

National Transportation Safety Board

Office of Aviation Safety

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POWERPLANTS - PROPELLER

Group Chair's Factual Report

August 29, 2025

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B TABLE OF ACRONYMS

ALF	Aft Looking Forward
CFR	Code of Federal Regulations
ESN	Engine Serial Number
FAA	Federal Aviation Administration
NTSB	National Transportation Safety Board
SN	Serial Number
TCDS	Type Certificate Data Sheet
TSN	Time Since New

C ACCIDENT

Location: Nome, Alaska
Date: February 6, 2025
Time: 1520 Local Time
Airplane: Textron Aviation (Cessna) 208B airplane, N321BA

D POWERPLANTS - PROPELLER SPECIALIST

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E SUMMARY

On February 6, 2025, at about 1520 Alaska standard time, a Textron Aviation (Cessna) 208B airplane, registration number N321BA, operated as Bering Air flight 445, was destroyed when it was involved in an accident near Nome, Alaska. The pilot and nine passengers were fatally injured. The airplane was operated as a *Title 14 Code of Federal Regulations (CFR) Part 135* scheduled commuter flight.

Initial visual inspection of the propeller found that the No. 4 blade was fracture separated from the propeller hub, the remaining three attached blades freely rotated within their respective hub sockets, the threaded studs were not present on the hub and the hub's threaded holes were damaged. All four blade snap rings were displaced from their respective blade grooves, which is consistent with propeller blades making contact while rotating at impact.

The anti-icing feed shoe on all four blades were torn at various locations along the leading edges. The anti-icing hardware for blades Nos. 1, 2, and 4 was still attached but the No. 3 blade was missing the spray head assembly, and the spray head bracket appeared torn and damaged, indicating the hardware was installed prior to impact.

The hub, made of an aluminum alloy, was fractured at the No. 4 blade socket with approximately half of the blade socket rim missing and the fracture surface was of a consistent texture indicating an overload failure. There was no evidence of fatigue.

All the propeller blades exhibited bends at various span wide locations and hard body impact damage. All four blade butts contained witness marks that corresponded to the beta rod springs. Blade angle at the time of impact was estimated by placing the No. 4 blade next to its respective hub socket and rotating all four blades to a position such that the blade butts would have made contact with the beta rod springs, corresponding to the observed witness marks. From this estimated blade position, the propeller appears to have been in a high power forward thrust condition at the time of propeller impact.

There was no evidence found of pre-impact failures or pre-existing conditions that would indicate abnormal operation of the propeller.

F DETAILS OF THE EXAMINATION

The propeller was shipped from Wasilla, Alaska to McCauley Propeller Systems (McCauley) in Wichita, Kansas for examination. Representatives of McCauley, Textron Aviation, and the National Transportation Safety Board (NTSB) were present for the examination performed on May 14, 2025.

All directional references to front and rear; left and right; top and bottom; and clockwise and counterclockwise are made aft looking forward (ALF). All numbering is in the circumferential direction starting with the No. 1 position at the 12:00 o'clock position or immediately clockwise from the 12:00 o'clock position and progressing sequentially clockwise ALF. The direction of rotation of the engine compressor, turbine and the propeller shaft is clockwise ALF.

1.0 Propeller Description

The accident airplane was equipped with a propeller manufactured by McCauley Propeller Systems, model 4HFR34C778-I. According to Federal Aviation Administration (FAA) Type Certificate Data Sheet (TCDS) P3NE, revision 18, dated February 24, 2023, model 4HFR34C778-I propeller is a four-bladed aluminum alloy variable pitch propeller with hydraulically operated blade pitch change mechanism providing constant speed operation mode, full feathering, and reversing functionality (Figure 1). Propeller model 4HFR34C778-I contains blade model number 102BH[X]-0 to -4 and according to the TCDS, propeller model 4HFR34C778/102BH[X] is eligible for McCauley deicer, P/N B-40245-56, or McCauley anti-ice feed shoe, P/N C-40323-83. This propeller has a maximum continuous rating of 867 horsepower (hp) at 2,000 rpm and a takeoff rating of 867 hp at 2,000 rpm.

