HARTZELL PROPELLER INC.

Aircraft Accident/Incident Report No.: 111222

Date of Accident:	December 22, 2011
Location:	Nashville, PA
NTSB File No.:	ERA12FA120
Aircraft:	Cessna 441 Conquest II
Registration No.:	N48BS
Serial No.:	441-0125
Owner:	per FAA registry: N48BS LLC 16531 Carousel Lane Huntington Beach, CA 92649

Written by:	Tom McCreary Air Safety Investigation Manager

Date:	March 7, 2012

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ACCIDENT SYNOPSIS

According to the NTSB Preliminary report, the aircraft crashed during an approach turn at the destination airport. “The right propeller did not exhibit any signs of power at impact.”

Aircraft Damage: Substantial
Injuries: One person on board, one fatal

SUMMARY AND ANALYSIS OF FINDINGS

Both propellers had unusually mild blade damage with no significant bending, twisting, tearing or leading edge damage in the tip area (as is commonly seen with propellers that impact with power ON).

Both propellers had similar impact marks from a blade counterweight that occurred while the blade was at a normal operating blade angle, i.e. not feathered, not in reverse.

Blades from the left propeller were driven toward a higher blade angle at impact as evidenced by forward bending of the blades and damage to the forward side of the fork. Witness marks on the blade preload plates varied from 27° to 35° blade angle with the lower (27°) considered to be the closest to a pre-impact position. This would be a little above flight idle and would be consistent with the spinner mark and consistent with operation at approach power. The very mild blade damage also strongly suggests the propeller was operating at low power.

The right propeller had such mild impact damage that it had no evidence of rotation. Blade damage indicated that, if rotating, it did not impact with any significant rotational energy. The grease marks on the blade preload plates varied from 35° to 43° are considered to not be indicative of a pre-impact blade angle because this position would not be consistent with the spinner marks and the low power/no power condition of the blades.

CONCLUSIONS

The left propeller was at a low pitch position (not feathered). Blade damage indicated that it was rotating but at low power at the time of impact.

The right propeller was at a low pitch position (not feathered). Blade damage indicated little or no rotational energy at the time of impact.

There were no discrepancies noted that would preclude normal operation. All damage was consistent with impact damage.

PROPELLER TEARDOWN REPORT

Date of Investigation: February 7, 2012

Location: Anglin Aircraft Recovery
4901 Hollets Corner road
Clayton, DE

Propeller Model: HC-E4N-5A with E8501 blades

Representatives:

Tom McCreary	Hartzell Propeller Inc.
John Popel	Hartzell Propeller Inc.
Paul Cox	NTSB
David Studtmann	Honeywell
Jay Eller	Honeywell
Henry Soderlund	Cessna

General Comments:

This type propeller is a 4-blade single-acting, hydraulically operated constant speed model with feathering and reverse pitch capability. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A feathering spring and blade counterweight forces are used to move the blades to the high pitch/feather direction in the absence of governor oil pressure. The propeller control system incorporates a beta mechanism that actuates when blade angles are lower than the flight idle position.
The propeller utilizes an aluminum hub with aluminum blades. Rotation is clockwise as viewed from the rear.

Installation Data: (Data reference the 30-inch station)

Reverse:	-10.0 ± 0.5 degrees
Start Lock:	-1.4 ± 0.2 degrees
Flight Idle:	not available
Feather:	84.7 ± 0.5 degrees

Service History:

Logbook records indicated that the propellers were installed (new) 09JAN09. The propellers had 304.7 hours TT on 06MAR10.

	S/N	Date of manufacture	TTSN	TSO
Left Hub	HE328	01DEC08	unknown	unknown
Blades	K48438	01DEC08	unknown	unknown
	K48437	01DEC08	unknown	unknown
	K48439	01DEC08	unknown	unknown
	K48433	01DEC08	unknown	unknown
Right Hub	HE330	01DEC08	unknown	unknown
Blades	K48435	01DEC08	unknown	unknown
	K48432	01DEC08	unknown	unknown
	K48434	01DEC08	unknown	unknown
	K48436	01DEC08	unknown	unknown

Position: **Left**

Hub Serial Number: HE328 **Factory No.:** A97590

Blade Model: E8501

S/N L1: K48438
S/N L2: K48437
S/N L3: K48439
S/N L4: K48433

Blade Orientation:

L1-L2-L3-L4 clockwise as viewed from the rear of the propeller. The hub serial number was between the L1 and L4 blades.

As Received:

The propeller had been removed from the engine and the spinner dome had been removed. One blade was in the feather position. One blade was disconnected and could be manually turned in the hub. The other two blades were at a low pitch position, but at different angles. The feather stop nut was 1-1/32 inch from the feather stop.

All four blades were bent forward of the plane of rotation. L2 and L3 blades were fractured at the shank.

Photo 1. Left propeller, as received

Spinner Assembly:

See photo on page 8.

