from its mount at the tail boom close out.

The landing gear, to include fore/ aft cross beams, fore/ aft strut, gear dampers and drag braces, experienced varying degrees of damage. Both skid tubes were fractured and separated.

b. Cockpit/instruments: The canopy frame structure was destroyed during the crash sequence. The canopy windshields and transparencies were all broken out or cracked. The floor structure was nearly broken free from the frame

and had displaced. The instrument panel was fractured from its floor mount and was contained only by the associated wire harnesses. The crew seats, seat support structure to include the seat panel and seat structure beams were distorted and punctured from engine and frame displacement. The crew restraint system seat and shoulder harness assemblies were intact and functional. The shoulder harness inertial reels operated correctly when actuated.

c. **Engine:** The engine seemed intact and appeared to have minimal damage as a result of the crash impact. The engine mounts and engine basket tubing was retained but there was some visible damage. The engine lower section to include intake and exhaust manifolds, fuel servo control, throttle linkage, impeller assembly, impeller shroud, and the Bendix gear and housing experienced minimal visual damage as a result of impact forces to the underside of the fuselage. The engine manufacturer, Lycoming, was present at the on-site inspection.

d. **Main rotor system:** The main rotor system sustained major damage. The main rotor hub assembly and components (pitch change bearing, pitch change links, friction dampers, swashplate, droop stops, etc.) exhibited damage commensurate with excessive blade flapping angles and sudden stoppage. The main rotor blades were still attached to the hub. The main rotor blades exhibited varying degrees of damage i.e., bent spars, skin cuts, gouges, and upper and lower skin wrinkling/delamination. There was impact damage to the leading edge and abrasion strips with varying degrees of trailing edge separation and tip cap damage. There were no indications that blades made contact with the fuselage or tail boom. Main rotor blade damage was indicative of sudden stoppage associated with low RPM blade strikes to ground and structures.

e. **Main transmission and drive system:** The main transmission exhibited no visible external damage and was still firmly attached to the airframe. The transmission rotated when actioned. The transmission oil was visible in the sight gauge. The static mast was in place and appeared undamaged. The left, right and aft mast supports were damaged. The main rotor driveshaft was intact and the rotor hub rotated when actioned. The belt drive system to include all V-belts, 'H' belt drive frame, upper and lower pulley assemblies were displaced as a result of impact damage to the airframe. Two drive belts had become unseated. The clutch actuator and actuator control cable were displaced but appeared to have been functional. It was noted that the left belt guide bracket was improperly assembled. The overrunning (sprag) clutch in the upper pulley assembly was functional.

The engine lower coupling driveshaft appeared to be intact however on removal the shaft was bent and there was evidence of wear on the shaft forward of the aft spline gear. The lower engine adapter appeared undamaged. The upper pulley pinion shaft was fractured at the aft end under the aft pinion nut. It was noted that the Cotter key on the nut was improperly installed. There was visible wear on the end of the shaft and splines. The splined drive sleeve exhibited evidence of wear on the sleeve and splines.

The tail rotor driveshaft was fractured into two sections. The forward section of the driveshaft was still attached to the upper pulley assembly airframe at the forward tail rotor drive shaft retaining nut. It was fractured some ten inches aft of that location. It appeared to be a non-rotational fracture. The remainder of the shaft was still attached to the input quill of the tail rotor gearbox.

f. **Tail rotor system:** The tail rotor system remained attached to the tail empennage. The tail rotor transmission was intact with no visible impact damage. There was no evident pre-mishap damage or material deficiency. The gearbox operated normally when actioned by hand. Gearbox oil servicing level appeared normal.

The tail rotor assembly to include swashplate, pitch control assembly, drive fork, hinge bolt, teetering bearings and hub, exhibited some minor visible damage, mostly minor nicks and gouges. The tail rotor pitch control mechanism operated normally when the tail rotor swashplate bellcrank was actioned by hand. The fiberglass tail rotor blades remained attached to the tail rotor hub and both blades exhibited varying degrees of damage to blade skin surfaces, blade tips, leading and trailing edges, abrasion strips and blade root fittings. Damage appeared to be mostly non-rotational from contact with ground and structures.

g. Flight control system: Flight control sticks were installed at the left side pilot position. The cyclic stick was fractured approximately three inches above the mount on the yoke at the torque tube. The collective control stick was damaged at the housing at the left side of the seat back structure. The cyclic lateral and longitudinal control systems and the collective flight control system exhibited continuity; however, movement of the controls was limited due to impingement on the control linkage from damage to the airframe structure. Collective throttle linkage was intact although exhibited binding when manipulated. This was most probably the result of impact damage to the lower forward fuselage.

Anti-torque control continuity from the pilot's pedals back to the forward end of the tail boom was evident. Movement was limited by damage to the lower forward airframe and control continuity ended with the severance of the tail rotor control rod at the tail boom mount. Continuity was established again from this point back to the tail rotor gearbox bellcrank at the tail rotor gearbox and then out to the tail rotor pitch change mechanism. Manipulation of the severed control rod indicated that the tail rotor pitch control mechanism functioned appropriately. The left pedal arm was fractured at the mid-point.

The upper flight controls to include the lateral and longitudinal bellcranks, pitch mixers, idler, collective pitch mixer bellcranks were in place and undamaged. The upper control rods were in place and undamaged. The stationary and rotating swashplate were intact. Two of the three-pitch change links were intact and undamaged with the red blade link having been fractured at the upper rod end bearing. System hardware (rod end bearings, nuts, bolts, etc.) was relatively free of corrosion.

h. Fuel system: The fuel system was intact except for some minor deformation to the right fuel tank. The fuel system was of standard configuration. There was no evidence of fuel leaks and no reported fuel spillage at the mishap site. A fuel sample was not taken during the onsite inspection.

6. Investigator comments:

- a. Other than the fractured upper pulley pinion shaft, all observed damage to the aircraft systems and structure and components were attributed to overstress/ overload as a result of impact forces during the crash sequence.
- b. Damage to the main rotor blades and minimal damage to the main rotor head and upper flight controls were indicative of main rotor sudden stoppage at low RPM.
- c. Damage to the tail rotor system was consistent with the tail rotor being in a low rpm state with no power applied.
- d. Other than the fractured upper pulley pinion shaft and associated hardware, no pre-existing aircraft material deficiencies were identified during the onsite inspection of the aircraft that could be attributed as causal to the mishap.