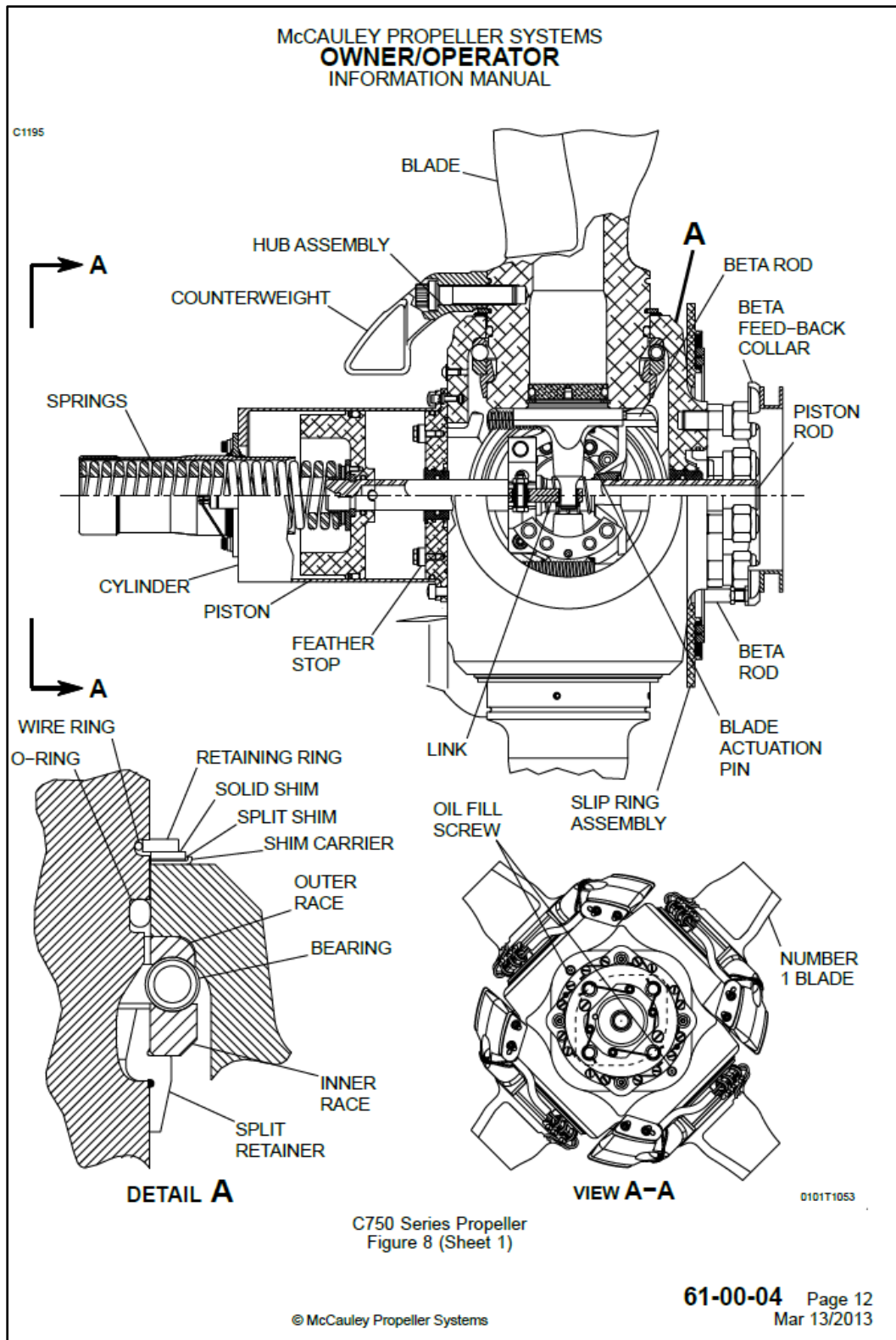


Figure 1. Typical C750 Series Propeller Diagram

Figure Courtesy of McCauley

2.0 Accident Propeller Details

Part/Model Number	4HFR34C778-I
Serial Number	191258
Number of Blades	4
Maximum Diameter	102 inches
Ice Protection	TKS (deicing fluid, boot on inboard side of the blades)

According to personnel at McCauley that reviewed maintenance records, a logbook entry dated August 2, 2024 stated propeller serial number (SN) 150502 was removed from the airplane for overhaul and that propeller SN 191258 was installed on the airplane; the airplane total time since new (TSN) was 3,927.8 hours at the time of the propeller change. Based on the records and information available during this propeller examination, the propeller had accrued 2,937.5 hours TSN at the time of the accident.