The spinner assembly had an impact mark from one blade counterweight. The blade was at a low pitch position (in the normal operating range) when the spinner was crushed. The dome was crushed on one side with no frontal crushing.

Spinner Bulkhead S/N: 531.

Propeller Cycling:

Cycling of the pitch change mechanism was not possible.

Engine/Propeller Mounting:

The mounting flange was intact and unremarkable.

Cylinder: (S/N: 989)

The cylinder and start lock mechanism were intact and unremarkable.

Piston: (S/N: 980172)

The piston was intact and unremarkable.

Pitch Change Rod: (S/N: 2535)

The pitch change rod was bent on the aft side of the fork.

Fork: (S/N: 081960)

One fork tine was bent/cracked on the forward (thin-walled) side of the fork.
All four fork bumpers were intact except that the nylon ends were deformed.

Feathering Spring/Guides:

The feather spring and spring guides were intact and unremarkable.

Pitch Stops:

The reverse pitch stop, feather stop, and start lock mechanism were intact and unremarkable.

Hub Assembly:

The hub assembly was intact. Two of the hub through-bolts were slightly bent.
The blade bearings were intact and unremarkable.

Preload Plates:

NOTE: For this propeller model, when the blade knob is aligned with the hub parting line, the blade angle at the reference station is the same as the knob angle impression stamped on the blade butt (40°). When a fork bumper is aligned with the hub parting line, the blade angle at the reference station is 5° less than the knob angle (fork bumper 5° lower than knob position)

L1 preload plate had multiple impact marks from a fork bumper between -4/32 to -8/32 inch from the hub parting line. This equates to approximately 29° to 24° blade angle.

L2 preload plate had an impact mark from a fork bumper at 6/32 inch from the hub parting line. This equates to approximately 27° blade angle.

L3 preload plate had multiple impact marks from a fork bumper between 0 to -4/32 inch from the hub parting line. This equates to approximately 35° to 29° blade angle.

L4 preload plate had multiple impact marks from a fork bumper between 0 to -2/32 inch from the hub parting line. This equates to approximately 35° to 32° blade angle.

Pitch Change Brackets:

All four blade pitch change brackets had separated from the blade butts. They were fractured into multiple pieces.

Propeller Blades:

Blade L1 was bent forward approximately 20° at 1/4 radius. It had slight additional forward bending further outboard (large radius). The counterweight had separated from the blade; bolts stripped. The tip was straight and not twisted. The tip had no significant leading edge damage or tearing.

Blade L2 was fractured at the shank due to forward bending. The tip was straight and not twisted. The tip had no significant leading edge damage or tearing.

Blade L3 was fractured at the shank due to forward bending. The tip was straight and not twisted. The tip had no significant leading edge damage or tearing.

Blade L4 was sharply bent forward approximately 60° at 1/4 radius. The counterweight had separated from the blade; bolts stripped. The tip was straight and not twisted. The tip had no significant leading edge damage or tearing.