3.0 Propeller Exam

The shipping crate was stored inside a secure building at McCauley and was opened by the investigation team present for examination of the propeller (Figure 2). The propeller, with three blades attached to the hub and one separated blade, was found secured within the crate (Figure 3).



Figure 2. Photo of the Shipping Crate - As Received



Figure 3. Propeller - As Received

The propeller assembly and the separated No. 4 blade were removed from the shipping crate, placed on the floor for initial visual examination and numbered according to the numbered hub sockets (Figure 4 and Figure 5). Blade Nos. 1 and 3 appeared rotated 180 degrees with the leading edges facing to the aft side of the hub but all three attached blades were found to freely rotate within their respective hub sockets. The propeller was rolled over with the No. 4 blade socket facing down to facilitate inspection of the hub flange; a small amount of red propeller lubricating oil drained out of the hub.



Figure 4. Propeller Removed - As Received



Figure 5. Propeller Hub Flange - As Received

The propeller model number and SN were confirmed on the propeller hub as model number 4HFR34C778-I and SN 191258 (Figure 6).

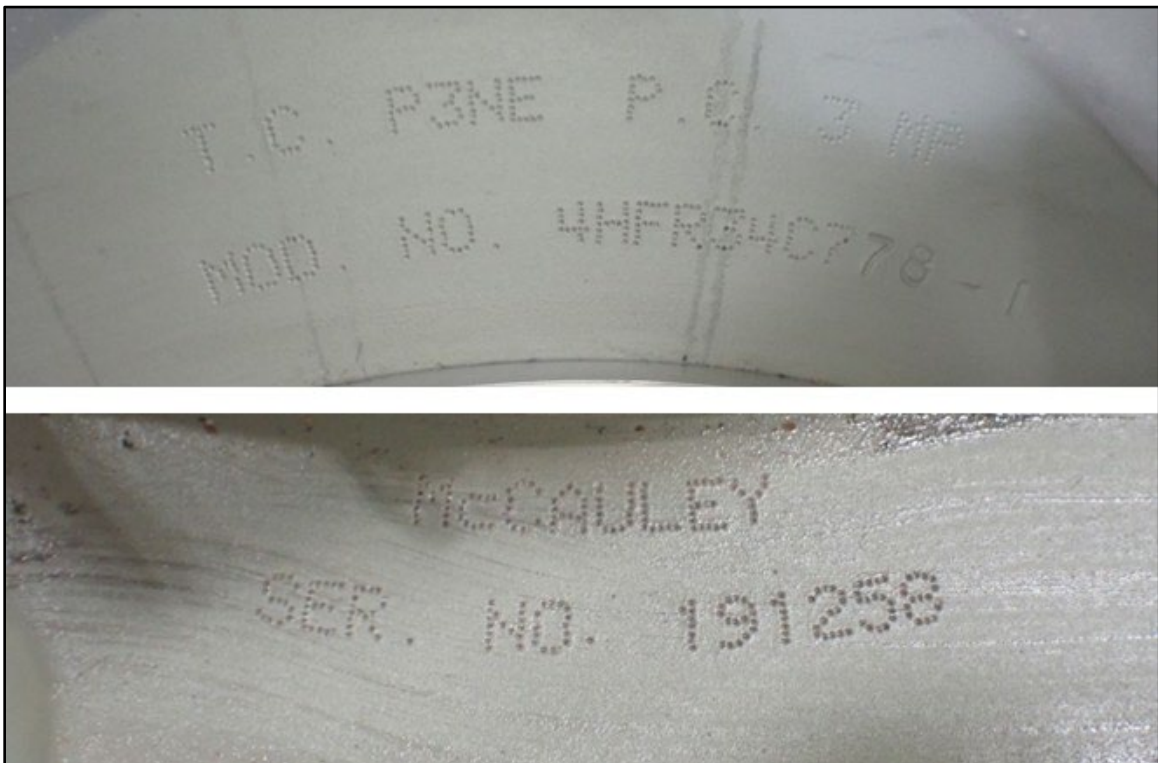


Figure 6. Propeller Data Plate and SN Confirmation

The No. 4 blade was fracture separated from the propeller hub and the hub was cracked between the No. 4 blade socket and the center of the hub. The propeller hub flange exhibited damage to approximately one quarter of the flange face/circumference. All 8 threaded studs, which attach the propeller hub to the engine propeller shaft, were not present and the damage to the hub's threaded holes were consistent with the bolts being pulled out with only remnants of the stud threads remaining within the threaded holes (Figure 7). One alignment dowel (a Pratt & Whitney Canada supplied component) was found loose and not engaged in the hub; the second alignment dowel was not found. They were tapped and threaded to install two mounting studs to facilitate mounting the propeller to the test/disassembly stand.

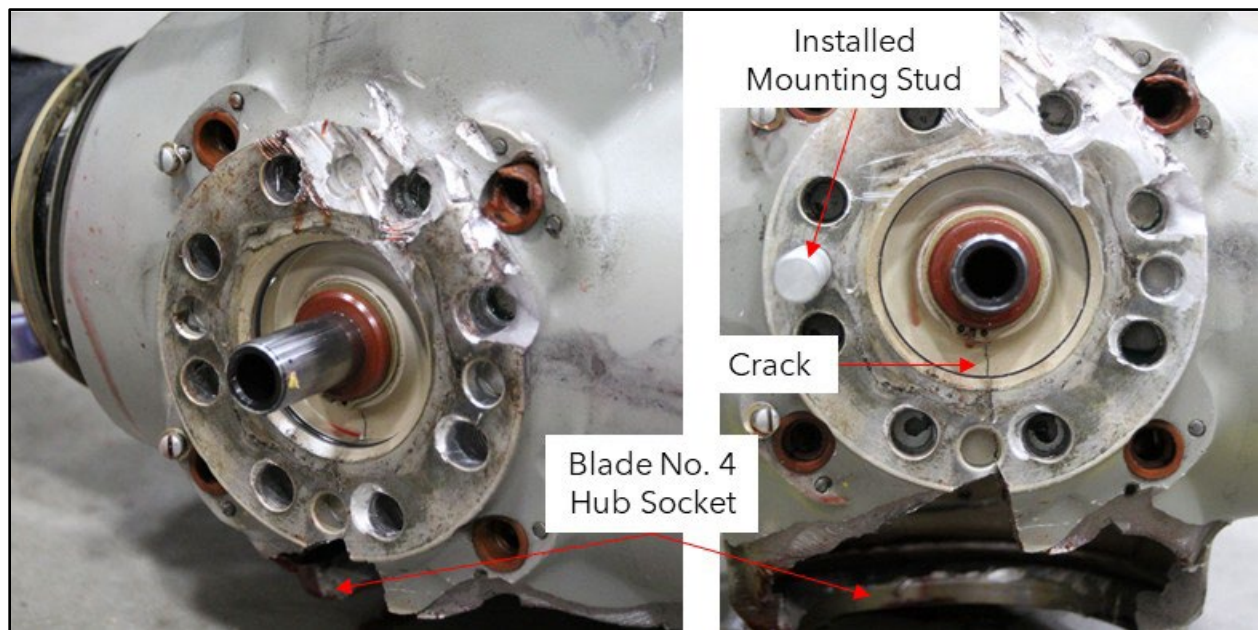


Figure 7. Propeller Hub Flange - As -Received

The length of the piston rod from the plane of the hub face was measured as 1.595 inches.

The propeller was mounted onto the test/disassembly stand for further examination and disassembly (Figure 8). All four blade snap rings were displaced from their respective blade grooves, which is consistent with blade making contact while the propeller was rotating at impact according to McCauley personnel. The anti-icing feed shoe on all four blades were torn at various locations along the leading edges. The anti-icing hardware was found on blades Nos. 1, 2, and 4. Blade No. 3 was missing the spray head assembly but the bracket holding it appeared torn and damaged, indicating the hardware was installed but separated during the accident sequence.

There were multiple bends present on all four blades; blade Nos. 2 and 3 contained "S" bends and blade Nos. 1 and 4 contained bends at different locations (Figure 8 and Figure 9). The No. 1 blade counterweight was not attached and missing

(not recovered). The No. 1 blade had hard body impact damage to the leading and trailing edges. The No. 4 blade counterweight was still attached to the blade. The leading and trailing edges of the No. 4 blade appeared typical of use with some scratching and loss of paint.