Photo 2. Left propeller blades

Photo 3. Left propeller blades

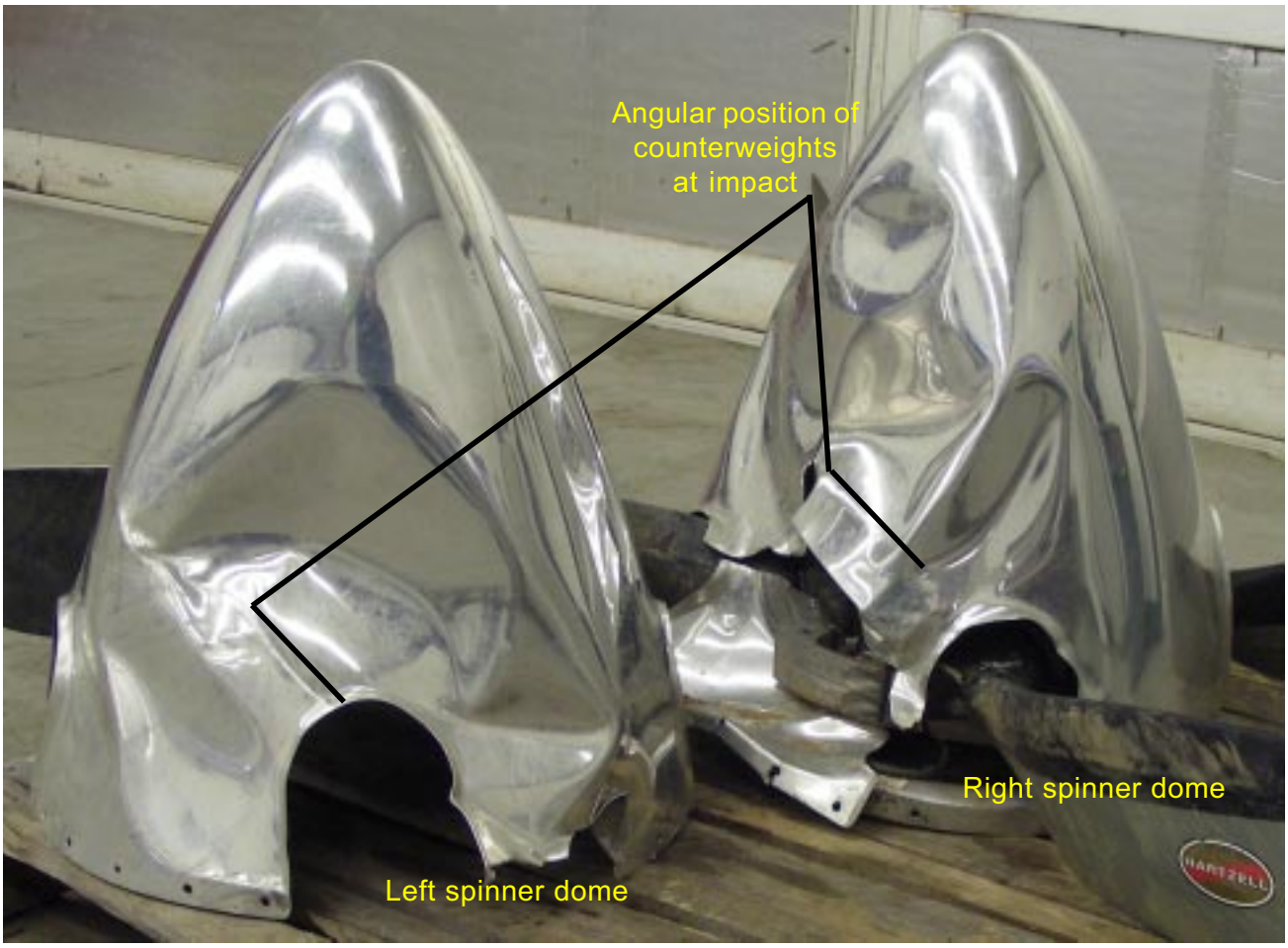

Photo 4. Both spinner domes

Position: **Right**

Hub Serial Number: HE330 **Factory No.:** A97592

Blade Model: E8501

S/N R1: K48435
S/N R2: K48432
S/N R3: K48434
S/N R4: K48436

Blade Orientation:

R1-R2-R3-R4 clockwise as viewed from the rear of the propeller. The hub serial number was between the R1 and R4 blades.

As Received:

See photos on Page 10.

The propeller had been removed from the engine. The spinner dome had been removed but had been put back on the propeller. All four blades were at the feather position. The piston was at the feather position.

Spinner Dome:

See photo on page 8.

The spinner assembly had an impact mark from one blade counterweight. The blade was at a low pitch position (in the normal operating range) when the spinner was crushed. The dome was crushed on one side with no frontal crushing.

Spinner Bulkhead S/N: 535.

Propeller Cycling:

Cycling of the pitch change mechanism was not possible.

Engine/Propeller Mounting:

The mounting flange was intact and unremarkable.

Photo 5. Right propeller, as received

Photo 6. Right propeller, as received

Cylinder: (S/N: 987)

The cylinder and start lock mechanism were intact and unremarkable.

Piston: (S/N: 080181)

The piston was intact and unremarkable.

Pitch Change Rod:

The pitch change rod was intact and unremarkable.

Fork:

The fork was intact and unremarkable.

Feathering Spring/Guides:

The feather spring and spring guides were intact and unremarkable.

Pitch Stops:

The reverse pitch stop, feather stop, and start lock mechanism were intact and unremarkable.

Hub Assembly:

The hub assembly was intact and unremarkable.
The blade bearings were intact and unremarkable.

Preload Plates:

NOTE: For this propeller model, when the blade knob is aligned with the hub parting line, the blade angle at the reference station is the same as the knob angle impression stamped on the blade butt (40°). When a fork bumper is aligned with the hub parting line, the blade angle at the reference station is 5° less than the knob angle (fork bumper 5° lower than knob position)

R2 and R4 preload plates did not have any witness marks that could be used to calculate a blade angle.

R1 preload plate had two “footprints” in grease caused by a fork bumper. The marks were 0 and +12/32 inches from the hub parting line. This equates to approximately 35° to 43° blade angle.

R3 preload plate had a “footprint” in grease caused by a fork bumper. The mark was +2/32 inch from the hub parting line. This equates to approximately 38° blade angle.

NOTE: A “footprint” in grease has questionable validity.

Blade Pitch change brackets:

All four blade pitch change brackets were intact and remained attached to the blade butts.

Propeller Blades:

See photos on Page 13.

The blade counterweight was intact on all four blades.

The tips of all four blades were straight and not twisted with no significant leading edge damage or tearing.

Blades R2 and R3 were straight with bending or twisting; no evident damage.

Blade R1 was bent aft approximately 45° at 1/4 radius.

Blade R4 was bent forward approximately 30° at 1/4 radius. The outer 1/2 of the blade was slightly twisted toward lower pitch and slightly bent aft.

Photo 7. Right propeller blades

Photo 8. Right propeller blades