Figure 8. Propeller Mounted in a Test Stand



Figure 9. Separated No. 4 Blade

The hub, made of an aluminum alloy, was fractured at the No. 4 blade socket with approximately half of the blade socket rim missing. The fracture surface appeared to have a consistent texture indicating overload failure with no evidence of fatigue. Looking into the hub through the fractured No. 4 blade socket, the beta yoke was

found fractured, all four beta rods were damaged, and two of the four beta rods were bent (Figure 10). The actuating pin for the No. 4 blade was not found.

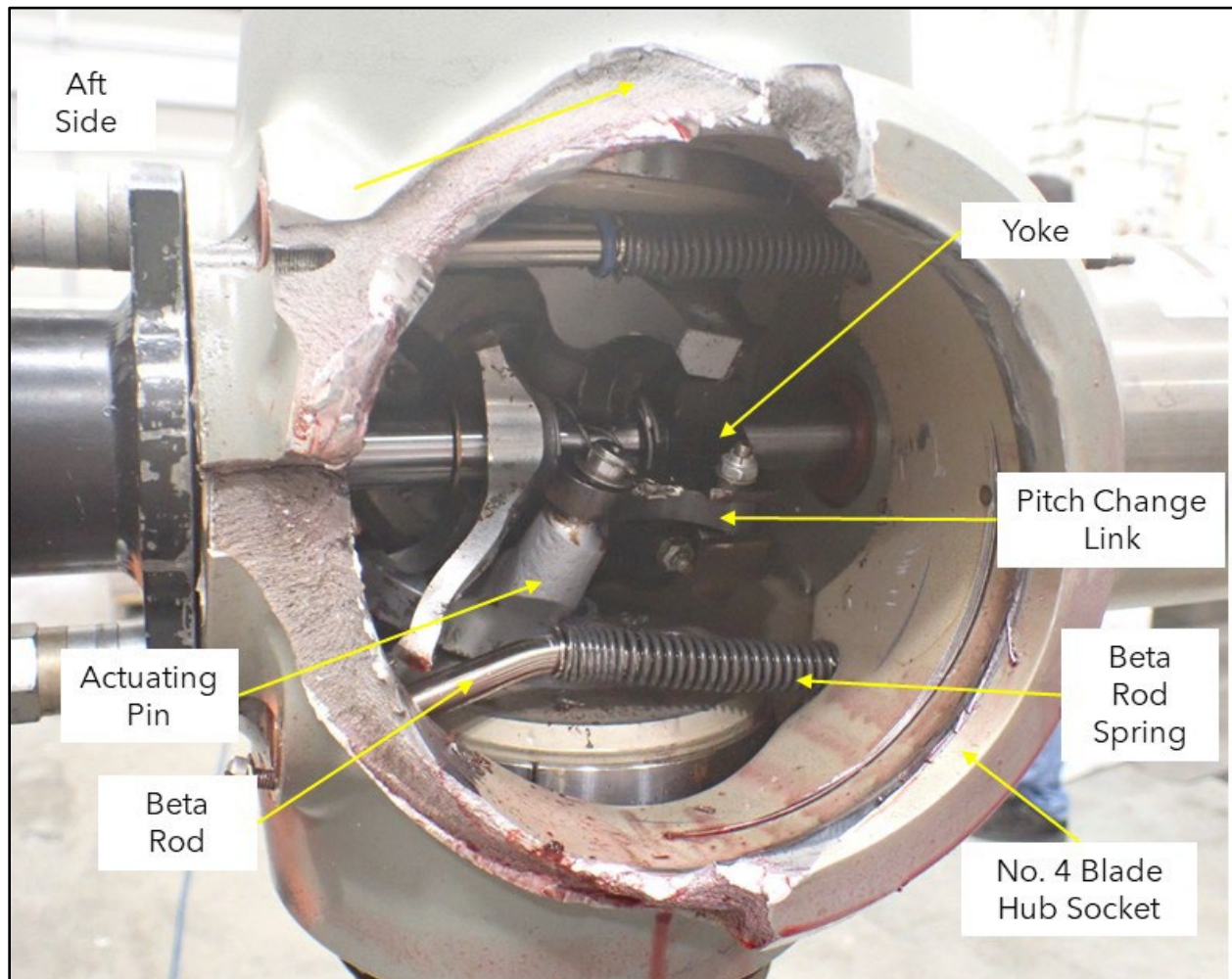


Figure 10. Fractured No. 4 Blade Hub Socket and Internal Hub Hardware

The cylinder and spring housing, on the forward side of the propeller, were in place, all the attachment bolts were installed and correctly lock wired. The spring housing was removed; there was no visible damage or cracking on the housing. The steel feather spring did not appear damaged, contained a small amount of localized rust color but was otherwise unremarkable. There was minor scratching found on the exterior of the cylinder but otherwise it appeared unremarkable.

The piston was correctly installed on the rod such that the oil transfer holes in the rod were properly aligned with the piston. The rubber o-ring on the piston was oil wetted with no visible damage or breaks. The piston contained minor pitting corrosion on the forward side of the piston which is not unusual for used hardware since that end of the piston is open to the atmosphere according to McCauley personnel.

All four blade pitch change links, attached to the piston rod yoke, were intact but deformed (Figure 11). The actuation pins for blade Nos. 1, 2, and 3 were intact and attached to their respective links but the fasteners attaching the pins to the blade butts were fractured. Blade No. 4's actuating pin was missing, and its respective link was deformed in the same manner as the other links and the No. 4 blade butt end contained the remnants of pin attachment fasteners.

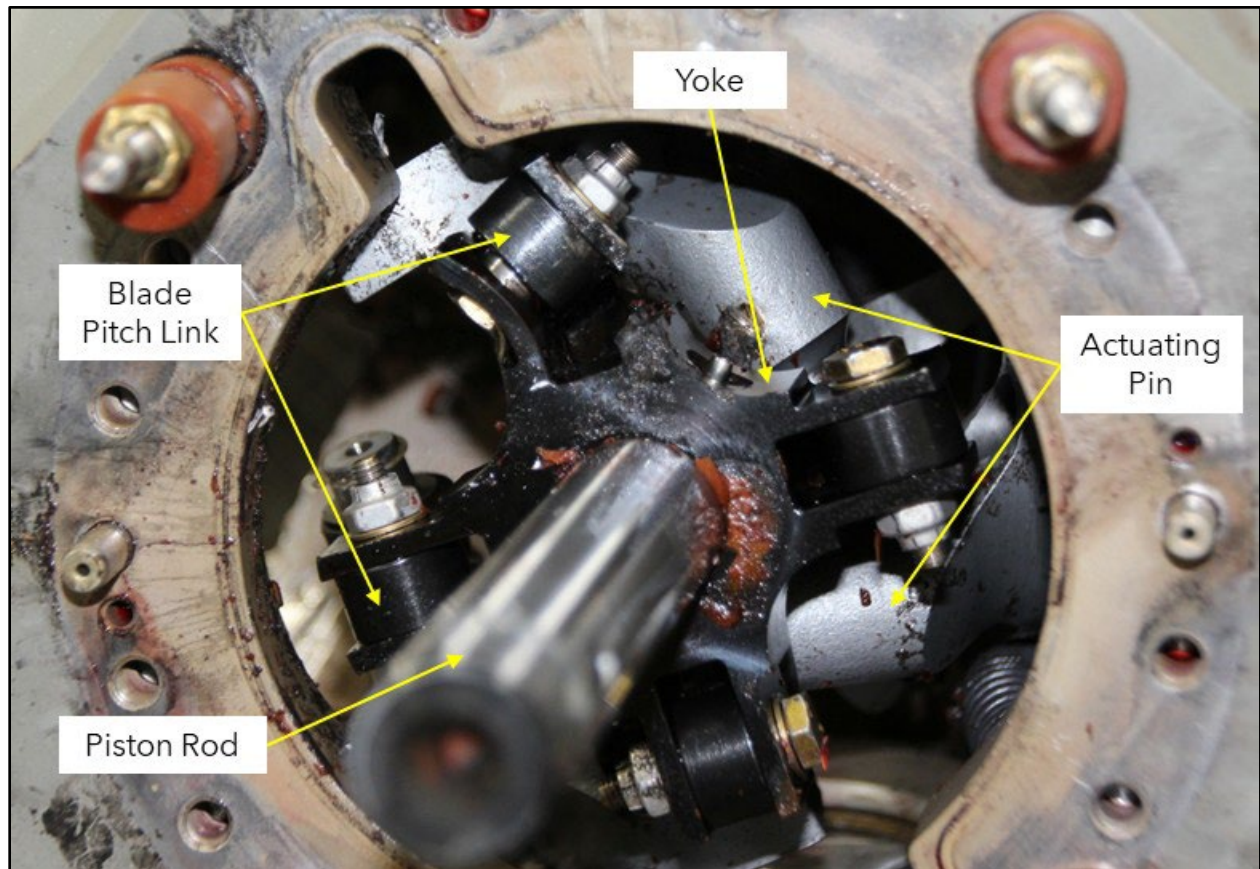


Figure 11. Internal Hub Hardware - Cylinder/Spring Housing Removed

The piston rod with the attached yoke, links and remaining actuation pins were removed from the hub, followed by the beta rods. All four beta rods were still found installed and intact but showed varying amounts of bending from contact with the actuating pins (Figure 12). The beta ring normally on the aft side of the hub was missing.

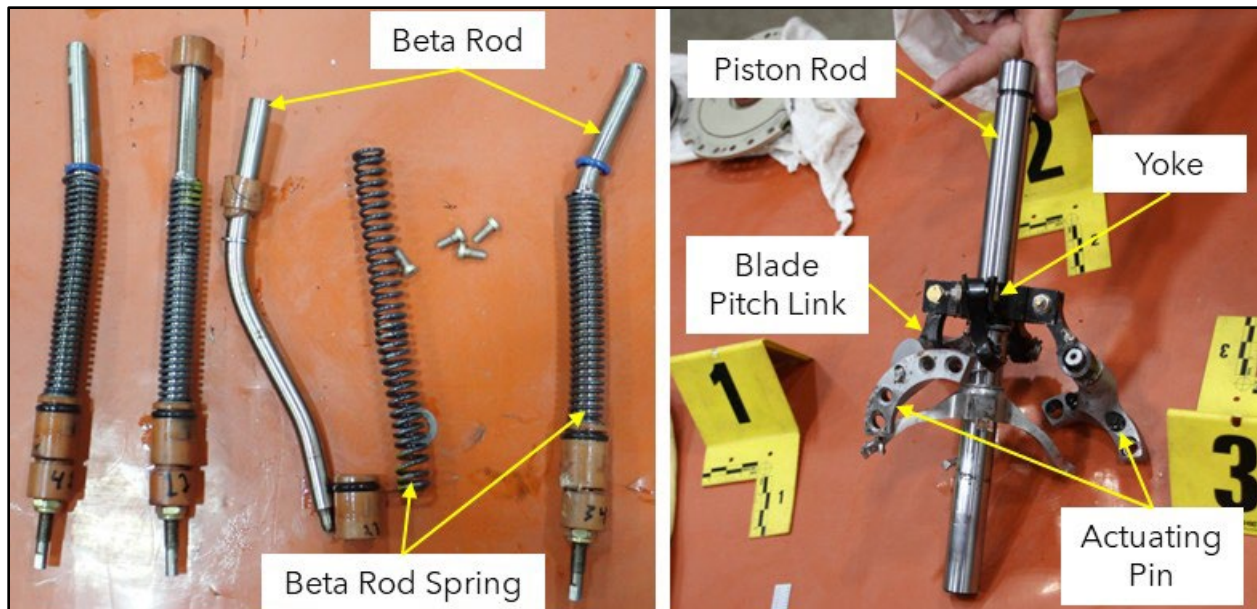


Figure 12. Beta Rods (Left) and Piston Rod Yoke - Removed

With the internal hub components removed, the three remaining blade butts exhibited multiple witness marks that correspond to the beta rod springs (Figure 13).



Figure 13. Blade Nos. 1 (Left), 2 (Center), and 3 (Right) Butt Damage

The butt of the No. 4 blade was damaged due to contact with a beta rod/spring, where the beta rod spring imparted contact witness marks (Figure 14).

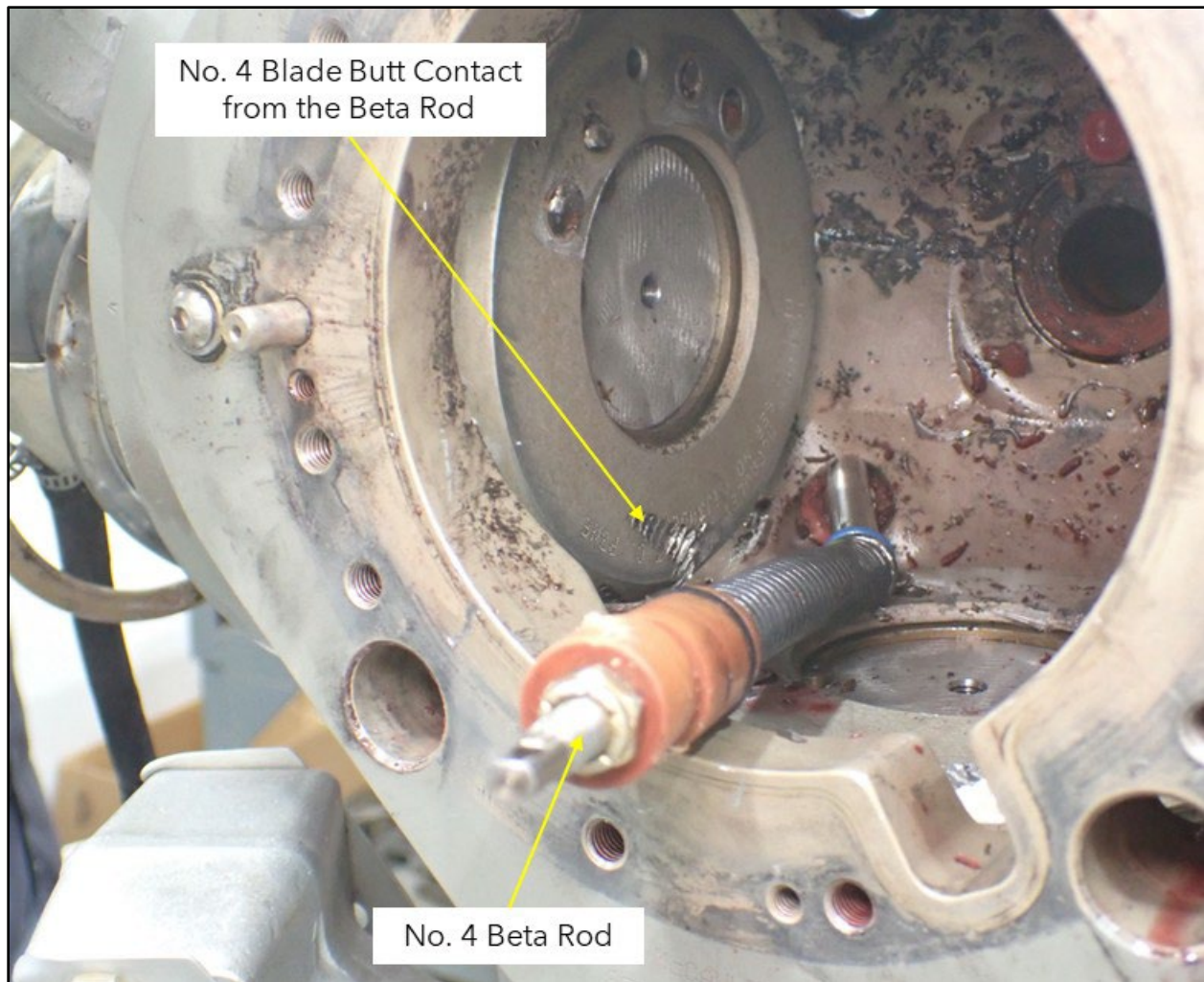


Figure 14. No. 4 Blade Butt Viewed Through the Hub

The No. 4 blade was held up next to the No. 4 hub socket and the three remaining blades were rotated in their respective hub sockets to a position where the blade butt witness marks would have made contact with the beta rod springs in order to estimate the blade angle at the time of impact. From this estimated blade position, the propeller appears to have been in a high-power forward thrust condition at the time of propeller impact.



Figure 15. Propeller with Blades Aligned to Beta Rod Witness Marks

There was no evidence found of pre-impact failures or pre-existing conditions that would have inhibited normal operation of the propeller.

McCauley Propeller Systems provided the NTSB a disassembly report which is available in the docket for this investigation.

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National Transportation Safety Board